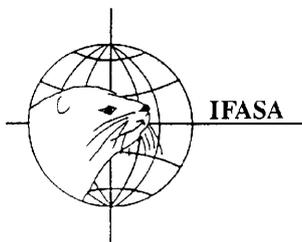
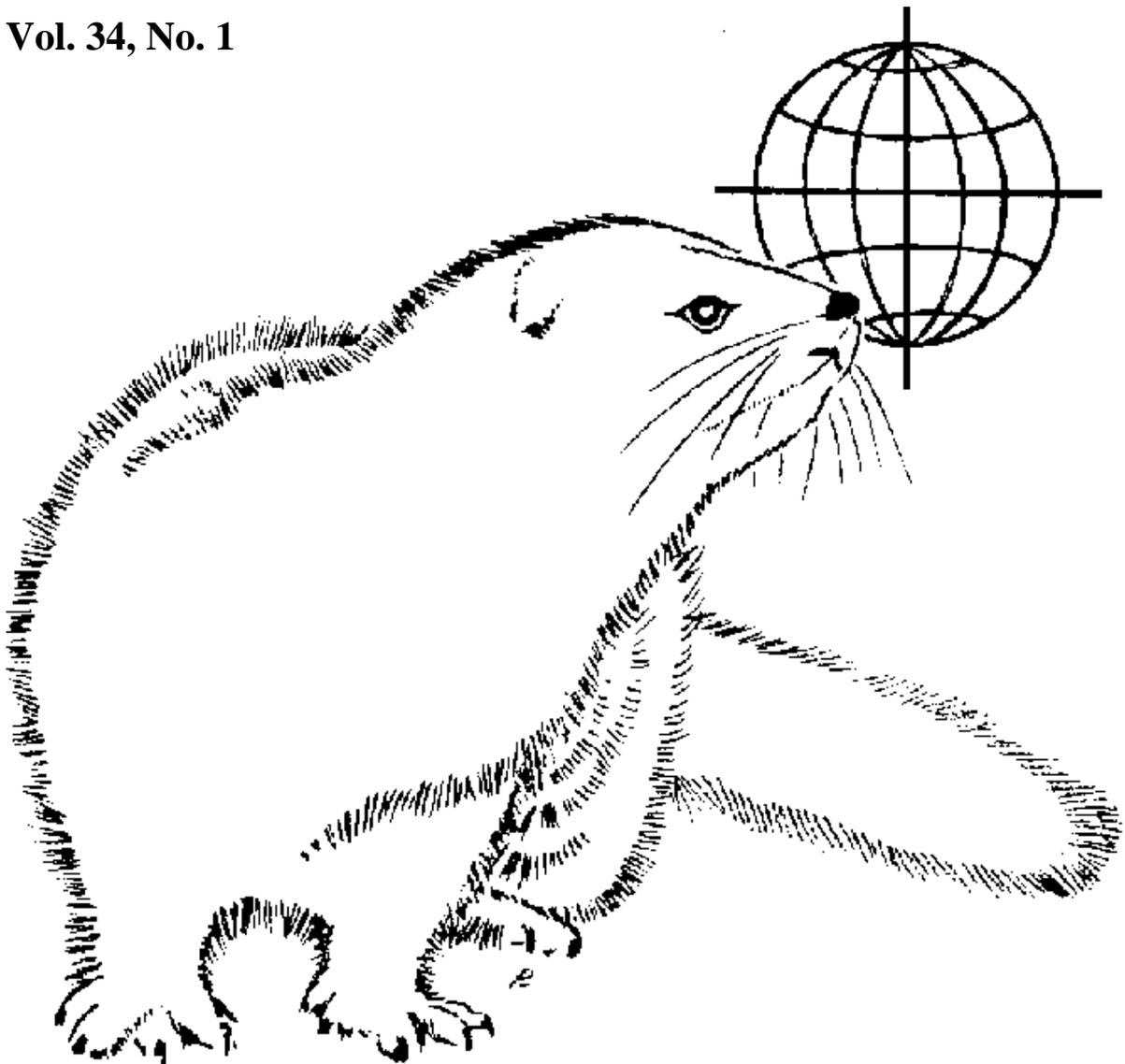


SCIENTIFUR

SCIENTIFIC INFORMATION IN FUR ANIMAL PRODUCTION

Vol. 34, No. 1



INTERNATIONAL FUR ANIMAL SCIENTIFIC ASSOCIATION

SCIENTIFUR - scientific information in Fur Animal Production.

SCIENTIFUR scientific information for those involved in fur animal production is published by the International Fur Animal Scientific Association (IFASA).

SCIENTIFUR is the contact link between fur animal researchers all over the world and serves as an outlet for scientific and other communication between researchers and others who are interested in the production of fur bearing animals. As such **SCIENTIFUR** contains reports of scientific and applied nature as well as abstracts of information published elsewhere and information regarding congresses, scientific meetings etc.

SCIENTIFUR is published as four issues per year (one volume).

REVIEWED SCIENTIFIC ARTICLES. Papers received for publication as Reviewed Scientific Articles will be sent for scientific approval by peer review.

SHORT COMMUNICATIONS. Other original papers can be published in **SCIENTIFUR** as short communications. In regard to such articles the author(s) alone is (are) responsible for the scientific validity of the article. Such papers must not exceed 4 printed pages.

EDITOR'S ADDRESS. All kinds of material suited for publication or abstracting in **SCIENTIFUR** have to be forwarded to the Editor:

Vivi Hunnicke Nielsen
SCIENTIFUR
P.O. Box 14
DK-8830 Tjele, Denmark

Tel: +45 8999 1361

Fax: +45 8999 1300

E-mail: Scientifur@agrsci.dk

SUBSCRIPTION: DKK 650.- per volume (year) including bank charges and postage.

Please note that members can subscribe, for personal use only, at a reduced rate.

Please apply for membership and further details at <http://www.ifasanet.org> or to the IFASA treasurer.

TREASURER'S ADDRESS. All correspondence regarding subscription and payment should be addressed to the Treasurer:

Steen H. Møller
IFASA
P.O. Box 14
DK-8830 Tjele, Denmark

Tel: +45 8999 1346

Fax: +45 8999 1500

E-mail: IFASA@agrsci.dk

INDEXING: Titles that have been published in **SCIENTIFUR** are covered in an electronic **SCIENTIFUR INDEX**.

Regional Scientifur Representatives

Canada: Dr. Bruce Hunter: E-mail: bhunter@ovc.uoguelph.ca

USA: Dr. Jack Rose: E-mail: rosewill@isu.edu

Finland: M.Sc. Nita Koskinen: E-mail: nita.koskinen@mtt.fi

Iceland: Advisor Einar Einarsson: E-mail: einare@krokur.is

Norway: Veterinary advisor Gorm Sanson: E-mail: sanson@norpels.no

The Netherlands: Ing. Jan deRond: E-mail: info@edelveen.com

Poland: Dr. Malgorzata Sulik: E-mail: m.sulik@biot.ar.szczecin.pl

International Fur Animal Scientific Association (IFASA). Board of directors:

Dr. Steen H. Møller (President, Treasurer): E-mail: IFASA@agrsci.dk

Dr. Bruce D. Murphy (Past President): E-mail: murphyb@MEDVET.Umontreal.CA

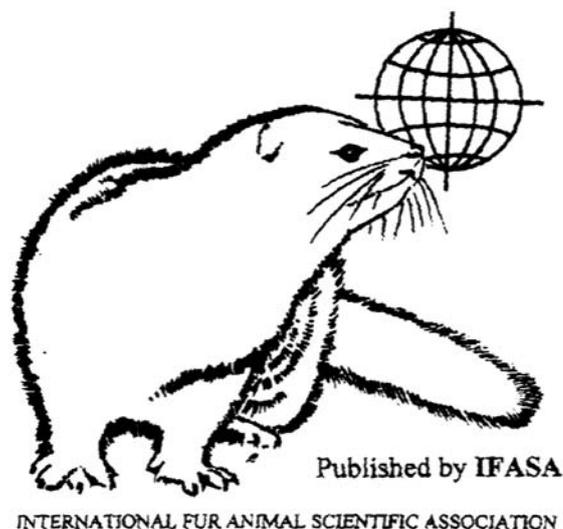
Dr. Kirsti Rouvinen-Watt (Vice President): E-mail: krouvinen@nsac.ca

Mr. Knud J. Vest. E-mail: kjv@kopenhagenfur.com

Dr. Gorm Sanson. E-mail: sanson@norpels.no

Dr. Marian Brzozowski. E-mail: brzozowskim@delta.sggw.waw.pl

SCIENTIFUR
ISSN 0105-2403
Vol. 34, No. 1



1.	Contents	1
2.	Notes	3
3.	New books	5
	<u>Annual Report 2009, Danish Fur Breeders Research Center</u>	5
	Low energy feed with barley hulls reduces stereotypies in the winter period <i>Clausen, T.N., Hansen, S.W. and Sandbøl, P.</i>	6
	Possibilities for selecting for reduced aggression in group-housing <i>Berg, P. and Møller, S.H.</i>	6
	Inheritance of black palate in mink <i>Christensen, K., Anistoroaei, R., Fredholm, M. and Nielsen, V.H.</i>	6
	Level of inbreeding and genetic distance in Danish farm mink (<i>Neovison vison</i>) <i>Larsen, P.F., Bækgaard, H., Sønderup, M. Møller, H.H., Hansen, B.K., Nielsen, V.H., Demontis, D., Loeschcke, V. and Pertoldi, C.</i>	6
	Protein to mink in the gestation period. Continued investigations <i>Clausen, T.N. and Sandbøl, P.</i>	7
	Mink kits, optimal growth and good skin size <i>Clausen, T.N. and Sandbøl, P.</i>	7
	Glycerol in mink feed in the growing- furring period <i>Clausen, T.N. and Sandbøl, P.</i>	7
	Investigation on the effect of L- and DL- methionine to mink in the growing-furring period <i>Clausen, T.N. and Sandbøl, P.</i>	8

Investigation on the importance of the amino acids phenylalanine (phe) and tyrosine (tyr), and the minerals iron (Fe), copper (Cu) and zink (Zn) on pelt colour in black and brown mink <i>Clausen, T.N. and Sandbøl, P.</i>	8
Apparent digestibility of Glycerol in mink <i>Schulin-Zeuthen, M. and Sandbøl, P.</i>	8
Apparent and true digestibility of nitrogen, fat energy, and amono acids <i>Hellwing, A.L.F., Hansen, N.E. and Tauson, A.-H.</i>	8
Compensatory growth in mink kits (<i>Mustela vison</i>) following reduced protein intake after weaning <i>Schulin-Zeuthen, M. and Sandbøl, P.</i>	9
Susceptibility of post weaning diarrhoea in mink kits – Effects of diet composition <i>Damgaard, B.M. and Hedemann, M.S.</i>	9
Evaluation of an ELISA for detection of antibodies to mink astrovirus <i>Ullman, K., Baule, C., Hammer, A.S., Hammer-Jensen, T. and Czifra, G.</i>	9
Kit death from birth to August the first <i>Clausen, T.N.</i>	10
Importance of feed consumption for urine pH <i>Clausen, T.N.</i>	10
Investigation of wildtype canine distemper virus and DNA vaccination in mink <i>Nielsen, L., Søgaaard, M., Jensen, T.H. Karlskov-Mortensen, P., Andersen, M.K., Jensen, T.D., Aasted, B. and Blixenkronne-Møller, M.</i>	10
Phylogeny investigation of new wildtypes of canine distemper virus <i>Nielsen, L., Jensen, T.H., Hammer, A.S., Banyard, A.C., Barrett, T. and Blixenkronne-Møller M.</i>	11
DNA vaccination protects mink kits against distemper <i>Jensen, T.H., Nielsen, L., Aasted, B. and Blixenkronne-Møller, M.</i>	11
Outbreak of masticatory myositis in farmed mink <i>Hammer, A.S., Jensen, T.H., Salomonsen, C.M., Harslund, J.L.F., Christensen, L.R., Chriel, M. and Clausen, T.</i>	11
Importance of nest box size and material, for litter size, a pilot study <i>Sønderup, M., Bækgaard, H., Larsen, P.F. and Clausen, T.N.</i>	12
Reducing feed loss in the growing period by metal plates in the cage <i>Clausen, T.N., Blæsbjerg, M. and Sandbøl, P.</i>	12
Importance of birth date on kit growth in the growing period <i>Clausen, T.N. and Sandbøl, P.</i>	12
<u>Doctoral dissertation</u>	13
Reproductive Biology and Embryo Technology in <i>Mustelidae</i> <i>Sergei Amstislavsky</i>	13

Notes from the Editor

This volume of *Scientifur* brings an abstract from a doctoral dissertation from the Faculty of Natural and Environmental Sciences, University of Kuopio, Kuopio, Finland. Education is essential to all scientific areas and it is a pleasure to present this work with *Mustelidae* entitled “Reproductive Biology and Embryo Technology in *Mustelidae*”. The study provides information of using embryo

technology transfer technologies in conservation programmes for the European mink.

This volume also contains abstracts from the Danish Fur Breeders Research Center Annual Report 2009. It reports studies in behaviour, breeding and genetics, nutrition and feeding, physiology and analytical techniques, health and management.

Vivi Hunnicke Nielsen
Editor *Scientifur*

Annual Report

2009

Danish Fur Breeders Research Center

Abstracts



Danish Fur Breeders Research Center

Herningvej 112 C

DK-7500 Holstebro

Denmark

Phone.: +45 96 13 57 00

Fax.: +45 96 13 57 14

e-mail: pfc@kopenhagenfur.com

Annual Report 2009

Coverphoto: Jesper Clausen

Layout: Sonja Lind Mose

Printer: DP/DPA

Editor: Peter Sandbøl

ISSN 1395-198X

Reports on: Behaviour

Low energy feed with barley hulls reduces stereotypies in the winter period

Clausen, T.N., Hansen, S.W. and Sandbøl, P.

To an investigation on the use of fibre in low and high concentrated mink feed in the winter period, we used tree groups of 175 black mink females each. The control group (Kon) was feed a low concentrated feed, to that feed we added 15 % fibre (Fib1), to compare we added 15 % fibres to a high concentrated feed (Fib2).

If females are feed the same amount of energy, an addition of fibres and water to the feed, will increase time with feed on the cage. This is due to both an effect of bigger feed volume and that fibres increase the feeling of satiety by increasing the filling of the digestive system. Stereotypic behaviour is reduced significantly by using low energy feed and thereby a bigger feed volume. However females who reduce there activity have a bigger body score before flushing, and had a higher number of dead kits at birth.

Annual Report 2009, 7-15, Danish Fur Breeders Research Center, Holstebro, Denmark.

Reports on: Breeding and reproduction

Possibilities for selecting for reduced aggression in group-housing

Berg, P. and Møller, S.H.

There is evidence from several species (e.g. poultry) that selection can contribute to reducing aggression in groups, and selection thus could be one way of reducing aggression in groups of mink in group housing. On this background, a selection experiment was started, aiming at reducing the number of bite marks on the skin side. This study describes variation in bite marks in the first generation. The study includes evaluation of bite marks on a total of 640 mink in group housing and 289 of their full sibs in standard cages (two animals). In group housing significantly more bite marks are observed than on the corresponding full sibs in standard cages. In addition, there seems to be a weak relationship

between number of bite marks in group housing and standard cages. In group housing the females are generally more bitten than males, though the most bitten male has on average more bite marks than the least bitten female. A higher correlation between number of bite marks are observed between animals of the same sex (the two males and the two females) than between sexes in group housing. This indicates that bite marks to a large extent is due to fights within sexes. A large variation between full sibs/cages was found in the number of bite marks. This indicates that genetic differences are an important factor contributing to the number of bite marks. Selection for reduced number of bite marks continues in the coming years.

Annual Report 2009, 17-22, Danish Fur Breeders Research Center, Holstebro, Denmark.

Inheritance of black palate in mink

Christensen, K., Anistoroaei, R., Fredholm, M. and Nielsen, V.H.

The inheritance of black palate colour has been investigated in more than 1000 F2 animals derived from a cross between Wild-mink and "short nap" Black mink. A statistically significant relationship was found between the palate colour in parent and offspring. In addition was found a statistically significant relationship between the palate colour and a gene marker Mvi1950; but the inheritance of palate colour could not be explained by segregation of the alleles in one locus alone. Absolutely no relationship was found between the colour of the palate and coat colour scored from one to seven.

Annual Report 2009, 23-25, Danish Fur Breeders Research Center, Holstebro, Denmark.

Level of inbreeding and genetic distance in Danish farm mink (*Neovison vison*)

Larsen, P.F., Bækgaard, H., Sønderup, M. Møller, H.H., Hansen, B.K., Nielsen, V.H., Demontis, D., Loeschcke, V. and Pertoldi, C.

With special emphasis on the level of relatedness (R) within mink color types (*Neovison vison*) originating from different mink farms in Denmark we present here the results from a microsatellite analysis study. Large differences were observed in level of R (R range: 0.017-0.520) and in genetic distance (F_{ST} range: 0-0.29) between strains and farms. Moreover, we correlated the level of R and breeding result for individual mink populations and found a very strong and highly significant negative correlation between these two parameters ($R^2=0.60$, $p<0.001$). To our knowledge this is the first time that such a correlation has been demonstrated in mink from commercial mink farms. As a result we suggest using microsatellite or an alternative type of markers e.g. VeraCode, SNPlex and Fluidigm EP1 systems, which can be utilized to evaluate level of R in mink strains with reproductive problems and apply information from genetic markers when e.g. buying in new breeding animals in order to optimize fitness. Alternatively this technique could also be employed in order to obtain heterosis within color types applying the genetic variation found within a color type. We hope that this new molecular genetic information can be applied in practical mink farming in the future.

Annual report 2009, 27-31, Danish Fur Breeders Research Center, Holstebro, Denmark

Reports on: Nutrition and feeding

Protein to mink in the gestation period. Continued investigations

Clausen, T.N. and Sandbøl, P.

To continue the investigations on the need of protein, fat, carbohydrates and amino acids in the gestation period (April 4 to April 26) we used 6 groups each consisting of 134 brown mink females. The females were fed with feed from the local Feedkitchen until April 6, thereafter the protein content was varied in the groups from 35 to 45 percent of metabolisable energy from protein (MEp) fat was varied from 40 to 55 MEf and carbohydrates was varied from 10 – 20 MEc. After April 26 these females had 30 MEp until day 28 in the nursing period, thereafter feed from the local feed kitchen was used. Only females giving birth between April 26 and May 5 was included in investigation.

The results showed no significant difference between any of the groups, so the current Recommendations for protein and amino acids in the gestation period will not be changed.

Annual Report 2009, 33-37, Danish Fur Breeders Research Center, Holstebro, Denmark.

Mink kits, optimal growth and good skin size

Clausen, T.N. and Sandbøl, P.

To an investigation on optimal feeding of mink kits in the early growing period, we used 7 groups consisting of 135 wildtype mink females and their kits. Until the kits were 28 days we used feed kitchen feed, after that feed with different amounts of protein were used until 12 weeks of age.

The results confirmed what we have found earlier. Kits in the period 4 to 8 weeks, need 45 percent of the metabolisable energy from protein (MEp) combined with a low amount of carbohydrates (10 and 15 MEc). In the period 8 to 12 weeks, the body weight increase is equally good in kits fed 35 MEp and 45 MEp. Further the body weight increase is reduced with increasing carbohydrates in that period. Kits feed 30 MEp from 4 to 12 weeks are smallest at pelting. The amino acid recommendations for that period, seems to be sufficient.

Annual Report 2009, 39-44, Danish Fur Breeders Research Center, Holstebro, Denmark.

Glycerol in mink feed in the growing- furring period

Clausen, T.N. and Sandbøl P.

To the investigation of increasing amounts of glycerol 0 – 2 – 4 – 6 – 8 percent to mink kits in the growing period, we used 5 groups of 132 wildtype mink kits each. The results showed that we can use up to 8 % glycerol instead of 8 % cornstarch, with reservations to changes in feed consistency. Glycerol should be analysed for Na and methanol before use. The skin quality was best at 8 % glycerol and no cornstarch, also it seems that glycerol reduces the liver fat content.

Annual Report 2009, 45-50, Danish Fur Breeders Research Center, Holstebro, Denmark.

Investigation on the effect of L- and DL-methionine to mink in the growing-furring period

Clausen, T.N. and Sandbøl, P.

To investigate the effect of L-met or DL-met to mink in the growing-furring period, we used 7 groups of 132 wildtype male- and female mink kits each. To a control feed with low methionine we added L-met or DL-met up to a calculated content of 0.10, 0.13 and 0.16 g digestible met / 100 kcal. The heaviest male kits and the longest skins at pelting were seen in the group with the highest addition of DL-met. From an analysed content of 0.14 g met / 100 kcal and more the skin size and pelt quality was good, and existing norm is adequate. Further it seems that the animals are able to use some of the D form of methionine, as an addition of DL-met in twice the amount of L-met gave better results.

Annual Report 2009, 51-56, Danish Fur Breeders Research Center, Holstebro, Denmark.

Investigation on the importance of the aminoacids phenylalanine (phe) and tyrosine (tyr), and the minerals iron (Fe), copper (Cu) and zinc (Zn) on pelt colour in black and brown mink

Clausen, T.N. and Sandbøl, P.

To find the optimal level of phe+tyr for body growth and pelt colour and to find the importance of Fe, Cu and Zn for pelt colour, we used 5 groups of 142 black male and female mink kits each, and 2 groups of 122 wildtype male and female kits each. To a control feed with a low content of phe+tyr (0.41 g digestible phe + tyr / 100 kcal) we added phe + tyr up to a total content of 0.47 vs. 0.55 g digestible phe + tyr / 100 kcal. Further we had two groups with and addition of chelated minerals, copper (Cu), zinc (Zn) and iron (Fe) in two levels to the control feed.

The results showed a tendency towards the lowest weight at the lowest phe + tyr level and a tendency

towards the darkest skins at the highest level, both in black and wildtype mink kits. Increased addition of minerals in the amounts used here gave a better body growth, there were no significant difference in skin length and pelt quality, but a tendency towards lower skin quality, and darker colour at the highest addition. The liver fat content was highest at the highest addition of chelated minerals. There was a tendency towards an increased liver mineral content when the feed mineral content increased, but no significant increase.

Annual Report 2009, 57-65, Danish Fur Breeders Research Center, Holstebro, Denmark.

Apparent digestibility of Glycerol in mink

Schulin-Zeuthen, M. and Sandbøl, P.

A dark and light sample of Glycerol was compared in a digestibility trial. The light Glycerol contained slightly more crude protein, fat, ash and salt (percentage of dry matter) and thus slightly less calculated crude carbohydrates than the dark sample. A discrepancy hydrates in the diets. The apparent digestibility of carborhydrates in both samples of Gly- cerol was 93 %.

Annual Report 2009, 67-70. Danish Fur Breeders Research Center, Holstebro, Denmark.

Apparent and true digestibility of nitrogen, fat, energy, and amino acids

Hellwing, A.L.F., Hansen, N.E. and Tauson, A.-H.

Thirty-two pairs of male mink kits were allocated to four different diets four weeks post partum. The kits were weaned when they were 5-6 weeks old. The apparent and true digestibilities of the diets were calculated from quantitative collection of faeces when the kits were 6, 9 and 12 weeks old. The diets contained either 30% or 45% of the metabolisable energy (ME) from protein and 15% or 25% of ME from carbohydrate. The diet codes were HPHC (high protein, high carbohydrate; 45:25), LPHC (low protein, high carbohydrate; 30:25), HPLC (45:15) and LPLC (30:15). The apparent digestibility of nitrogen and amino acids was

significantly lower on both LP than on the HP diets. The true digestibility on the LPHC diet was the same as on the HP diets except for methionine, leucine and valine, which were lower. The true digestibility of the LPLC was significantly lower than that of the other diets except for histidine. Both apparent and true digestibility of nitrogen, fat, energy, and amino acids decreased with age.

Annual Report 2009. 71-78. Danish Fur Breeders Research Center, Holstebro, Denmark.

Reports on: Physiology and analytical techniques

Compensatory growth in mink kits (*Mustela vison*) following reduced protein intake after weaning

Schulin-Zeuthen, M. and Sandbøl, P.

Two groups of 8 weeks old mink kits were offered a synthetic diet containing 17.5 % ME_p corresponding to 50 % of the protein requirement of the kits. In one of these groups, soy lecithin replaced 5 % of the dietary fat fraction. A control group was kept under normal farm conditions offered a regular feed kitchen diet. The two restricted groups maintained weight (lecithin group) or loosed weight (synthetic control) during the 11 days of restriction. 2 weeks after conclusion of the restriction period, live weight of all mink kits were the same and therefore the two restricted groups was able to compensate growth.

Annual Report 2009, 79-83, Danish Fur Breeders Research Center, Holstebro Denmark.

Reports on: Health

Susceptibility of post weaning diarrhoea in mink kits - Effects of diet composition

Damgaard, B.M. and Hedemann, M.S.

The aim of the project was in a challenge model to measure the susceptibility of post weaning diarrhoea in mink kits. The kits were from litters fed a kit diet (high digestibility) and an ordinary farm diet, respectively. The project was performed during the

first 7 days after weaning. The mink kits were orally challenged with coli bacteria (*Escherichia coli O68*) on day 1 and 2 after weaning. The frequency of mink kits with diarrhoea was not affected by the composition of the diets. The body weight and the body growth were not affected by the diet composition and the challenge with bacteria. The number of erythrocytes, the content of haemoglobin and the haematocrit value in the blood were higher in kits fed kit diet than in kits fed farm diet. The number of leucocytes and neutrophils in the blood and the plasma content of the acute phase proteins haptoglobin and fibrinogen were lower in kits fed kit diet than in kits fed farm diet. The thickness of the muscles in the last part of the small intestine, the area of the mucins on villi in the small intestine and the area of the mucins in the crypts in the last part of the intestine were higher in kits fed kit diet than in kits fed farm diet.

Annual report 2009, 85-90. Danish Fur Breeders Research Center, Holstebro, Denmark.

Evaluation of an ELISA for detection of antibodies to mink astrovirus

Ullman, K., Baule, C., Hammer, A.S., Hammer-Jensen, T. and Czifra, G.

Previous epidemiological studies have shown an association between presence of mink astrovirus and pre-weaning diarrhoea in affected as compared to non-affected farms. In order to enable investigations on the spread of astrovirus infections in mink and to monitor production of antibodies following immunization or challenge experiments, a serological tool was needed. An indirect ELISA was developed using recombinant capsid protein of mink astrovirus as antigen. Plates were coated with capsid protein and incubated with the sera diluted 1:100. As secondary antibody, a horseradish peroxidase-labeled mouse anti-mustelid IgG was used. Development of the reaction was done with tetramethylbenzidine as substrate. The readings were done by measuring the optical density (OD) at 450 nm. This ELISA has been used in different studies, such as for determination of immunogenicity of the capsid protein, and detection of antibodies in sera from farms with and without clinical history of greasy kits. Production of specific

antibodies could be detected with the ELISA in mink immunized with the complete and with two short variants of the capsid protein. Also, by means of this ELISA it could be demonstrated that antibodies to mink astrovirus are commonly present in farms reporting the wet kits syndrome. However, also on farms without wet kits antibodies to mink astrovirus could be detected, albeit with lower titres. It is concluded that the developed ELISA is a suitable tool for detection of antibodies against mink astrovirus. Also, the ELISA supports the evidence that infection with astrovirus is common in mink farms, and indicates that different presentations, from subclinical to overt clinical manifestations appear in different farms.

Annual report 2009, 91-96. Danish Fur Breeders Research Center, Holstebro, Denmark.

Kit death from birth to August the first

Clausen, T.N.

Investigation on the courses of death among kits from 828 litters in the period from birth to August the first. The results showed that we lose many kits in connection with birth. Around ½ a kit per litter is stillborn. Since especially the fat females lose kits, feeding and control of body score in the winter and pregnancy period should be optimised. The rest of May only a few kits die, but when they start to eat, around 4 weeks of age, some kits get diarrhoea and become unthrifty. To avoid that management at the farm is very important, good bedding materials, hygiene, optimal food quality, water supply and immediate treatment if there is diarrhoea. If those conditions are not optimal we further risk cannibalism among the kits. From the middle of June bladder infections is the main problem, the feed in that period should have acidifying properties and the water supply should be optimised.

Annual Report 2009, 97-103. Danish Fur Breeders Research Center, Holstebro, Denmark.

Importance of feed consumption for urine pH

Clausen, T.N.

To an investigation on the importance of the feed for urine pH we used 2 x 36 wildtype male and female mink kits. Urine samples for pH measurement were taken after a fasting period, and at different times after feeding. The results showed, that fasting urine pH is in the area 6.05 to 6.50. Consumption of feed influence the urine pH dependent on feed composition and amount. Urine pH is investigated 4 hours after feeding. If there is feed on the wire all day long, urine pH will not reach fasting level unless the feed composition act in direction of low urine pH or unless substances that lower urine pH is added. It is recommended that urine pH 4 hours after feeding is in the area 6.0 to 6.4.

Annual Report 2009, 105-109. Danish Fur Breeders Research Center, Holstebro, Denmark.

Investigation of wildtype canine distemper virus and DNA vaccination in mink

Nielsen, L., Søgaard, M., Jensen, T.H. Karlskov-Mortensen, P., Andersen, M.K., Jensen, T.D., Aasted, B. and Blixenkron-Møller, M.

Mink were inoculated with two different Canine distemper viruses (CDV) – a Danish (DK91) virus strain and an American (Snyder Hill) virus strain. DK91 represents a circulating European wildtype genotype, while the Snyder Hill strain represents the American genotypes isolated before 1960. Clinical and paraclinical investigations of the mink were performed after inoculation. The wildtype CDVs investigated provoked marked virulence differences. The Danish wildtype showed a mildly virulent course in our natural host model, in contrast to the acute, severe disease outcome in the Snyder Hill challenged mink.

Furthermore, we investigated if DNA vaccine consisting of the genes from vaccine strains induced cross-protection against circulating European CDV. Our results indicate that DNA vaccine-induced immunity protected the mink against disease development. Further work on DNA vaccines against circulating wildtype CDVs could lead to new and safer strategies to control and to prevent distemper.

Annual Report 2009, 111-118, Danish Fur Breeders Research Center, Holstebro, Denmark.

Phylogeny investigation of new wildtypes of canine distemper virus

Nielsen, L., Jensen, T.H., Hammer, A.S., Banyard, A.C., Barrett, T. and Blixenkron-Møller M.

Canine distemper virus and the closely related phocine distemper virus have an overlapping host range and both have induced disease among terrestrial and marine carnivores. We have characterized the distemper virus among the wildlife in Denmark from 2000 to 2003.

We have isolated viral RNA from the new wildtype CDVs, performed nucleic acid sequencing and determined the relatedness of the wildtypes. We found that the isolated virus from the investigated terrestrial carnivores (mink, badger, European polecat, beech marten and pine marten) were canine distemper virus, which was phylogeny separated from virus isolated from diseased seals. Our results revealed no direct epidemiological link between the two distemper viruses isolated from distemper cases among land-living carnivores and the marine carnivore.

Annual Report 2009, 119-125. Danish Fur Breeders Research Center, Holstebro, Denmark.

DNA vaccination protects mink kits against distemper

Jensen, T.H., Nielsen, L., Aasted, B. and Blixenkron-Møller, M.

DNA vaccination is a promising vaccination strategy with potentials for inducing immunity in young individuals because of the possibility to overcome maternally derived antibodies. However, the capacity of a DNA vaccine to induce immunity against CDV in young mink without maternal antibodies has so far not been described. In this study young mink kits (n=8) were vaccinated with DNA plasmids encoding the viral haemagglutinin protein (H) of Canine distemper virus (CDV). Virus neutralising antibodies (VN) were induced after 2 immunisations and after the third immunisation all kits had high VN antibody titres which remained for more than 4 months until challenge inoculation. The

DNA vaccinated mink were protected against viremia, lymphopenia and clinical disease after challenge inoculation with a recent wild type strain of CDV. The T-cell immune response of the vaccinated mink was boosted by challenge inoculation indicating that the vaccine primed a memory response.

Annual Report 2009, 127-133. Danish Fur Breeders Research Center, Holstebro, Denmark.

Outbreak of masticatory myositis in farmed mink

Hammer, A.S., Jensen, T.H., Salomonsen, C.M., Harslund, J.L.F., Christensen, L.R., Chriel, M. and Clausen, T.

Necrotizing and eosinophilic myopathia was first observed in farmed mink kits in Denmark in August 2008. During the following months the disease was identified on altogether 13 farms in the south-western part of Denmark. In 2009 outbreaks appeared on 6 farms. A total of 202 mink kits with myopathia were included in this investigation. Histopathology showed necrotizing myopathia with fragmentation, hyalinization and atrophy of muscle fibres. Inflammatory cell infiltrations varied from primarily eosinophilic to predominantly mononuclear infiltrations. Differential count of blood samples from two mink showed increased numbers of eosinophilic cells. The disease affects mink of all colour types, which makes it unlikely to be inherited, though there may be genetic factors affecting the course of disease. Testing was conducted to determine the cause of the disease, including tests for specific viral diseases (canine distemper, Aleutian mink disease), tests for protozoa (*Toxoplasma gondii*, *Neospora caninum*), bacteria (general aerobic and anaerobic culture) and toxins (Narasin, Monensin, Salinomycin, Lasalocid, melamin) and blood analyses. The preliminary results are inconclusive and further investigations are necessary to identify the cause of the disease.

Annual Report 2009, 135-140. Danish Fur Breeders Research Center, Holstebro, Denmark.

Reports on: Management

Importance of nest box size and material, for litter size, a pilot study

Sønderup, M., Bækgaard, H., Larsen, P.F. and Clausen, T.N.

Nest box design and type of nesting material affect kit survival and wellbeing. In this pilot study, 12 farms were involved. As background material in the nest was, Easy Stroe (trade name for heat-treated, forage harvester wheat straw), compared with shavings and short cutted barley straw were studied. As nesting material the long cutted barley straw was compared with the short cutted barley straw and the wood shavings. It was also investigated whether reduced nest box size had an impact. The Number of living and dead pups from 2 to 5 days of age and the number of living pups at 3 to 4 weeks of age were recorded. Easy Stroe compared to shavings as bottom material, showed a statistically significant difference in favour of Easy Stroe on a total number of pups at birth, the number of living pups at birth and the number of puppies at the second count.. There was no significant difference for kit loss between the first and second counts. The study points to the importance of choice of nesting material and design. There was found a statistically significant difference of 0.20 kits/female for Easy Stroe over shavings, measured as living pups at 3 to 4 weeks of age. Moreover, future areas of focus will be discussed.

Annual Report 2009, 141-146. Danish Fur Breeders Research Center, Holstebro, Denmark.

Reducing feed loss in the growing period by metal plates in the cage

Clausen, T.N., Blæsbjerg, M. and Sandbøl, P.

In an attempt to reduce the loss of feed under the cages in early July, we placed metal plates in the bottom of 155 cages with wildtype mink kits. Feed

consumption and body growth was registered in this group and in a control group (155 cages) without plates.

Feed consumption in early July can be reduced from about 9 % to about 2 % by using metal plates, and body growth tended to increase. The loss of food was reduced gradually to around 1.2 % in early August in cages without plates. However there are great variations from year to year depending of feed consistency, temperature, weather etc. By removing the plates in early September problems with lumps in the pelt was avoided.

Annual Report 2009, 147-150. Danish Fur Breeders Research Center, Holstebro, Denmark.

Importance of birth date on kit growth in the growing period

Clausen, T.N. and Sandbøl, P.

The purpose of this investigation was to follow feed consumption and body weight growth in early and late borne mink kits. To the investigation we used one male mink kit from each of the 58 first borne wildtype litters (borne April 22 to April 26) and from each of the 52 latest borne wildtype litters (borne May 6 to May 14).

Body weight in early and late borne kits was equal at the same age, and the total food consumption from July to pelting was equal. In the beginning of the growing period, late borne kits eat less than early borne, but from September late borne kits eat more. Pelt quality, body length, skin length and body condition at pelting were equal.

Annual Report 2009, 151-154. Danish Fur Breeders Research Center, Holstebro, Denmark.

Reproductive Biology and Embryo Technology in *Mustelidae*



Doctoral dissertation

by

Sergei Amstislavsky

KUOPION YLIOPISTON JULKAISUJA C. LUONNONTIETEET JA YMPÄRISTÖTIETEET 256
KUOPIO UNIVERSITY PUBLICATIONS C. NATURAL AND ENVIRONMENTAL SCIENCES 256



SERGEI AMSTISLAVSKY

**Reproductive Biology and
Embryo Technology in *Mustelidae***



Department of Biosciences
Faculty of Natural and Environmental Sciences
University of Kuopio, Finland

2009

Kuopio University Publications C. Natural and Environmental Sciences 256, 2009, 149 p.

ISBN 978-951-27-1194-9

ISBN 978-951-27-1289-2 (PDF)

ISSN 1235-0486

Mustelidae is the largest family in the order *Carnivora*, with 59 extant species and more than 400 subspecies. The present research project represents the first attempt to develop embryo technologies appropriate for use in the conservation of European mink. To study mustelid early embryonic development *in vivo*, a total of 100 embryos were flushed from 26- to 92-day-old female stoats (*Mustela erminea*), and a further 150 embryos were flushed from European mink. Embryos were either transferred or fixed for microscopic study; in parallel morphological changes in the *corpora lutea* in ovaries and the progesterone profile in faeces were monitored during early pregnancy of European mink.

Newborn stoat females entered oestrus during the first month of life and stayed in heat for up to several months. When mated, these female ovulated 3 - 4 days later. Embryos arrived in the uterus 11 - 12 days *post coitum* (dpc), slowly expanded and persisted as diapausing blastocysts until implantation 8 - 9 months later. European mink proved to be a seasonally polyoestrous species with no diapause. Embryos migrated into the uterine horns 6 dpc at the morula

stage, and, in most, cavitation began within the first day of arrival. Blastocysts grew rapidly until implantation on day 12 pc. Prominent *corpora lutea* were observed in the ovaries throughout the preimplantation period and concentrations of progesterone reached their maximum around the day of implantation.

The transfer of 7 - 11 dpc European mink blastocysts to pseudopregnant honorik/nohorik females (interspecies hybrids between European polecat and European mink) resulted in term kits. This approach was successful since a reasonable survival rate (= live kits/transferred embryos) of 50 % was achieved on a repeatable basis. Although in the first trial only 56.3 % of term kits survived, the rate of postnatal survival in the second trial was higher, reaching 70 %. The results of these experiments with European mink and related species in the genus *Mustela* provide basic reproductive knowledge for incorporation embryo technology into the framework of conservation programmes for the European mink.

INSTRUCTIONS FOR AUTHORS

SCIENTIFUR is published as four issues per year in the following way:

- Three issues containing short communications (max. 4 pages), abstracts, letters, book reviews etc.
- One issue entitled "Fur Animal Science" containing only reviewed articles

SCIENTIFIC REVIEWED ARTICLES should not exceed 6 printed pages (=12 typewritten A4 pages with double spacing including figures and tables). Additional pages will be charged to the author(s) at Euro 100 per printed page. Scientific reviewed articles will be sent to two referees for scientific approval.

Papers submitted for publication as scientific reviewed articles are received with the understanding that the work has not been published before, and is not considered for publication elsewhere and has been read and approved by all authors. Animal experimental methods reported in **SCIENTIFUR** should meet ethical standards of animal treatment.

SHORT COMMUNICATIONS. Other original papers can be published in **SCIENTIFUR** as short communications. In regard to such articles the author(s) alone is (are) responsible for the scientific validity of the article. Such papers must not exceed 4 printed pages.

Please indicate if an original article should be published as a Scientific Reviewed Article or as a Short Communication.

MANUSCRIPTS

All manuscripts must be sent in three copies and preferably accompanied by an electronic copy on a diskette or by E-mail. The electronic files should preferably be in Microsoft Word. The material should be sent to:

SCIENTIFUR/Faculty of Agricultural Sciences, Aarhus University, P.O. Box 14, DK-8830 Tjele, Denmark or

E-mail: Scientifur@agrsci.dk

Manuscripts must be in English, typed double spaced with page and line numbering and consisting of:

Title, which should be concise and informative, but as short as possible, and contain the main key words.

Authors name(s) as well as name(s) and address(es) of the institutions to which the work is attributed. E-mail address of the corresponding author should preferably be included.

Summary/Abstract, which should not exceed 150 words.

Keywords in alphabetic order if not included in the title.

Text. The text should normally be divided into: Introduction, Material and Methods, Results, Discussion, Acknowledgements and References and follow the internationally accepted rules. Double documentation in both figures and tables will not be accepted.

Illustrations. All graphs, photos and pictures are considered as figures and have to be labelled on the reversed side of the sheet with number, authors name and indication of orientation. All drawings have to be professionally drafted (photocopies are not an acceptable standard). The illustrations included in the electronic version should be as JPG-, GIF- or TIF-files. Any halftones must exhibit high contrast and text and other details must be large enough to retain the readability after reduction of figure size to single column (width 80 mm); the width of 170 mm can be accepted in special cases.

Colour illustrations can be included in the electronic version of **SCIENTIFUR**. Any colour illustrations in the printed copies must be paid by the author.

Tables. Each table should be typed on a separate page. Tables must be numbered consecutively with Arabic numerals, and have a self-explanatory title. Tables should be planned to fit a final width of 80 or 170 mm.

References should be kept to a pertinent minimum. References in the text should be made according to the following examples: Nielsen, 1992; Hansen & Berg, 1993; Bakken et al., 1999. The list of references should be arranged in alphabetic order according to the name of the first author and the year of publication within the names. The year of publication should be written between the name(s) and the title.

Reprints. After publication of a reviewed article the authors receive 25 reprints without charges. Additional reprints can be ordered from the editor after individual agreement.