11. Stored product pests

11.1 Official examination of consignments 1999

DPIL examines consignments of grain and other dried plant products intended for export. Based on the results of these examinations the Plant Directorate of the Ministry of Food, Agriculture and Fisheries issues a phytosanitary certificate for countries requiring such certification. In 1999 a total of 827 consignments was examined: 127 lots of grain, 124 lots of malt, 99 lots of dried peas, 99 lots of tobacco and 378 consignments of other products, mainly potato starch. Live insects were found in less than 1% of the consignments, all of them in lots of grain and malt. The following pest species were detected: *Sitophilus granarius*, *Ptinus tectus*, *Tribolium confusum*, *Oryzaephilus surinamensis*, *Cryptolestes ferrugineus*, *Plodia interpunctella*.

L. S. Hansen

11.2 Biological control of the Mediterranean flour moth *Ephestia kuehniella*

Use of natural enemies is a potential solution to problems with the Mediterranean flour moth *Ephestia kuehniella* in industrial flour mills. The aims of the present project is to identify candidate species for biological control of *E. kuehniella* and to describe appropriate application strategies. Two natural enemies are the subject of investigations, and important aspects of the biology of these two species have been studied during the past year.

A colony of an egg parasitoid, received under the name *Trichogramma evanescens* Westwood, "Lager" strain, has been subjected to intensive studies within this project since 1998. However, during the course of 1999 it was discovered that the strain had been misidentified. A test conducted at Wageningen Agricultural University, The Netherlands, using molecular methods revealed that the true identity of this strain is *T. turkestanica* Meyer. Thus, previous references to this species in DPIL Annual Reports from 1997 and 1998 must be read as *T. turkestanica*.

Investigations with *T. turkestanica* in 1999 were aimed at determining the age-specific fecundity and survival at four constant temperatures: 15°C, 20°C, 25°C and 30°C. The female fecundity was 67, 76, 82 and 40 eggs per female at 15°C, 20°C, 25°C and 30°C, respectively. The longevity of adult females ranged between 32 days at 15°C and 2 days at 30°C. Based on these and previous data the intrinsic rate of natural increase (r_m) at the temperatures used was found to be between 0.09 and 0.40. Furthermore, the studies were designed so that they included determination of the rate of host-feeding, i.e. the number of host eggs that are destroyed when the female punctures the host egg with its ovipositor and subsequently feeds on the fluids from the wound. The host-feeding rate was surprisingly high. For example, at 20°C it comprised 50% of the total mortality of the host eggs. Thus, host-feeding is an important factor in the total effect of *T. turkestanica* on a pest population. Furthermore, the investigations showed that *T. turkestanica* can be expected to be actively parasitising host eggs at temperatures as low as 15°C to 20°C, temperatures which are common in Danish flour mills during the spring.

Investigations on the biology of the other species of natural enemy included in the project, the predatory mite, *Blattisocius tarsalis*, on eggs of *E. kuehniella* have continued. As the development of this species has previously only been investigated at temperatures between 25°C and 27°C, investigations of the development rate were conducted at 15°C, 21°C and 25°C. Within this temperature regime the relationship between development rate and temperature could be described by means of linear regression, which will facilitate the incorporation of the data in a simulation model. The results were in agreement with published data on the development time at 25°C and 27°C. A calculation of the thermal threshold for development was in accordance with previous observations on thresholds for activity and predation.

The fecundity of *B. tarsalis* was investigated at 15°C and 21°C. At 15°C, virgin females copulated, but failed to reproduce, but females which had oviposited at 25°C could also do so when transferred to 15°C, but at a low rate. At 21°C the peak oviposition rate was approximately 1 egg per day, which is lower than other results conducted at 27°C.

Both natural enemies will be used in field trials in 2000.

L. S. Hansen and P. S. Nielsen

11.3 Ecological constraints and spatial distribution of an introduced agricultural pest *Prostephanus truncatus* in natural habitats in West Africa

In the Ph.D. project on the larger grain borer *Prostephanus truncatus*, most of the previous year's activities were continued at the International Institute of Tropical Agriculture in Benin in order to increase the understanding of the ecology of *P. truncatus* outside maize stores. Vegetational studies were conducted in the Lama Forest. Two software packages have been used for spatial and ecological analyses of pheromone trap catches of the pest in the forest and in nearby maize stores. The vegetation types with the highest catch rates have been identified. Trap catches were generally highest in the most disturbed part of the forest; efforts are being made to identify specific host substrates mainly in this part of the forest. A predictive climate driven-model has been established to simulate changes in flight activity of the pest. Temperature was found to be an important factor for the occurrence of *P. truncatus* in traps.

Woody substrates were sampled intensively in the field and tested for their susceptibilty to *P. truncatus*. In West Africa, the only identified host substrate in forest environments is *Lannea nigritana* (Anacardiacea) previously girdled by Cerambycids. These branches, however, cannot adequately explain the large numbers of adult *P. truncatus* found during monitoring. Screening of potential non-wood substrates (roots and seeds) for *P. truncatus* in the forest was conducted as a subsequent phase to previous screening of woody substrates. The importance of substrate quality (woody substrates compared with maize) on male pheromone production is being studied quantitatively by means of gaschromatography. Preliminary results show that *P. truncatus* males fed on maize produce larger amounts of pheromone than males on wood.

Analysis and publication of the results will be conducted in 2000, which is the final year of the project.

C. Nansen and L. S. Hansen

12. Various other arthropods

12.1 The effect of low oxygen pressure on museum pests

This project aims at determining exposure times necessary for effective control of museum pests after nitrogen treatment (oxygen level 0.3%). The following species and stages were used in the study: *Anthrenus museorum*, all stages; *An. verbasci*, all stages; *Attagenus smirnovi*, eggs, larvae; *At. woodroffei*, larvae; *Ptinus tectus*, larvae, pupae, adults; *Reesa vespulae*, larvae; *Tineola bisselliella*, eggs; *Trogoderma angustum*, eggs, larvae. Exposures were conducted at 25°C and 55% RH with exposure times ranging between 6 and 72 hours.

The results of previous investigations were analysed, and the following conclusions were drawn: In most of the species and stages 100% mortality was obtained within 72 hours of exposure. The test species can roughly be divided into three groups: a relatvely sensitive group containing three stages of *An. museorum*, a relatively resistant group consisting of *An. verbasci* pupae, *At. smirnovi* larvae and *At. woodroffei* larvae, and the remaining species and stages as an intermediate group.

The following species and stages were selected for further studies. *An. museorum* eggs; *An. verbasci* pupae and *T. angustum* larvae. Exposures were conducted at 0.35% oxygen, 20°C and 50% RH. The eggs were exposed for maximum 72 hours, and the pupae and larvae for maximum 96 hours. None of the exposures resulted in 100% mortality. The larvae of *T. angustum* were extremely resistant with almost 50% of the test specimens surviving after 96 hours' exposure.

The investigations are conducted in collaboration with PRE-MAL (J.-E. Bergh) and the Danish Technical University (P. V. Nielsen).

L. S. Hansen and K.-M. V. Jensen

13. Rodents

13.1 Resistance to anticoagulants

13.1.1 Resistance in the brown rat

During 1999 a total of 548 brown rats (*R. norvegicus*) were received for anticoagulant resistance testing. New municipalities where resistance has been found are: coumatetralyl in Skjern (Jutland) and Stenlille (Zealand), and bromadiolone in Brøndby (Zealand).

J. Lodal

13.1.2 Population effects of anticoagulant rodenticide resistance in brown rats

Resistance to anticoagulant rodenticides has pleiotropic effects that can decrease the fitness of resistant rats compared to non-resistant rats when anticoagulants are no longer used. Thus, it can be hypothesized that resistance will disappear from the population if no anticoagulants are being used. In order to investigate this, a Ph.D. project was started in 1998 with experimental populations of resistant rats that were established with wild rats trapped in two localities in Denmark. These populations will be submitted to treatments with or without anticoagulant rodenticides, in order to investigate how the prevalence of resistance will change over time and how the resistance genes spread through the population.

Resistance in this project is determined by the use of the Blood Clotting Response (BCR) test. With microsatellite markers it will be possible to measure an individual's reproductive success as their contribution into next generation of rats can be traced, and thereby obtain a measurement of the individual fitness in relation to its state of resistance. Furthermore, we will measure changes of genetic composition due to the environmental selection over successive generations. All samples collected during 1999 from the four experimental populations are being typed with a total of 18 microsatellite markers in order to produce DNA profile of each individual rat. The molecular work is conducted at the DNA-laboratory, Department of Evolutionary Biology, Institute of Zoology, University of Copenhagen. The project will be running until August 2001.

A.-C. Heiberg

13.1.3 Implementing blood clotting response test for detection of anticoagulant rodenticide resistance

During 1999 a total of 161 rats were tested for bromadiolone resistance by means of the blood clotting response (BCR) test. Of these, 81 (40 females and 41 males) were then tested in a 0.005% feeding test in order to evaluate the power of the BCR test and finally to see if the BCR test will be able to replace the feeding test in most cases.

The BCR test is based on dosing of small amounts of anticoagulant together with menadione sodium bisulphite (MSB), a synthetic source of a vitamin k derivate, which can be utilised by resistant rats only. The animal's blood clotting time is measured before and after dosing the anticoagulant. Increase in clotting time indicates an effect on the rat by the anticoagulant poison, whereas an unchanged clotting time indicates that the animal has not been affected significantly. Such rats will be considered resistant.

Survival of BCR declared resistant rats in the feeding test was correlated to the percentage clotting activity (PCA) of the animals. A *T-test* revealed no statistical significant difference between mean PCA of rats surviving or dying in the feeding test ($p< 0.2085$). The data for males and females, respectively, show that

survivors' mean PCA did not differ from the PCA of the non-survivors (males, $p< 0{,}3940$; females, $p<$ 04282), see Table 13a below.

The survival in the feeding test did not correlate with the BCR test. However, the survival rate in the feeding test is strongly influenced by the length of the test (six days), and thus the feeding test is most likely to underestimate the level of resistance as rats being heterozygous for the resistance genes will probably die in a feeding test. The heterozygous rats will be detected in the BCR as this test is more sensitive. A better correlation between the two tests will probably exist if the feeding periods are shortened to four days (H. J. Pelz, pers.com)

Some preliminary conclusion can be drawn from these experiments. All rats known to be susceptible (22 control rats were included, they do not appear in Table 13a) were identified as susceptibles in the BCR (all had a PCA below 10%), and all 22 rats died shortly after the BCR test due to anticoagulant poisoning. Thus truly susceptible rats are easily identified by the use of BCR. However, we were not able to distinguish between degrees of resistance using BCR, only to identify the individuals carrying one or two copies of the resistant gene. Compared to the feeding test, this gives an opportunity to detect resistance, before it becomes a control problem.

Table 13a: Mean PCA calculated using PCA_4/PCA_0 x 100, where PCA_4 is the PCA after the administration of anticoagulant and PCA_0 before the administration.

		N	Mean PCA	SE	*p* (t-test SAS)
Females:					
	Survivors	18	108.11	6.4	
	Non-survivors	22	104.86	7.0	*0.4282*
Males:					
	Survivors	22	90.50	4.92	
	Non-survivors	19	84.10	6.42	*0.3940*
Total:					
	Survivors	40	98.43	4.15	
	Non-survivors	41	95.24	5.0	*0.2085*

A.-C. Heiberg

13.2 Other work on rodents and rodent management

13.2.1 Feeding decisions as an anti-predation strategy in the African multimammate rat

In an ongoing research project in Tanzania, populations of African Mastomys rats are submitted to different replicated predation treatments (predators excluded, predators allowed, and predators attracted). Any observed effects in that project could be due to direct effects of predation on survival, but also due to indirect effects caused by the rodents' individual reactions to the changed risk of predation. In order to investigate whether the differences in predation pressure are apparent to the individual rodents living in these areas, a number of experiments has been set up as an M.Sc. project.

In this project, the feeding decisions of the rodents are measured with a method known as the "giving-up-density"-method. For this method, a known amount of millet seeds was mixed with sand in a tray, and six trays were placed in each of the 10 study fields. Rodents that visit these trays during night were expected to search and remove seeds from the sand, until the density of the grains becomes so low that they no longer consider the profit of searching for more grains to balance the risk of doing so. The hypothesis was that

animals in the fields, from which predators were excluded, would continue searching for the seeds in the trays to a lower final density, than in the fields where predators could hunt. Simultaneously, a number of the seed trays was monitored by a video camera in order to observe difference in the feeding behaviour of the rodents. Data collection was carried out at the Sokoine University of Agriculture in Morogoro, Tanzania from October to December 1999.

K. Mohr

13.2.2 Population ecology of the African field rat *Mastomys natalensis*

S. Vibe-Petersen continued the data collection for the Ph.D. project "Predation pressure and population dynamics in African *Mastomys* rats: possibilities for integrated pest management?" at Sokoine University of Agriculture in Morogoro, Tanzania. The study began November 1997 and will terminate October 2000. *Mastomys* rats are common agricultural pest species in Sub-Saharan Africa. In an attempt to look for alternative methods of control than use of rodenticide, this study is a follow-up on previous results, which have indicated that predation may be an important mortality factor of the species. The aim of the study is to evaluate the effect of either attracting avian predators or excluding predators from maize-cultivated field plots of ½ ha (see also Danish Pest Infestation Laboratory, Annual Report 1998 for explanations on the set-up).

Preliminary analyses of the rodent CMR-data from the first trapping year indicate that the return rates of females in several months are lower in predator-attracted areas than in predator-excluded or control areas. This may indicate that females in predator-attracted areas have a lowered survival. Further, during the reproductive period it seems that reproducing females are trapped for a longer period in predator-excluded and control areas than in predator-attracted areas. Possibly this means that females in predator-attracted areas have a lowered reproduction. Analyses of frequency of raptor pellets have shown a clear correlation between pellet numbers and rodent population size. This suggests a numerical response of raptors to the rodent population.

Although there are some indications of an indirect effect of predators on the rodents, the rodent population dynamics still follows the usual seasonal variation that is known from literature, and no marked differences according to treatments of the plots are yet obvious. It is possible, however, that long-term exposure to increased predation risk may show a delayed effect in the rodent population dynamics and/or that the rodents are able to compensate for the increased predation pressure. Thus at present, the question of the effect of perch poles and nest boxes are still left open.

A second study, "Population dynamics of *Mastomys natalensis* in different habitats: an experimental and modelling study" was undertaken as a Ph.D. study at the University of Antwerp (Belgium) with supervision from DPIL. The population dynamics of these rats are investigated in capture-recapture set-ups on a 3 ha field-fallow mosaic and a 1 ha maize mosaic. Recolonization of maize fields after control is studied on a set of additional experimental maize fields. The field work continues with monthly captures until mid-2001.

H. Leirs and S. Vibe-Petersen

13.2.3 A population dynamics model for rodent management in Africa

Rodents of the genus *Mastomys* are common in sub-Saharan Africa. They are important pests in agriculture, both in field crops and in post-harvest storage, as well as in public health, carrying diseases like Lassa fever and plague. Their population dynamics is characterized by irregular large fluctuations, both intraannually and interannually. In order to organize rodent control more efficiently, it is necessary to understand how and why the population sizes change and, if possible, to predict them.

We used already available robust capture-mark-recapture (CMR) data from several localities in East Africa to analyse *Mastomys* demography in detail, using state-of-the-art multi-state CMR statistics. The obtained estimates were used to parameterize a population dynamics model, building on a model developed at DPIL before. The population dynamics model was tested for its sensitivity to variations in parameter values and predictions of the model were verified with observed rodent densities from several existing time series from Tanzania. In the near future, the model will be verified for other parts of East Africa.

In order to refine the parameters of the model for reproduction and early survival, a colony of *Mastomys natalensis* rats was established at DPIL, and information was collected about their reproductive output.

H. Leirs

13.2.4 Search for the natural reservoir of Marburg virus

In early 1999, in the region of Durba, Democratic Republic of the Congo, an outbreak occurred of a hemorrhagic fever. After identifying the cause of the disease as Marburg virus, a relative of Ebola virus, the World Health Organisation decided to send out a research equipe in May. In order to identify the still unknown natural reservoir of the virus, an Ecological Investigatory Team was established with participants from the National Institute of Virology, South Africa, Centers for Disease Control, USA, Institut Pasteur, France, and DPIL. The mission was to be based on the simple assumption that the majority of cases of Marburg disease were arising as primary infections in the Gorumbwa goldmine, and therefore likely reservoir hosts were to be sought in the mine and its immediate environments. The aim was to trap and sample potential vertebrate hosts (rodents, bats) found in and around the mine. In total, 165 specimens belonging to 14 species were collected, most of them bats. Laboratory investigation of the collected blood and tissue samples did, unfortunately, not reveal any indications of the virus.

H. Leirs

13.2.5 Effects of grazing on small mammals in wet meadows

Differences in vegetation structure affect living conditions for small mammals with respect to food quality and quantity, cover against predators, etc. In the framework of a large project to investigate the different grazing systems as a nature management strategy, DPIL and the Royal Veterinary and Agricultural University (Copenhagen) investigate the population ecology and behaviour of rodents under different grazing pressure. The experimental areas are situated in Fussingø, Jutland, and subject to different grazing and/or mowing intensity by sheep or cattle. On six of these areas, a capture-recapture study with monthly trapping was carried out in 1999. The data collection will continue for another year.

H. Leirs

13.2.6 Cable resistance to gnawing

A special cable type for use in structures where rats often occur was tested for resistance against being gnawed and damaged by brown rats. It was compared with a standard cable of the same diameter, about 14 mm. The cables were exposed to singly-caged rats in glass cages. The special cable showed a high degree of resistance to severe damage, whereas the standard cable in many cases was completely destroyed.

J. Lodal

13.2.7 Rat trap

At the request of a Danish inventor a prototype of a special trap for rats was tested in the laboratory. The aim of the test was - through studies of the reactions of the rats to the trap - to find out how to optimize the function of the trap.

J. Lodal

14. List of species maintained at DPIL

The numbers in square brackets [a,b] after some of the species indicate the following: a = the number of strains kept at DPIL; b = the number of resistant strains (if tested); - = no information is available.

ARACHNIDA	**SPINDLER**
Acarina	**Mider**
Lepidoglyphus destructor	Kornmide
Blattisocius tarsalis	Rovmide
INSECTA	**INSEKTER**
Blattaria	**Kakerlakker**
Blatta orientalis	Orientalsk kakerlak
Blattella germanica [5,4]	Tysk kakerlak
Periplaneta americana	Amerikansk kakerlak
Supella longipalpa	Brunstribet kakerlak
Lepidoptera	**Sommerfugle**
Ephestia kuehniella	Melmøl
Plodia interpunctella	Tofarvet frømøl
Tineola bisselliella	Klædemøl
Coleoptera	**Biller**
Anthrenus museorum	Museumsklanner
Anthrenus verbasci	Almindelig tæppebille
Attagenus smirnovi	Brun pelsklanner
Attagenus unicolor (piceus)	Sort pelsklanner
Attagenus woodroffei	Båndet pelsklanner
Oryzaephilus surinamensis	Savtakket kornbille
Ptinus tectus	Australsk tyvbille
Prostephanus truncatus	(intet dansk navn)
Reesa vespulae	Amerikansk klanner
Sitophilus granarius	Kornsnudebille
Stegobium paniceum	Brødbille
Tribolium confusum	Rismelbille
Trogoderma angustum	Smal frøklanner
Trogoderma granarium	Khaprabille
Diptera	**Tovinger (myg og fluer)**
Fannia canicularis [5,-]	Lille stueflue
Haematobia irritans	Lille stikflue
Musca autumnalis	Kvægflue
Musca domestica [23,20]	Stueflue
Neomyia cornicina (*Orthellia caesarion*)	Grøn kokasseflue
Siphonaptera	**Lopper**
Ctenocephalides felis	Katteloppe
Xenopsylla cheopis	Tropisk rotteloppe
MAMMALIA	**PATTEDYR**

Apodemus sylvaticus	Skovmus
Apodemus flavicollis	Halsbåndmus
Mastomys natalensis	En afrikansk gnaver
Mus musculus/domesticus [3,1]	Husmus (lys og mørk)
Rattus norvegicus	Brun rotte
Rattus rattus	Husrotte

15. Publications and reports

15.1 Publications by members of staff in 1999

Bergh, J. E., L. Stengård Hansen, K.-M. Vagn Jensen, P. V. Nielsen, 1999: Lethal exposure times of anoxic treatment of eight species of museum pests. Poster, 12th Triennial Meeting of ICOM CC (International Council of Museums Committee for Conservation), August 29-September 3, 1999, Lyon, France.

Bolbroe, T., L. L. Jeppesen and H. Leirs. Behavioural response of field voles under mustelid predation risk in the laboratory: more than neophobia. Abstracts of the 3rd European Congress of Mammalogy, 29 May - 3 June 1999, Jyväskylä, Finland, p.74.

Van Cakenberghe, V., F. De Vree and H. Leirs, 1999: The bats (Chiroptera) from Kikwit, Democratic Republic of the Congo. Abstracts of the International Symposium on African Small Mammals, 4-9 July 1999, Paris, France, p.27.

Van Cakenberghe, V., F. De Vree and H. Leirs, 1999: A collection of bats (Chiroptera) from Kikwit, Democratic Republic of Congo. *Mammalia,* **63(3)**:291-322.

Carlsen, M., J. Lodal, H. Leirs and T. S. Jensen, 1999: The effect of predation risk on body weight in the field vole *Microtus agrestis*. *Oikos*, **87(2)**:277-285.

Carlsen, M., 1999: The effect of predation on field vole *Microtus agrestis* populations in fragmented forest habitats. Ph.D. Thesis. Danish Pest Infestation Laboratory/University of Aarhus. 143 pp.

Carlsen, M., J. Lodal, H. Leirs and T. S. Jensen, 1999: The effects of predation on winter and spring body weights and onset of reproduction in *Microtus agrestis*. Abstracts, 3rd European Congress of Mammalogy, Jyväskylä, Finland, May 29–June 3, 1999, p. 84.

Denholm I. and J. B. Jespersen, 1999: Overview of insecticide resistance, pp. 26-35 *in* Denholm, I, & P. M. Ioannides (eds): Combating Insecticide Resistance. Proceedings of a Symposium on Combating Insecticide Resistance. Thessaloniki. 125 pp.

Hansen, L. Stengård, 1999: Insekter og mider i korn- og frølagre. Effektivt Landbrug **6**, p. 12.

Heiberg, A.-C. and H. Leirs, 1999: Population effects of anticoagulant rodenticide resistance in Norway rats. Abstracts of the 3rd European Congress of Mammalogy, 29 May - 3 June 1999, Jyväskylä, Finland, p. 123.

Heiberg, A.-C. and H. Leirs, 1999: Population effects of anticoagulant rodenticide resistance in Norway rats. Abstracts of the 2nd European Vertebrate Pest Management Conference, 6-8 September 1999, Braunschweig, Germany, p. 26.

Jespersen, J. B., T. Steenberg, O. Kilpinen, and H. Skovgaard, 1999: Arthropod pest problems in organic animal husbandry and methods for their control. Abstract for NJF-seminar No. 303: Ecological Animal Husbandry in the Nordic Countries, Horsens, Denmark.

Jespersen, J. B., T. Steenberg, O. Kilpinen and H. Skovgaard, 1999: Methods for biological control of arthropod pests in organic animal husbandry. Abstract for International Symposium Biological Control Agents in Crop and animal protection, Swansea, UK.

Julliard, R., H. Leirs, N. C. Stenseth, N. G. Yoccoz, A.-C. Prévot-Julliard, R. Verhagen and W. Verheyen, 1999: Survival variation within and between functional categories of the African multimammate rat. *Journal of Animal Ecology*, **68**:550-561

Kilpinen, O., 1999: A poster entitled "Effects of the chicken mite *Dermanyssus gallinae* on egg layers". The 17th International Conference of the World Association for the Advancement of Veterinary Parasitology in Copenhagen, Denmark.

Kristensen M., J. B. Jespersen, A. G. Spencer, K.-M. Vagn Jensen, S. E. Jensen, L. M. Hansen, J. Clausen and S. A. Nielsen, 2000: Unødigt højt forbrug af insektgifte. Naturens Verden. Særnummer Februar, 28-31.

Kristensen M., F. Lok, V. Planchot, I. Svendsen, R. Leah and B. Svensson, 1999: Isolation and characterization of the gene encoding the starch debranching enzyme, limit dextrinase from germinating barley. Biochimica et Biophysica Acta **1431**: 538-546.

Leirs, H, 1999: Populations of African rodents: models and the real world. *in:* Singleton, G., L. Hinds, H. Leirs and Zhang Zhibin (Eds) *Ecologically-based management of rodent pests.* ACIAR, Canberra, pp.388-408.

Leirs, H, 1999: The rodent problem in Africa: challenges for ecologically-based management. Abstracts of the International Symposium on African Small Mammals, 4-9 July, Paris, France, p. 60.

Leirs, H., G. Singleton and L. Hinds, 1999: Ecologically-based rodent management in developing countries: where to now? *in:* Singleton, G., L. Hinds, H. Leirs & Zhang Zhibin (Eds). *Ecologically-based management of rodent pests.* ACIAR, Canberra, 477-484.

Leirs, H., J. Mills, J. W. Krebs, J. E. Childs, Dudu Akaibe, N. Woollen, G. E. Ludwig, C. J. Peters, T. G. Ksiazek, 1999: Search for the Ebola-reservoir in Kikwit: reflections on the vertebrate collection. *Journal of Infectious Diseases*, **179** (Suppl 1):S155-63.

Lodal, J., 1999: The mole: A matter of control or conservation? In *Advances in Vertebrate Pest Management* (Eds D. P. Cowan & C. J. Feare), Filander Verlag, Fürth, p. 43-56.

Lodal, J., 1999: Distribution and levels of anticoagulant resistance in rats (*Rattus norvegicus*) in Denmark. Abstracts, Second European Vertebrate Pest Management Conference, Braunschweig, Germany, September 6-8, p. 40.

Mercelis, S., H. Leirs and R. Verhagen, 1999: The recolonisation of 'emptied' maize fields by rodents: implications for rodent control. Abstracts of the International Symposium on African Small Mammals, 4-9 July, Paris, France, p.118.

Nielsen, B. O.**,** C. Sommer, J. Bresciani, K.-M. Vagn Jensen, J. B. Jespersen and S. A. Nielsen, 1999: Fluer og myg i husdyrbruget. 2. Stikmyg. Dansk Veterinærtidsskrift **82**, 9 1/5: 398-401.

Nielsen, P. S., 1999: The use of *Blattisocius tarsalis* (Berlese) (Acari:Ascidae) for biological control in flour mills. In: (Eds: Jin, Z., Liang, Q., Liang, Y., Tan, X. & Guan, L.) Stored product protection. Proceedings of the 7th International Working Conference on Stored-Product Protection. 14-19 October 1998. Beijing, P.R. China Vol. 2, pp. 1265-1268.

Nielsen, P. S., 1999: The impact of temperatures on activity and consumption rate of moth eggs by *Blattisocius tarsalis* (Berlese) (Acari:Ascidae), a predatory mite on moth eggs. Experimental & Applied Acarology. **Vol. 23(2)**: 149-157.

Nielsen, S. A., B. O. Nielsen, K.-M. Vagn Jensen, J. B. Jespersen**,** C. Sommer and J. Bresciani, 1999: Fluer og myg i husdyrbruget. 3. Mitter. Dansk Veterinærtidsskrift **82**, 12 15/6: 522-526.

Palmer, R. J., O. P. Settnes, J. Lodal and A. E. Wakefield, 1999: Five different *formae speciales* of rat-derived *Pneumocystis carinii* found in Danish wild rats. Abstracts, 52nd Annual Meetings Society of Protozoologists and 6th International Workshop on Opportunistic Protists, Raleigh, North Carolina, USA, May 26-29, p. 39.

Parrella, M. P., L. Stengård Hansen and J. C. van Lenteren, 1999: Glasshouse environments. Pp. 819-839 *in:* Bellows, T.S. & T.W Fischer (eds.): Handbook of Biological Control. Academic Press, San Diego, CA, USA. 1046 pp.

Rasmussen, A. og K. S. Larsen, 1999: Et par gode råd om hovedlus. Apoteksassistenten **3:** 16-18.

Singleton, G., L. Hinds, H. Leirs and Zhang Zhibin (Eds), 1999: Ecologically-based management of rodent pests. ACIAR Monograph 49, Canberra, 494 pp.

Singleton, G., H. Leirs, L. Hinds and Zhang Zhibin, 1999: Ecologically-based management of rodent pests: re-evaluating our approach to an old problem. *in:* Singleton, G., L. Hinds, H. Leirs and Zhang Zhibin (Eds) Ecologically-based management of rodent pests. ACIAR, Canberra, pp. 17-29.

Skov, M. N., A. G. Spencer, B. Hald, L. Petersen, B. Nauerby and M. Madsen, 1999: Kan biller overføre salmonella og campylobacter mellem to rotationer af slagtekyllinger? Abstract for Theme day on salmonella and broilers, Foulum, Denmark, 15 pp.

Skovgård, H., N. Holst and P. Sejerø Nielsen, 1999: Simulation model of the Mediterranean flour moth (Lepidoptera: Pyralidae) in Danish flour mills. Environmental Entomology **28** (6): 1060-1066.

Skovgård, H. and J. B. Jespersen, 1999: Activity and relative abundance of hymenopterous parasitoids that attack puparia of *Musca domestica* and *Stomoxys calcitrans* (Diptera: Muscidae) on confined pig and cattle farms in Denmark. Bulletin of Entomological Research **89**: 263-269.

Sommer, C., B. O. Nielsen, J. Bresciani, K.-M. Vagn Jensen, J. B. Jespersen and S. A. Nielsen**,** 1999: Fluer og myg i husdyrbruget. 4. Klæger. Dansk Veterinærtidsskrift **82**, 13 1/7: 578-581.

Spencer, A. G., J. B. Jespersen and M. Knorr Lauridsen, 1999: Biller i dansk fjerkræproduktion: Angrebsniveau, biologi og bekæmpelse. Abstract for Theme day on salmonella and broilers, Foulum, Denmark, 14 pp.

Spencer, A. G., J. B. Jespersen and M. Knorr Lauridsen, 1999: Kan biller overføre salmonella og campylobacter mellem to rotationer af slagtekyllinger? Abstract for Theme day on salmonella and broilers, Foulum, Denmark.

Steenberg, T. and K.-M. Vagn Jensen, 1999: Interaction between entomopathogenic fungi (Deuteromycotina: hyphomycetes) and the biology of German cockroaches (*Blattella germanica* (L.)) (Dictyoptera: blattellidae). Proc. 3rd International Conference on Urban Pests, Prague, Czech Republic, pp 621.

Steenberg, T. and R. A. Humber, 1999: Entomopathogenic Potential of *Verticillium* and *Acremonium* Species (Deuteromycotina: Hyphomycetes). J. Invertebr. Pathol. **73**, 309-314.

Vagn Jensen, K.-M. and R. Schenker, 1999: The impact of a single treatment with the chitin synthesis inhibitor lufenuron on German cockroach (*Blattella germanica* (L.) (dictyoptera: blattellidae)) populations. Proc. 3rd International Conference on Urban Pests, Prague, Czech Republic, pp 147-152.

Vagn Jensen, K.-M., J. B. Jespersen, B. O. Nielsen, C. Sommer, J. Bresciani, and S. A. Nielsen, 1999: Fluer og myg i husdyrbruget. 1. Kvægmyg. Dansk Veterinærtidsskrift **82**, 8 15/4: 348-350.

Vibe-Petersen, S. and H. Leirs, 1999: Prey dynamics of African rats under different predation pressure. Abstracts of the 3rd European Congress of Mammalogy, 29 May - 3 June, Jyväskylä, Finland, p. 232.

Vibe-Petersen, S. and H. Leirs, 1999: Predation in populations of *Mastomys natalensis*: potential for pest management? Abstracts of the International Symposium on African Small Mammals, 4-9 July 1999, Paris, France, p.61.

15.2 Appearances in the media

Lodal, J.: Rats, TV 2, 26 January.

Lodal, J.: Field voles and their damage caused to forest trees, TV 2, 17 March.

Rasmussen, A.: Danish Pest Infestation Laboratory in general, TVØST, April

Jensen, K.-M. V.: Interview about common black ants, Danish Broadcasting, 25 April.

Kristensen, M.: Mosquito biology and repellents, DR1 TV, 19Direkte, 10 June.

Kristensen, M.: Mosquito biology and repellents, TV2, Lorry, 24 June.

Kristensen, M.: Mosquito biology and repellents, DR, P1 radio, Postkort, 2 July.

Kristensen, M.: Mosquito biology and repellents, DR, P1 Leksikon, 27 July.

Lodal, J.: Mice, traps and rodenticides, Danish Broadcasting, 31 August.

Jespersen, J. B.: Insecticides, WDR, Germany, September.

Steenberg, T., H. Skovgaard and J. B. Jespersen: Assistance to Danish Broadcasting on video on the housefly. September.

Lodal, J.: Water vole, biology and control, Radio Mølleå, 9 September.

15.3 Unpublished reports on laboratory tests and/or field trials

The reports are confidential except those marked *

1-1999 Kristensen, M., A. Spencer and J. B. Jespersen: Biochemical and toxicological analysis of CGA-293 in susceptible and resistant strains of the housefly *Musca domestica*, 24 pp.

2-1999 Kristensen, M. and J. B. Jespersen: Larvicidal efficacy of CGA-293 in tests with two susceptible strains of the housefly *Musca domestica*, 6 pp.

3-1999 Kristensen, M. and J. B. Jespersen: Larvicidal efficacy of dicyclanil in tests with two susceptible strains of the housefly *Musca domestica*, 6 pp.

4-1999 Lauridsen, M. Knorr, J. B. Jespersen and M. Kristensen: Field evaluation of Fipronil Fly-bait Gel for control of the housefly *Musca domestica*, 34 pp.

5-1999 Kristensen, M. and J. B. Jespersen: Larvicidal efficacy of dicyclanil in tests with three resistant strains of the housefly *Musca domestica*, 9 pp.

6-1999 Jespersen, J. B. and M. Knorr Lauridsen: Laboratory evaluation of NAF granular formulations for control of the housefly *Musca domestica,* 14 pp.

7-1999 Lauridsen, M. Knorr and J. B. Jespersen: Laboratory evaluation of CGA 293 343 paint-on-bait for control of the housefly *Musca domestica*, 21 pp.

*8-1999 Jespersen, J. B.: Retningslinier for fluebekæmpelse på gårde med husdyr i 1999, 7 pp.

9-1999 Lauridsen, M. Knorr and J. B. Jespersen: Laboratory evaluation of Fipronil Fly-bait gel for control of the housefly *Musca domestica*, 21 pp.

10-1999 Lodal, J.: Undersøgelse af lyslederkabels modstandsdygtighed mod gnav af brune rotter (*Rattus norvegicus*), 54 pp.

11-1999 Kristensen, M. and J. B. Jespersen: Laboratory tests with fiprole RP 782 against susceptible and resistant strains of the housefly *Musca domestica*, 15 pp.

*12-1999 Rasmussen, A.-M. and K. Søholt Larsen: Spørgeskemaundersøgelse om hovedlus (*Pediculus capitis*) i Danmark, 37 pp.

13-1999 Lauridsen, M. Knorr and J. B. Jespersen: Laboratory evaluation comparing the previous and the new formulation of Fipronil Fly-bait gel for control of the housefly *Musca domestica*, 13 pp.

14-1999 Knorr, M. and J. B. Jespersen: Field evaluation of triflumuron-impregnated targets for control of the housefly *Musca domestica,* 36 pp.

15-1999 Kristensen, M. and J. B. Jespersen: Route of uptake of CGA-293 and azamethiphos in a susceptible and a multi-resistant strain of the housefly *Musca domestica*, 19 pp.

16-1999 Jensen, K.-M. Vagn and O. Kilpinen: Evaluering af tørret kvartssand til bekæmpelse af myrer, 7 pp.

17-1999 Jensen, K.-M. Vagn: Kakerlaktiltrækkende stoffer, 7 pp.

1-2000 Jespersen, J. B.: Retningslinier for fluebekæmpelse på gårde med husdyr i 2000, 7 pp.

16. Evaluation of the efficacy of pesticides and medical and veterinary products

16.1 Pesticides

According to the Danish Act on Chemical Substances and Products (No. 231 of 21 April 1999), the registration of a new pesticide formulation requires documentation of the efficacy of the formulation used according to the directions on the label and under Danish conditions. The National Agency of Environmental Protection makes decisions on registration concerned with the control of the pest in question, but the Agency sends the applications to a hearing at the national laboratories, e.g. DPIL or the Plant Protection Centre. These institutes evaluate the efficacy and possible risks and drawbacks of using the formulation, including the potential for developing resistance and cross-resistance (see Annual Report 1982, p.102).

In 1999, pesticides submitted for evaluation and registration included formulations for control of rodents and various insects, such as houseflies and flies on cattle, fleas, ectoparasites on livestock, ants, cockroaches, storage pests, and household insects generally, as well as insects attacking wood or textiles. Several formulations were recommended for approval, but in some cases it was concluded that more documentation was needed, supplementary tests should be carried out, or it was recommended that, for certain reasons, the formulation should not be permitted for the use requested. The registration authorities generally followed our recommendations.

In 1999, DPIL received, as usual, a steady stream of drafts of new pesticide labels submitted to the National Agency of Environmental Protection for approval. In many cases changes were suggested or required in the directions for use.

16.2 Medical and veterinary products

Medical and veterinary medical products are registered according to a common EU-directive. Guidelines for testing the efficacy of such products have been worked out or is at the moment being established. In 1999, DPIL agreed with the Danish Medicines Agency - who makes decisions on registration of medicinal products - to comment on draft versions of guidelines for testing the efficacy of medical and veterinary products and to evaluate the efficacy and possible risks and drawbacks of using such products. In 1999, we commented on the “Guideline for the testing and evaluation of the efficacy of antiparasitic substances for the treatment and prevention of tick and flea infestations in dogs and cats" and "Guideline for efficacy testing of ectoparasiticides for sheep”. Besides we evaluated the efficacy of several products for control of headlice, ticks and fleas.

N. Bille

17. Formulations approved by the Danish Pest Infestation Laboratory as of 1 March 2000

Fortegnelse over bekæmpelsesmidler anerkendt af Statens Skadedyrlaboratorium 1. marts 2000

Trade name	Active material	Conc.	Company

1 Formulations for fly control (Midler til bekæmpelse af fluer)

I Space sprays for indoor fly control
(Forstøvningsmidler til udsprøjtning i luften til bekæmpelse af fluer i lukkede rum)

(a) Solutions approved for fly control using fine atomization of at least 0.5 cm^3 per m^3
(Opløsninger anerkendt til bekæmpelse af fluer ved fin forstøvning af mindst 0,5 cm^3 per m^3 rum)

DLG Staldfluedræber	bioresmethrin	0.20%	AgroDan
	piperonylbutoxyd	0.75%	
Pytoxan Fluemiddel	pyrethrin I & II	0.4%	Bayer
	piperonylbutoxyd	2.4%	
Mortalin Special 86	pyrethrin I & II	0.4%	Mortalin
	bioresmethrin	0.05%	
	piperonylbutoxyd	2.40%	

(b) Aerosols approved for fly control when sprayed for at least 10 seconds (approx. 10 g aerosol) per 30 m^3
(Aerosoler (trykdåser) anerkendt til bekæmpelse af fluer ved sprøjtning i mindst 10 sekunder per 30 m^3 rum (svarende til ca.10 g aerosol pr 30 m^3))

Kill-it stald spray N	pyrethrin I & II	0.36%	Bayer
	piperonylbutoxyd	2.16%	

(c) Aerosols approved for fly control when sprayed for at least 7 seconds (approx. 10 g aerosol per 30 m^3)
(Aerosoler (trykdåser) anerkendt til bekæmpelse af fluer ved sprøjtning i mindst 7 sekunder pr. 30 m^3 rum (svarende til ca. 10 g aerosol pr. 30 m^3))

Mortalin Special Flueaerosol	pyrethrin I & II	0.40%	Mortalin
	bioresmethrin	0.05%	
	piperonylbutoxyd	2.40%	

Trade name	Active material	Conc.	Company

(d) Aerosols approved for fly control when sprayed for at least 5 seconds (approx. 10 g aerosol per 30 m^3) (Aerosoler (trykdåser) anerkendt til bekæmpelse af fluer ved sprøjtning i mindst 5 sekunder pr. 30 m^3 rum (svarende til ca. 10 g aerosol pr. 30 m^3))

Flue Kvit*	pyrethrin I & II piperonylbutoxyd	0.40% 2.00%	Aeropak
Stald-chock fluespray D	pyrethrin I & II piperonylbutoxyd	0.40% 2.00%	Aeropak
Trinol Turbo jet mod fluer	pyrethrin I & II piperonylbutoxyd	0.40% 2.00%	Aeropak

* Norway only

(e) Aerosols approved for fly control when sprayed for at least 6 seconds/ blue nozzle or 7 seconds/green nozzle (approx. 10 g aerosol per 30 m^3)
(Aerosoler (trykdåser) anerkendt til bekæmpelse af fluer ved sprøjtning i mindst 6 sekunder med blå dyse eller 7 sekunder med grøn dyse pr. 30m^3 rum (svarende til ca. 10 g aerosol pr. 30m^3))

Trinol jetfluemiddel	pyrethrin I & II piperonylbutoxyd	0.40% 2.40%	Trinol

II Paint-on baits or treated strips approved for supplementary fly control in animal houses
(Smøremidler anerkendt til supplerende fluebekæmpelse i stalde)

Paint-on baits:

ALFICRON plus	azamethiphos	10%	Novartis
Malure Fluesmøremiddel	methomyl muscalure	1.07% 0.04%	Mortalin
Trinol smøremiddel	propetamphos muscalure	6% 0.04%	AgroDan

Treated strips:

		g per strip	
Malure flueplader	methomyl muscalure	0.1111 0.0042	Mortalin

Trade name	Active material	Conc.	Company

III Larvicides approved for control of fly larvae
(Larvebekæmpelsesmidler anerkendt til bekæmpelse af fluelarver)

(a) Dosage 1 g a.i. per m²
(Dosering 1 g virkstof pr. m²)

Dimilin	diflubenzuron	25%	KVK
Trinol larvemiddel	diflubenzuron	25%	KVK

(b) Dosage 0.5 - 1 g a.i. per m²
(Dosering 0,5 - 1 g virkstof pr. m²)

Neporex WSG 2	cyromazin	2%	Novartis
Mortalin Cyromazin mod fluelarver	cyromazin	2%	Mortalin

IV Repellents (ear tags) approved for fly control on pastured cattle when two ear tags are attached to each animal
(Afskrækningsmidler (øremærker) anerkendt til bekæmpelse af fluer på græssende kvæg ved påsætning af to øremærker pr. dyr)

		g per tag	
Flectron	cypermethrin	1.02	Fort Dodge

V Repellents (liquids) approved for fly control on pastured cattle
(Afskrækningsmidler (væsker) anerkendt til bekæmpelse af fluer på græssende kvæg)

Renegade Pour-on	**α -cypermethrin**	1.5%	Fort Dodge
Flusa	**α-cyp**ermethrin	1.5%	Pharmacia & Upjohn

2 Formulations for control of fleas on pets and in their surroundings (Midler til bekæmpelse af lopper på kat og hund og i omgivelserne)

(a) Approved impregnated collars to be used in combination with group (c) or (d)
(Anerkendte, imprægnerede halsbånd anvendes kombineret med gruppe (c) eller (d))

Bifopet utøjshalsbånd til hunde til katte	propoxur	10%	Bifopet

Trade name	Active material	Conc.	Company
Lop-A' utøjshalsbånd	propoxur	10%	Bifopet

til hunde **til katte**			
Material Shop loppehalsbånd **til hunde** **til katte**	propoxur	9.4%	Bayer

(b) Solutions approved for control of fleas in the surroundings
(Sprøjtemidler anerkendt til bekæmpelse af lopper i omgivelserne)

Gett	chlorpyrifos	0.8%	Dow AgroSciences
Absolut D	diazinon	2%	Bayer

(c) Aerosols approved for preventive treatment of flea larvae in the surroundings
(Anerkendte aerosoler godkendt til forebyggende bekæmpelse af loppelarver i omgivelserne)

Pre-lop Spray	methopren	0.3%	Bayer

(d) Pump spray approved for preventive treatment of fleas. The product acts as a flea ovicide when used on pet fur (cats or dogs)
(Pumpespray anerkendt som forbyggende loppebehandling. Produktet forhindrer loppeæg i at klække, når katte- eller hundepels behandles)

Anti-larve spray til katte	methopren	0.5%	Bayer
Material Shop kattespray med methopren	methopren	0.5%	Bayer
Pre-lop til katte	methopren	0.5%	Bayer

3 Formulations for flea control on farmed mink (Midler til bekæmpelse af lopper hos farmmink)

Pulvex	permethrin	1%	Schering Plough
Safrotin 1% D	propetamphos	1%	Novartis

Trade name	Active material	Conc.	Company

4 Apparatus for control of hornets

(Midler til bekæmpelse af gedehamse)

Light trap for use in bakers' shops, etc.
(Lysfælde til brug i bagerforretninger, etc.)

Insect-0-Cutor	Elektrisk apparat	Tanaco

5 Apparatus for indoor mosquito control (Midler til indendørs bekæmpelse af myg)

Electric heater with vaporizing mats
(Elektrisk varmeplade med rygetabletter)

Kimo Myggetablet	d-trans-allethrin (S)-d-transallethrin piperonylbutoxyd	0.67% 3.33% 3.00%	Bjørn Hansen

6 Rodenticides for control of mice inside and around buildings (Midler til bekæmpelse af mus i og ved bygninger)

(a) Baits for general use
(Almindelige ædegifte)

Rentokil Klerat Rotteblok	brodifacoum0.005%	Zeneca	
Brota Musekorn	bromadiolon	0.01%	Mortalin
MausEx-Duo	bromadiolon	0.01%	Trinol
Materialshop musekorn D	difenacoum	0.005%	Zeneca
Ratak musekorn	difenacoum	0.005%	Zeneca
Trinol Musekorn	bromadiolon0.01%	Trinol	

(b) Bait for control of mice in or around buildings at temperatures below 16°C
(Ædegift til bekæmpelse af mus i og ved bygninger ved temperaturer under 16°C)

Alta Musepasta	chloralose	4.0%	Mortalin

Trade name	Active material	Conc.	Company

7 Formulations for control of the water vole (*Arvicola terrestris*) (Midler til bekæmpelse af mosegrise)

Bromadiolone concentrate for the impregnation of fresh apple slices used for control of water voles (Bromadiolon-koncentrat til fremstilling af bromadiolon-æbler mod mosegrise)

Brota Koncentrat	bromadiolon0.25%	Mortalin

8 Rodenticides for control of rats (*Rattus norvegicus* and *R. rattus*) (Midler til bekæmpelse af rotter)

The following 35 products were approved by the Danish Pest Infestation Laboratory as of 1 March 1999. A list of the various products is published by the Ministry of the Environment. It may be obtained from the following addresses: Torben F. Jensen, Miljøstyrelsens Konsulent i Rottebekæmpelse for Jylland, Langdalsvej 38C, 8220 Brabrand, or Peter Weile, Miljøstyrelsens Konsulent i Rottebekæmpelse for Øerne, Strandgade 29, 1401 København K.

(Følgende 35 produkter var pr. 1. marts 1999 anerkendt af Statens Skadedyrlaboratorium. En liste omfattende de forskellige produkter er udgivet af Miljøstyrelsen. Listen kan erhverves ved henvendelse til følgende adresser: Torben F. Jensen, Miljøstyrelsens Konsulent i Rottebekæmpelse for Jylland, Langdalsvej 38C, 8220 Brabrand, eller Peter Weile, Miljøstyrelsens Konsulent i Rottebekæmpelse for Øerne, Strandgade 29, 1401 København K)

Hydroxycoumarines:

Baits (0.0025-0.01%)	*18 preparations*
Tracking powders (0.15%)	*3 preparations*
Solutions (0.005%)	*1 preparation*
Paraffin blocks (0.0025-0.01%)	*12 preparations*
Concentrate (0.25%) for fresh apple	*1 preparation*

9 Formulations for control of the mole (*Talpa europaea*) (Midler til bekæmpelse af muldvarpe)

Pellets containing 56-57% aluminium phosphide are approved for the control of moles. Restricted use.
(Pellets med et indhold af 56-57% aluminiumphosphid er anerkendt til bekæmpelse af muldvarpe. Kan kun anvendes af personer, der har fået en særlig tilladelse.)

Trade name	Active material	Conc.	Company

10 Traps for control of rodents (Fælder til bekæmpelse af gnavere)

RM Mosegrisefælden	Water vole trap	RM-Service

11 Device to prevent sewer rats entering buildings via waste pipes (Aggregat til forhindring af kloakrotters indtrængning i bygninger via faldstammer)

Rottestop	Steel section to be inserted into ordinary waste pipe	SR-Stål

List of companies
Firmafortegnelse

Company Firma	**Address** Hjemsted	**Abbreviation used in chapter 17** Forkortelse anvendt i kapitel 17
Aeropak A/S	Hedensted	Aeropak
AgroDan A/S	Esbjerg	AgroDan
Bayer A/S	Kgs. Lyngby	Bayer
Bifopet Product Aps	Lynge	Bifopet
Dow AgroSciences Danmark A/S	Kgs. Lyngby	Dow AgroSciences
Fort Dodge Animal Health	Belgien	Fort Dodge
Hansen, Bjørn	Hellerup	Bjørn Hansen
KVK Agro A/S	Køge	KVK
Medimerc A/S	Tåstrup	Medimerc
A/S Mortalin	Haslev	Mortalin
Novartis Agri A/S	København Ø	Novartis
Pharmacia & Upjohn Animal Health	København K	Pharmacia & Upjohn
RM-Service/v. Herluf Rosing	Brønderslev	RM-Service
Schering Plough Animal Health A/S	Farum	Schering Plough
SR-Stål A/S	Søborg	SR-Stål
Tanaco Danmark A/S	Esbjerg	Tanaco
Trinol A/S	Nørresundby	Trinol
Zeneca Agro	København S	Zeneca