

1. Introduction

It is a pleasure for me to introduce the laboratory's 1997 Annual Report.

The laboratory's financial situation continues to be stable with a satisfactory distribution between our basic budget and our externally financed activities. The laboratory intends to maintain this combination, which gives an acceptable balance between strategic research and applied research.

The two projects on biological and microbiological pest control and the project on the biochemical mechanisms behind pesticide resistance are now running satisfactorily, and the first results are being published. The micro-biological and biological pest control programme is carried out in collaboration with the Royal Veterinary and Agricultural University and the Danish Institute of Plant and Soil Science. The resistance research programme involves the University of Roskilde and the Danish Institute of Plant and Soil Science. The training of Ph.D. students is incorporated in both programmes. Besides a Ph.D. project in progress concerning rodent biology and biological control in Denmark, a similar project was initiated in Tanzania, and we expect that another Ph.D. project concerning rodent resistance will begin next year. The laboratory gives training of young scientists high priority and we intend to attach Ph.D.-students to future projects when possible.

The high level of activities calls for more space. It is my hope that in the near future the laboratory can increase the working area by rebuilding or extending our facilities.

Finally, I should like to take this opportunity to thank the board and all staff members for their close co-operation.

N. Bille

2. Management and organization

2.1 Board of the Danish Pest Infestation Laboratory

Members:

Boy Overgaard Nielsen
University of Aarhus
Chairman

Bent Christensen
University of Copenhagen

Lars Damberg
Danish Pest Infestation Laboratory

Peter Esbjerg
Royal Veterinary and Agricultural University
Vice-chairman

Lise Stengård Hansen
Danish Pest Infestation Laboratory

Hans Kristensen
Danish Agricultural Advisory Centre

Leif Mortensen
Danish Environmental Protection Agency

Lars Diernæs
Research Secretariat, Danish Directorate for Development, Observer

2.2 Staff 1997

DIRECTOR

Nils Bille

SECRETARIAT, ACCOUNTS AND BOOKKEEPING

Inge Børgesen

Marianne Christensen (part-time) (from 10.11)

Lisbeth Gammelgaard (part-time)

Jette Hansen (part-time)

Ilse Hall Jensen

Kirsten Engell Jørgensen (part-time)

Hanne Olsen

Aase Rasmussen (part-time) (until 31.10)

Vibeke Rostgaard Schmidt

Annette Pilgaard

DEPARTMENT OF ENTOMOLOGY

Scientists

Jørgen Brøchner Jespersen (Head)

Charlotte Danielsen (until 31.07)

Lise Stengård Hansen* (part-time)

Karl-Martin Vagn Jensen*

Ole Østerlund Kilpinen

Michael Kristensen

Kim Søholt Larsen*

Mette Knorr Lauridsen (from 09.01 until 31.07)

Henri Mourier

Per Sejerø Nielsen

Alice Olsen (until 31.03)

Henrik Skovgård Pedersen

Anne Marie Rasmussen (until 31.05)

Ole Skovmand (until 31.10)

Andrew Spencer

Tove Steenberg

* Senior Research Scientists

Technicians

Aase Borges (part-time)
Ulrik Cold
Lars Damberg
Kristian Fordsmand (until 31.03)
Eva Hald
Henriette Hansen (from 01.03 until 31.10 and from 19.12)
Nicolai Hansen (from 15.12)
Gitte Jensen
Marianne Søs Ludvigsen
Bodil Malle Pedersen (part-time)
Kirsten Peschel
Jonna Rungsøe
Minna Wernegreen

MAMMAL DEPARTMENT

Scientists

Herwig Leirs (Head)
Jens Lodal

Technicians

Sarah Adams
Kristian Fordsmand (from 01.04)
Folmer Jensen

TECHNICAL MANAGEMENT

Jørgen Christensen

Assistants in the workshop

Githa Christensen (1)
Solveig Quist Nielsen (until 28.02 and from 21.07 until 31.10)
Ib Bjarne Nielsen (1) (from 17.11)

(1) Paid using special reemployment funds

2.3 Ph.D. and M.Sc. students

Michael Carlsen, Ph.D. student (University of Aarhus)

Vibeke Kalsbeek, Ph.D. student (Royal Veterinary and Agricultural University, Copenhagen)

Saskia Mercelis, Ph.D. student (from 01.10, University of Antwerp, Belgium)

Solveig Vibe-Petersen, Ph.D. student (from 01.11, Royal Veterinary and Agricultural University, Copenhagen)

Thomas Bolbroe, M. Sc. student (University of Copenhagen)

Lars Dag Erichsen, M.Sc. student (University of Copenhagen)

Mette Homann Keseler, M.Sc. student (University of Aarhus)

Thomas Nørgaard, M.Sc. student (University of Aarhus)

Tina Stendal Mortensen, M.Sc. student (University of Copenhagen)

2.4 Guest scientist

As in previous years we have had the pleasure of frequently seeing J. Keiding, Scientist Emeritus.

3. International collaboration

3.1 Conferences

J. B. Jespersen attended a Danida meeting on research in agriculture and aid to developing countries, 11 February, in Copenhagen, Denmark.

H. Leirs and J. B. Jespersen attended a Danida meeting on Danish Research in International Health, 21 February, in Copenhagen, Denmark.

K. S. Larsen participated in the Fourth International Symposium on Ectoparasites of Pets, 6-8 April, Riverside, California, USA.

A. Spencer, M. Kristensen, K.-M. V. Jensen and J. B. Jespersen participated in Resistance '97 Integrated approach to combating resistance, 14-16 April 1997, at IARC-Rothamsted, Harpenden, UK. J. B. Jespersen and M. K. Lauridsen presented a paper entitled "Management of insecticide resistance in the housefly *Musca domestica* using paint-on baits". M. Kristensen, A. Spencer, and J. B. Jespersen presented a poster entitled "Development and implementation of biochemical insecticide resistance detection in Danish field strains of *Musca domestica* ", and A. Spencer, M. Kristensen, and K.-M. V. Jensen presented a poster entitled "The biochemical detection of insecticide resistance in Danish field populations of the German cockroach *Blattella germanica* (Blattellidae)".

J. B. Jespersen attended the First ENMARIA workshop, 17-18 April, held at IACR Rothamsted, where he presented a working paper on pesticide resistance problems in Denmark.

O. Kilpinen participated in the XVIII Symposium of the Scandinavian Society for Parasitology, 22-24 May, in Rønne, Denmark.

N. Bille participated in the annual meeting of the Nordic Pesticide Registration authorities, 10-12 June, in Bergen, Norway.

Vibeke Kalsbeek participated in the 6th European Meeting in the IOBC/wprs Working Group "Insect pathogens and insect parasitic nematodes" that was held in Copenhagen, August 10-15. She presented a paper entitled "Persistence of *Entomophthora schizophorae* Conidia on Different Surfaces at Different Temperatures".

T. Steenberg was part of the local organizing committee for the 6th European Meeting in the IOBC/wprs Working Group 'Insect pathogens and insect parasitic nematodes' that was held in Copenhagen, August 10-15. She presented a paper entitled "Microbial pest control in animal husbandry" and a poster entitled "Entomopathogenic fungi for control of German cockroach and other synanthropic cockroaches".

L. S. Hansen participated in the meeting of the IOBC/WPRS study group on "Integrated protection of stored foodstuffs and other commodities" in Zürich, Schweiz, August 31 - September 2, 1997, where she presented a paper entitled "Prospects for developing strategies for biological control of the Mediterranean flour moth *Ephestia kuehniella* in flour mills".

P. S. Nielsen participated in the meeting of the IOBC/WPRS study group on "Integrated protection of stored foodstuffs and other commodities" in Zürich, Schweiz, 31 August - 2 September, 1997, where he presented a paper entitled "*Blattisocius tarsalis* (Berlese), would this predatory mite be effective against moth eggs in Scandinavian flour mills?".

H. Leirs and J. Lodal participated in the First European Vertebrate Pest Management Conference, 1-3 September at the Central Science Laboratory in York, UK. J. Lodal presented a paper entitled "The mole: A matter of control or conservation". H. Leirs chaired one of the sessions.

H. Leirs participated in the 7th International Theriological Congress, 7-11 September in Acapulco, Mexico, where he was Convenor of the symposium "Ecology of disease and parasites in small mammals: victims and models" and of the symposium "Biology and management of rodent pests". He presented two papers: "Hunting Ebola virus in Kikwit: Lessons for mammalogists" and "Simulating and forecasting African *Mastomys* populations"

H. Leirs and J. B. Jespersen attended a Danida meeting with the Directors of the CGIAR institutes, 17-18 September, in Copenhagen, Denmark, to discuss potential future collaboration..

3.2 Visits and co-operation

DPIL staff paid visits to the following countries:

3 January, J. B. Jespersen visited IACR Rothamsted, UK, to discuss ENMARIA business matters.

16-17 January, T. Steenberg visited Dr. Judy Pell and Ph.D.-student V. Kalsbeek, Rothamsted Experimental Station, England, to discuss the progress of V. Kalsbeek's work.

28-30 January, H. Leirs visited the Department of Zoology, University of Oslo, Norway, to discuss population dynamics of *Mastomys* rats.

1-3 March, H. Leirs visited the Department of Biology, University of Antwerp, Belgium, to discuss joint projects and exchange of students.

2 April, K. S. Larsen visited Centers for Disease Control and Prevention, Plague Section, Fort Collins, Colorado, USA, to discuss plague control.

3-4 April, K. S. Larsen visited National Wildlife Research Center, Fort Collins, Colorado, USA, and gave a talk on "The plague situation in the Lushoto district, Tanzania".

21-23 May, K. S. Larsen visited Frank Clark, Department of Zoology, University of Leicester, England, to discuss flea research projects.

4-6 June, J. B. Jespersen visited the University of Oviedo, Spain, to plan field trials on semiochemicals.

9-12 July, K.-M. V. Jensen visited the Universidad de Oviedo, Spain, to participate in the design and initiation of the trials with semiochemicals. (AAIR proposal 1445).

6-9 August, J. B. Jespersen visited the University of Oviedo, Spain, to evaluate field trials on semiochemicals.

8 - 25 August, H. Leirs visited Indonesia, Malaysia, Vietnam, and Australia as member of a review team for the Australian Center for International Agricultural Research (ACIAR), reviewing research projects "Management

of rodent pests in Southeast Asia” and “Management of rodent pests in Vietnam”.

4 September, H. Leirs and J. Lodal visited Dr Alan MacNicoll and Dr Roger Quy at the Central Science Laboratory, Sand Hutton, York for discussions on rodent control and anticoagulant resistance in rats.

23 September, J. B. Jespersen participated in an SEMG meeting in Brussels, Belgium.

29 September-16 October, M. Kristensen visited Martin Williamson, IARC-Rothamsted, Harpenden, England. They succeeded in developing a molecular diagnostic method for pyrethroid resistance caused by modification of the voltage dependent sodium channel protein in the housefly *Musca domestica*, in order to survey the mutation frequency of this mechanism in field populations.

13 October, M. Kristensen and K. S. Larsen visited Institute of Virology & Environmental Microbiology, Oxford, England.

13-14 October, J. B. Jespersen visited the Central Veterinary Institute, Lelystad, Holland.

3-5 November, J. B. Jespersen visited Rhone-Poulenc, Lyon, France.

3-5 December, J. B. Jespersen visited Almeria, Spain, to plan the second ENMARIA workshop.

15-16 December: H. Leirs visited the Department of Biology, University of Oslo, Norway, to discuss the progress of collaborative work on population dynamics of African field rats.

The DPIL was visited by the following colleagues and other guests:

2-4 March, G. Thomas (CVI, Lelystad, Holland), J. Trapman (CVI, Lelystad, Holland), H.J.Prijs (CVI, Lelystad, Holland) and L. Wadhams (IACR-Rothamsted, UK) participated in the 9th meeting on flies on grazing cattle and semiochemicals (AAIR proposal 1445).

18 March, Dr. Thomas S. Jensen and 12 students, University of Aarhus, Department of Zoology, to discuss various aspects of pest control.

23 April, Dr. Sigitas Lazauskas, Lithuanian Institute of Agriculture, and Dr. Peteris Busmanis, Latvia University, Latvia; general information.

15 May, Jan Theunissen, WHO Regional Office for Europe, and Norman Gratz, Geneva, to discuss body lice control and insect vectors in general.

24 June, Dr. Ian Denholm, IACR Rothamsted, UK, to discuss ENMARIA business matters.

15 July-15 November, Saskia Mercelis, University of Antwerp, visited the laboratory for four months in the framework of the European Union Leonardo vocational training program.

10 October, Dr. Garry Hill, International Institute of Biological Control, U.K., to discuss possibilities of future collaboration.

26-28 November, Thomas Brevig, M. Sc. student, University of Oslo, Norway, to discuss management simulations with a population dynamics model for African field rats.

28 November, Prof. Dr. Nils Chr. Stenseth, University of Oslo, to discuss population dynamics in African field rats.

Dr. Jan-Erik Bergh, Dalarna University College, Sweden, spent three periods of several days at the laboratory in March, May, and September to do research in a project on museum pests.

3.3 WHO Collaborating Centre and Expert Panel

The DPIL is a "WHO Collaborating Centre on Pesticide Resistance". The terms of reference are:

1. To study insecticide resistance developments in flies, cockroaches and rodents, and to establish discriminating concentrations/exposure times to different pesticides used for the control of these pests.

2. To maintain strains of susceptible and resistant colonies for the above studies and serve as a reference centre providing material from the above colonies for other WHO collaborators.

3. To study how to overcome resistance problems caused by the above-mentioned pests through delay approaches, alteration, change of control methods or a combination of methods.

Much of the work summarized in the section "Scientific and technical work" fulfils the terms of the centre. The DPIL is looking forward to a continued and extended collaboration with the WHO.

Since 1991 J. B. Jespersen has been a member of the WHO Expert Advisory Panel on Vector Biology and Control. In 1996 J. B. Jespersen accepted an invitation to serve as a member of the above-mentioned WHO Expert Panel for a further period of four years.

3.4 EPP0 (European and Mediterranean Plant Protection Organization)

As from October 1994 J. Lodal has become a permanent member of the EPP0 Rodent Control Panel.

3.5 Scientific and Environmental Monitoring Group (SEMG)

In 1985 the European Commission formed the SEMG to monitor the application of insecticide in the Regional Tsetse and Trypanosomiasis Control Programme (RTTCP) on Malawi, Mozambique, Zambia and Zimbabwe. In 1992 the mandate of SEMG expanded to include other effects of tsetse control with regard to land use and other possible environmental effects. In addition the activities of SEMG were not to be restricted to just RTTCP, but could now also involve all other EDF-funded projects in Africa. In 1997 the role and mandate of the SEMG were reviewed again. The mission of SEMG is now to support the European Commission, its member states and partners in the development and implementation of socially, economically and environmentally sustainable livestock production systems for agriculture.

At a meeting in Brussels on September 23-24, 1997, the new terms of references were discussed, agreed upon, and referred to the member states.

J. B. Jespersen has been the Danish member of SEMG since 1988.

3.6 Hypodermosis of livestock in Europe

As part of the European Co-operation in the field of Scientific and Technical Research, a European Concerted Action on improvements in the means of control of the warble fly in cattle and goats was established in 1991. Altogether, 13 countries are involved in implementation of the COST Action 811, which is organized by the Management Committee. In 1994 J. B. Jespersen was appointed the Danish representative of the Management Committee.

In 1991 COST action came to an end. The final report entitled: "Improvements in the control methods for warble fly in livestock", COST 811, Agriculture, European Cooperation in the field of scientific and technical research, pp 141, 1998, edited by C. Boulard, J. Sol, K. Pithan, D. O'Brian, K. Webster and O. C. Sampimon, and published by the European Commission, Rue de la Loi 200, B-1049 Brussels, Belgium.

3.7 ENMARIA: European Network for the Management of Arthropod Resistance to Insecticides and Acaricides

ENMARIA (European Network for the Management of Arthropod Resistance to Insecticides and Acaricides), a new EU-funded Concerted Action, was launched in November 1996 to promote the development and implementation of management strategies for insecticide and acaricide resistance throughout Europe, thereby minimizing reliance on these chemicals and avoiding their increased use following resistance outbreaks. Nominated participants in ENMARIA include scientists and advisors from 12 countries and the agrochemical industry's Insecticide Resistance Action Committee (IRAC). ENMARIA hopes to achieve progress in four main areas - compilation of a European resistance database, workshops, training visits and publicity.

This database will detail all individuals and institutions engaged in insecticide and acaricide resistance research activities, and all available information on the incidence, impact and management of resistance in EU and EFTA countries. It will also include information on insect strains (especially susceptible reference strains) cultured by different laboratories that could be shared to save unnecessary duplication of effort.

The workshops will aim to develop and promote standardized methods for detection and monitoring of resistance and to identify and disseminate guidelines for its management.

The first workshop was held at IACR-Rothamsted in April 1997, in conjunction with the Resistance '97 International Conference on Pesticide Resistance. In addition to reviewing scientific aspects of resistance, the workshop identified important constraints to implementing resistance management on a large scale - in particular the difficulties with ensuring sufficient cooperation between researchers, advisors and industrialists to formulate management guidelines and with disseminating recommendations to end-users. It was concluded that ENMARIA should focus its attention on pest problems or relevance to Europe as a whole, while still contending with issues of more local importance.

A second workshop will take place in Almería in southern Spain in May 1998. Difficulties encountered in this region with insect and mite control encapsulate well the need to integrate resistance management tactics with non-chemical approaches and are relevant to protected horticulture throughout Europe.

ENMARIA participants will be contributing to several influential meetings during 1998, including the 9th IUPAC Congress on Pesticide Chemistry (London), 50th International Symposium of Crop Protection (Ghent) and the Brighton Crop Protection Conference - Pests and Diseases, where insecticide and acaricide resistance (including the activities of ENMARIA) will receive much coverage and discussion.

ENMARIA will soon have a web site giving information about its activities. The home page will include logos, maps and details of participants, and the site will eventually include working papers prepared by national representatives reviewing resistance problems in their respective countries.

ENMARIA sponsors technical training visits, focusing on techniques for monitoring resistance and evaluating resistance. The first of these was undertaken in September 1997 by Dr Michael Kristensen of the Danish Pest Infestation Laboratory, who spent 3 weeks at IACR-Rothamsted acquiring expertise in the molecular diagnosis of target-site resistance to pyrethroids.

The primary long-term objective of ENMARIA is to encourage closer and formal scientific collaboration on resistance research between European laboratories, thereby avoiding duplication of effort and expertise. In addition, ENMARIA will remain committed to creating an environment more favourable for the implementation of resistance management strategies, notably by promoting open and frequent dialogue between researchers, pest management advisors, the agrochemical industry and regulatory authorities.

Involvement in ENMARIA is open to all interested individuals and organizations; further details are available from the main coordinators whose details are listed below:

Dr Jorgen B. Jespersen
Danish Pest Infestation Laboratory
Skovbrynet 14
DK-2800 Lyngby
Denmark
Tel.: (45) 45 87 80 55
Fax: (45) 45 93 11 55
E-mail: j.b.jespersen@ssl.dk

Dr Ian Denholm
IACR-Rothamsted
Harpenden
Herts AL5 2JQ
United Kingdom
Tel.: (44) 1582 763 133
Fax: (44) 1582 762 595
E-mail: ian.denholm@bbsrc.ac.uk

3.8 Field rat ecology in Tanzania

DPIL has taken up the coordination of long-time field studies in Morogoro, Tanzania, which attempt to better understand the population ecology of the important agricultural public health pest rodent *Mastomys natalensis*, and use this knowledge to design improved management strategies.

This work happens in close collaboration with the Rodent Research Unit of the Sokoine University of Agriculture and the Rodent Control Centre of the Ministry of Agriculture, both in Morogoro, the University of Antwerp, Belgium and the University of Oslo, Norway. Recent work has been

funded by the European Union (DG XII- STD3 program), DANIDA, and the Belgian Agency for Development Cooperation.

Similar research is being undertaken, in collaboration with DPIL, at the Addis Ababa University, Ethiopia, and the Kenyatta University in Nairobi.

4. Educational activities

4.1 Training courses

In February nine one-day courses for personnel using phosphine-generating pellets for the control of moles and water voles were run by J. Lodal in various parts of the country. A total of 607 persons participated.

24 April, K. S. Larsen chaired a course on ectoparasites on cats and dogs held by the Industrial Association of Veterinary Medicine and gave a talk on "Biology and control of fleas on cat and dog".

13-14 May, a course on biology and control of insects, mites and rodents was run for military personnel intended to operate in foreign countries (N. Bille, K. S. Larsen, L. S. Hansen and J. B. Jespersen).

4.2 Lectures

21 January, J. Lodal gave a lecture on rat resistance to anticoagulants at an authorization course in rat control held by the Ministry of the Environment, Copenhagen.

22 January, N. Bille gave a lecture on "The Proper Use of Rodenticides. Risks and Hazards" at an authorization course in rat control held by the Ministry of the Environment, Copenhagen.

29 January, H. Leirs gave a seminar on population dynamics of *Mastomys natalensis* rats at the Department of Zoology, University of Oslo, Norway.

30 January, K.-M. V. Jensen: "Insects in food producing establishments", a lecture given as part of a course arranged by the Danish Society of Veterinarians.

20 February, J. B. Jespersen gave a lecture on biology and control of litter beetles at a training course for broiler farmers at Koldkærgaard, Aarhus.

2 March, H. Leirs gave a seminar on population dynamics of *Mastomys natalensis* rats, at the Department of Biology, University of Antwerp, Belgium.

10 March, L. S. Hansen gave two lectures on "Pests related to storage and production of food" for food technology students at the Royal Veterinary and Agricultural University, Copenhagen.

13 March, L. S. Hansen gave a lecture on "Stored product pests and pest allergens" at the Spring Meeting of the Danish Cereal Association.

18 April, L. S. Hansen gave a lecture on "Biology and control of seed destroying pests" for a group of students from developing countries participating in a course on seed pathology at the Danish Plant Directorate.

28 May, L. S. Hansen participated in a seminar for museum conservators on packing of museum objects (textiles, paper documents, books etc.) and presented the results of a project on insecticide treated packing materials.

21 August, H. Leirs presented a divisional seminar at CSIRO's Division of Wildlife and Ecology, Canberra, Australia, entitled "Hunting Ebola in Kikwit & the multimammate rat in Morogoro."

18 September, K. S. Larsen: "Cat flea biology", a lecture to the Veterinary Society on Funen.

10 December, J. Lodal gave a lecture on town pigeons and how to reduce damage caused by pigeons at a one-day seminar arranged by the Municipality of Copenhagen.

4.3 External examiner and reviewer duties

N. Bille served as an external examiner for veterinary students in veterinary special pathology and in environmental hygiene. He is also in charge as chairman of the external examiners at the Veterinary Faculty, Royal Veterinary and Agricultural University, Copenhagen.

N. Bille served as a referee for the *Belgian Journal of Zoology* (1).

L. S. Hansen served as an external supervisor for Ph.D. student Charlotte Danielsen, University of Copenhagen.

L. S. Hansen served as an external examiner for forestry students in forestry entomology and ecology at the Royal Veterinary and Agricultural University, Copenhagen.

J. B. Jespersen served as a supervisor for two M. Sc. students, University of Copenhagen , and for one Ph.D. student, Royal Veterinary and Agricultural University, Copenhagen.

K. S. Larsen served as a referee for the *Belgian Journal of Zoology* (2) and *Journal of Medical Entomology* (1).

H. Leirs served as a supervisor for two M.Sc. students at the University of Antwerp (Belgium).

H. Leirs served as an adviser to an M.Sc. student at the University of Oslo (Norway).

H. Leirs served as a member of the Editorial Board to *Mammalia* (Paris).

H. Leirs served as a referee for *Mammalia* (6), *Journal of Tropical Ecology* (2), *Wildlife Research* (1); as editor of a special issue for the *Belgian Journal of Zoology*, he reviewed 21 contributions.

H. Leirs served as a reviewer for the European Union (DG XII - ISTC program) and the International Foundation for Science.

J. Lodal served as a supervisor for one Ph.D. student, University of Aarhus.

J. Lodal served as a referee for the *Belgian Journal of Zoology* (1).

T. Steenberg served as a reviewer for *Journal of Invertebrate Pathology* (1) and *Sydowia* (1).