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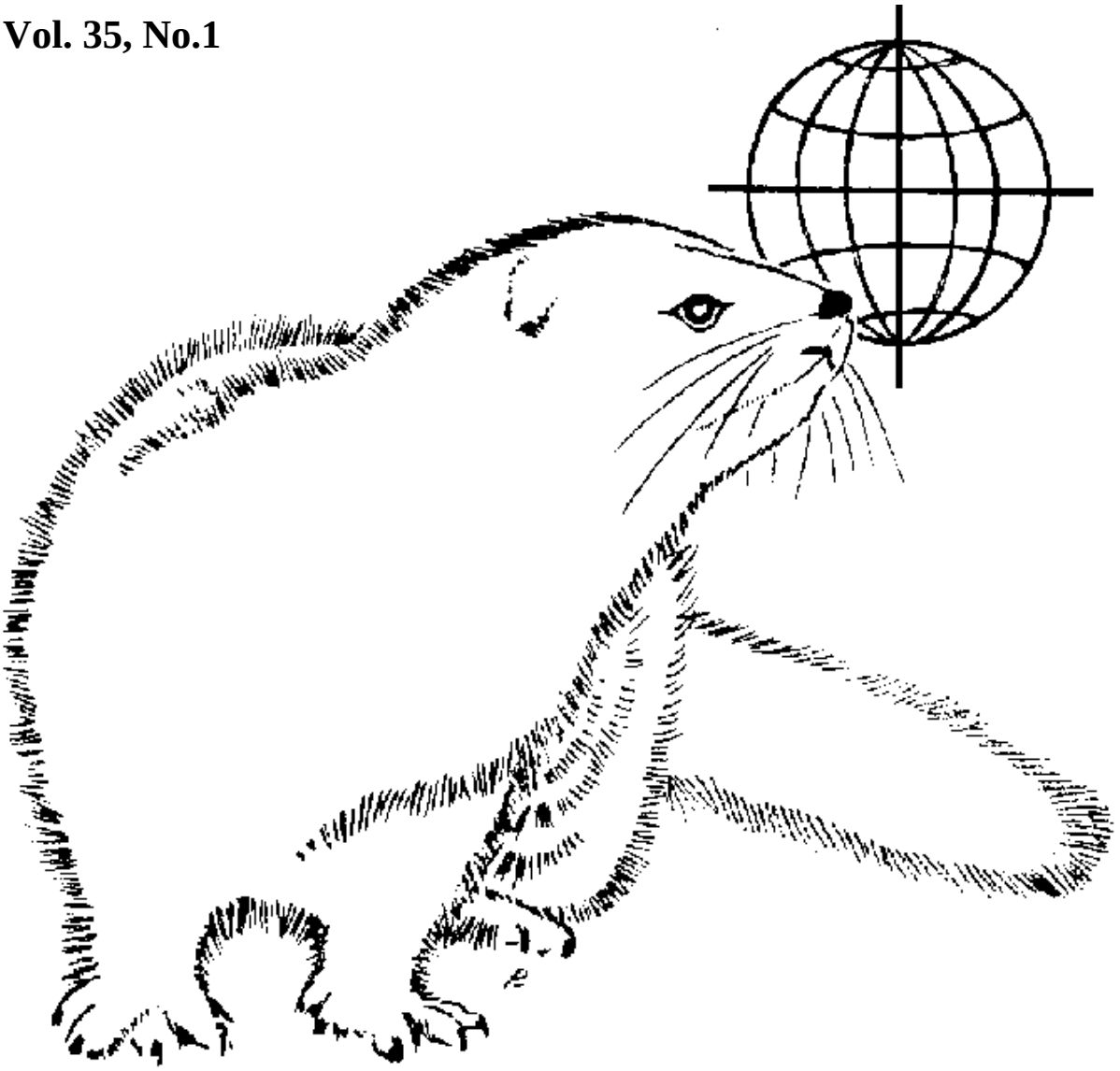

IFASA

INTERNATIONAL FUR ANIMAL SCIENTIFIC ASSOCIATION

SCIENTIFUR - scientific information in Fur Animal Production.

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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.

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Notes from the Editor

It is the aim of Scientifur to report all scientific work related to fur animal production. It includes results from research projects as full articles or short communications. It also includes summaries or abstracts of scientific publications published elsewhere. Other important contributions are abstracts from congresses, seminars, workshops etc. and summaries of books and reports. This scientific information is addressed to actors in fur animal production such as researches, advisers, farmers and employees in industry related to fur animal production. The purpose is to provide updates of the most recent developments within fur animal research for mutual information and application in the industry. Thus submission to Scientifur of results from all scientific investigations regarding fur animal production is greatly encouraged.

This volume contains abstracts from the Danish Fur Breeders Research Center's Annual Report 2010. The report contains publications of scientific work within behaviour, breeding and genetics, nutrition and feeding, physiology and analytical techniques, health and management.

It is a pleasure to draw attention to the Xth International Scientific Congress in Fur Animal Production. It will be held in Copenhagen in Denmark, August 21-25, 2012.

Vivi Hunnicke Nielsen
Editor Scientifur

Annual Report

2010

Danish Fur Breeders Research Center

Abstracts

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Reports on: Behaviour

Aggression and damages in climbing cages with four juvenile mink

Jeppesen, L.L.

Behaviour and production data were sampled in order to estimate whether selection against aggression in climbing cages with four juvenile mink could potentially also lead to fewer damages and in that way improve both behavioural and damage related aspects of animal welfare. Observations comprised 102 climbing cages, including 43 with the colour type mahogany and 59 with the colour type wild. The observations were carried out during 18 days evenly distributed over the autumn. All data were made up as sum of the scores of each group of juveniles. The frequency of fighting over feed was registered in a 10 min period following feed delivery. Intensive spontaneous fights were registered when they took place during an observation day.
In mahogany, the frequency of intensive spontaneous fights was relatively low, and even though mahogany showed higher frequency of feed fights, their feed fights were less intensive and often developed into social play. In mahogany, there was a good correlation between spontaneous fights and various forms of damages. So, for peaceful populations, like the observed mahogany population, selection against aggression could lead to reduced occurrence of damages. However, in such populations the frequency of spontaneous aggression is low and time consuming to register, and the frequency of the more easily registered feed fights does not correlate with damages. So, neither of the aggression measures are suitable as selection criteria. The damages themselves are easy to register and could constitute a feasible criteria for a selection that might reduce damages as well as spontaneous aggression, and in that way improve both production and welfare in its broadest sense.
In the wildmink there was a significant positive correlation between the two measures of aggression and between both measures of aggression and stay at the upper floor in the cage. This supports the immediate impression of feed fights being very intensive in this colour type, and of stays at the upper level being a means of avoiding both forms of aggression. The wildmink were split in two halves, a peaceful and an aggressive. In consistence with the correlation analysis the aggressive mink differed from the peaceful ones in a number of ways: They had more feed fights and more spontaneous fights and were more at the upper floor. The aggressive mink had also a lower weight in September than the peaceful mink. However, in the wildmink there was no correlation between behaviour and damages. Selection against aggression in aggressive populations, like the wildmink used here, could be undertaken on the basis of feed fights, but the selection cannot be expected to reduce damages.
The higher weight in the peaceful group of wildmink and a tendency towards higher weight in mahogany as compared to wildmink suggests that these groups utilize the feed better. This could depend on a lower energy consumption due to lower levels of activity, or a lower level of metabolism due to lower levels of social stress. The better feed utilisation in peaceful mink suggests that selection for peaceful co-existence could result in an increase in this positive production quality. The comparison between mahogany and wildmink suggests that such a selection could also result in fewer damages. This is however not supported by the comparison of the peaceful and the aggressive wildmink.

Annual Report 2010, 7-16, Danish Fur Breeders Research Center, Holstebro, Denmark.

Does tryptophan content in feed influence mink behaviour?

Malmkvist, J.

Background. The essential amino acid tryptophan (Trp) is the precursor of serotonin, an important neurotransmitter. Brain serotonin is involved in fear and exploratory behaviour, and affects thereby the temperament of mink. Studies in other species have suggested feeding with a high ratio of tryptophan relative to large neutral amino acids (LNAA) as one way to reduce fearfulness. It is unknown whether the feed Trp/LNAA ratio can affect the temperament of mink. If this is the case, feeding could be used for calming mink, e.g. in connection with handling procedures.
Method. Two feeding groups A: High Trp/LNAA ratio (1:2), and B: Low Trp/LNAA ratio (1:23) are used in 26 days, each to half of 180 individually housed mink, with an equal and balanced distribution of sex and three breeding lines (C: confident, P: production, F: fearful). Animal reactions are tested in stick test, Trapezov' hand

test, novel object test, and behaviour observed before and during the feeding treatment.
Results. Low Trp/LNAA in feed can increase fear (distance towards test person) for production mink in the stick test (P=0.014). High Trp/LNAA ratio feed mink tended to be less fearful and used more time in contact with an unknown object (P=0.063). However, the treatment effects on the latency to object contact was opposite between sex within the group of production mink. Treatment A (compared with B) reduced female fear (P=0.013), but increased male fear (P=0.001). No effect could be determined on stereotypic behaviour.
Conclusion. The ratio between Trp/LNAA in feed can affect mink behaviour; a high ratio can reduce fearfulness. The effect is clearest in production mink, being more sensitive to changes, than lines breed for temperament. However, the effects can be different in males and females, and the effects in comparison to normal farm feed are not investigated.

Annual Report 2010, 17-24, Danish Fur Breeders Research Center, Holstebro, Denmark.

Reports on: Breeding and reproduction

Identification of mutations in colour genes in mink, based on family material and a DNA library

Anistoroaei, R., Christensen, K. and Fredholm, M.

The genetic base has been revealed for *Aleutian, Silverblue* and for *Hedlund white*. The genetics *for Regal white* and *Himalaya* are based on alleles in the same locus. *Palomino* and *Red* are inherited as well from alleles at the same locus.

Annual Report 2010, 25-28, Danish Fur Breeders Research Center, Holstebro, Denmark.

Genetic parameters in lines of mink selected with normal and low protein content in the feed

Liboriussen, T., Clausen, T., Sandbøl, P., Nielsen, V.H. and Berg, P.

Two selection lines (KON and SEL) were established and selected for 5 generations for a selection index based on information of individual kit weight, litter size and fur quality. The diet used for the SEL-line contained 20% less protein than the diet used for the KON-line. All breeding animals were replaced each generation. This paper presents results from genetic analyses of quality and production traits and maternal performance for each line. Kit weight and fur quality were analyzed for each sex separately. Data on pelt length and pelt quality were only available from male kits.
Selection for 5 generations resulted in a considerable increase in kit weight and pelt length in both lines. Heritability estimates (h^2) for weight of kits and length of skin varied between 0.36±0,08 and 0.65±0,08. The highest estimate was obtained in the SEL-line. The heritability for fur and pelt quality varied between 0.19±0,06 and 0.36±0,08. Estimates for the heritability for weight-loss of dams during the nursing period were 0,14±0,08 and 0,13±0,09. The heritability for litter size at birth and at weaning was also similar for both lines and varied between 0.00 and 0.03.
The common litter environment affected kit weight and skin length. Weight of female kits was more affected by litter environment than weight of male kits. Estimates of c^2 varied between 0.05±0,01 and 0.27±0,10. Fur and pelt quality were also affected by litter environment with c^2 varying between 0.03±0,03 and 0.10±0,03.
Genetic correlations between similar traits in males and females were only significantly different from 1,0 for weight in the KON-line. Genetic correlations between length of pelt and pelt quality were negative in both lines, and in the SEL-line it was significantly different from zero (-0.39 ± 0.14). The genetic correlations between weight and quality were of different sign in males from the KON- and the SEL-line, respectively. Neither were significantly different from zero, while it was significantly different from zero and positive in females in both lines. It was highest in the SEL-line with an estimate for r_g of 0.50 ± 0,19. The correlations due to litter effects between size and quality were all negative and similar for lines and sex. That was also the case for the residual correlations.
The experiment was carried out at the Danish Fur Breeders Research Center, and results have been published in Annual Reports from the Danish Fur Breeding Research Center. The annual report from 2007 shows the development over the years from 2002 to 2006 for each of the two lines.

Annual Report 2010, 29-36, Danish Fur Breeders Research Center, Holstebro, Denmark.

FurMap - Mapping of genes (QTL) for fur quality traits and growth

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

Mapping of genes (QTL) for fur quality traits was performed in a 3-generation QTL-population (F_2-design). Nordic wildmink were crossed with black American short nap mink in the parental generation. Genotypings were performed using microsatellites on all chromosomes except the sex chromosomes in all mink in all generations. Recordings of fur quality traits were made on mink in generation 2. Preliminary results show QTL for fur quality traits on all autosomal chromosomes. Identification of QTL for fur quality traits allows DNA-based selection to be used to improve fur quality quickly and efficiently.

Annual Report 2010, 37-41, Danish Fur Breeders Research Center, Holstebro, Denmark.

Reports on: Nutrition and feeding

Fibers to black mink females in the winter period

Clausen, T.N.

The importance of weekly variations during the winter period in feed energy concentration for body weight changes and reproduction results was investigated in groups of 166 black mink females. Energy concentration in the feed was varied by addition of fibres in periods of 3 days followed by 4 days without. Further two different nest boxes were tested.
There was no negative effect of big daily variations in fibre and energy in the feed. The females shall be slimed down February 21, whereas the body weight January 7 seems less important. Difference in nest box type had no effect on the results.

Annual Report 2010, 43-47, Danish Fur Breeders Research Center, Holstebro, Denmark.

Feeding mink kits day 28 to day 56

Clausen, T.N.

In an attempt to increase mink kits water uptake by the fed, eight groups of 120 liters of wildtype mink were used in the period day 28 to day 56. To the investigation groups we added three different fibres in two levels (Arbocel, Peafibres, Beatpulp) and two levels of a feedbinder (T95).
No of the investigation groups had better kit growth or lower female weight loss than the control group.

Annual Report 2010, 49-53, Danish Fur Breeders Research Center, Holstebro, Denmark.

Strong feeding of mink kits in June – July

Clausen, T.N.

The purpose of the investigation was to se, whether an increased feeding frequency in the early growth period is an advantage for the animals. The results showed that an increased feeding frequency gave a lower weight loss in the females from day 28 to day 56, and a better male kit body weight growth in the period day 28 to dag 42. Fighting among kits were equal in the two groups, but seemed more violent in the control group. I the period August 2 to pelting the best body weight growth were seen among male mink feed 3 times daily in the early growth period, that resulted in the heaviest body weight and longest skins at pelting in this group.

Annual Report 2010, 55-58, Danish Fur Breeders Research Center, Holstebro, Denmark.

Water balance in 8 week old mink kits

Clausen, T.N.

Water is very important for the wellbeing of mink kits. A way to make it easier for the kits to get enough water is to increase water content in the feed. This can be done by adding different products that binds the water in the feed. To se if we could increase water intake by the feed in 8 week old mink kits, we added different fibres (Arbocel 1 and 2 %, Pea fibre1 and 3 %, Beet pulp 1½ %) and a Feed binder (Scanpro T95 ½ and 1 %) to wet feed and measured the water balance.

Adding different kinds of fibres and Feed binders to mink kits at 8 weeks of age, can have an influence on their water intake and faecal water excretion. Arbocel seemed to reduce the amount of drinking water, whereas Scanpro T95 increased total water uptake but resulted in very loose faeces. The used fibres and feedbinder had no influence on mineral content in the faeces. Total water consumption in gram per 100 kcal feed uptake was a little lower than found in adult male mink, whereas total water uptake in gram per gram feed dry matter corresponded to results from adult male mink.

Annual Report 2010, 59-65, Danish Fur Breeders Research Center, Holstebro, Denmark.

Continued investigations on the importance of the amino acids phenylalanine (phe) and tyrosin (tyr), and the minerals iron (Fe) and cobber (Cu) for pelt colour in black mink

Clausen, T.N. and Sandbøl P.

To the investigations on the effect of Fe and Cu for the colour of black mink, 5 groups of 146 male- and female minkkits each were used. In the period August 15 to pelting the kits were feed an addition of Fe and Cu alone or in combination.
The results showed no effect of the addition of the chelate minerals Fe and Cu on skin colour when phe + tyr is lower than the norm.

Annual Report 2010, 67-71, Danish Fur Breeders Research Center, Holstebro, Denmark.

Glycerol in mink feed in the furring period

Clausen, T.N. and Sandbøl, P.

To the investigation we used 7 groups of 131 – 136 wildtype male- and female minkkits. In three groups we used increasing addition of barley and wheat. To the other four groups we used increasing addition of glycerol. The investigation period was from September 15 to pelting. At pelting the liverfat content was analysed in 15 male mink from each group.
The results showed that the carbohydrate content of the feed could be increased by the addition of glycerol up to 27 MEc, without any negative consequences on body weight increase, skin length and pelt quality. No influence on liver fat content was seen.

Annual Report 2010, 73-78, Danish Fur Breeders Research Center, Holstebro, Denmark.

Need of isoleucine and threonine in the growth period

Clausen, T.N. and Sandbøl, P.

To the investigation on minkkits need of ile and thr, for body weight increase, 8 groups of each 125 wildtype male kits was used. In the period July 7 to August 14 different levels of ile and thr were feed.
The results show that the norm for thr in the growing period should be kept at 0.17 g digestible thr / 100 kcal and that the norm for ile to growth (July to mid August) can be lowered to 0.21 g digestible ile / 100 kcal.

Annual Report 2010, 79-83, Danish Fur Breeders Research Center, Holstebro, Denmark.

Effect of choline chloride on liver fat and weight loss in mink

Larsen, H., Schulin-Zeuthen, M. and Clausen, T.N.

The effect of choline chloride on liver lipids and weight gain was investigated in four groups of 11 males each group fed an individual level of choline chlorine (0.0004, 0.04, 0.1 or 0.5% of the feeding). The diet was a synthetic mixture and thus all the nutrients were exactly known. The weight of the kidneys and livers were investigated as well as any abnormalities of the organs. The lowest amount of liver lipids on 11.6 % was obtained with the diet containing 0.04% of choline chloride. The two groups which were fed the highest levels of choline chloride contained both kits and full grown males, whereas the two other groups only included full grown males. The levels of lipids in the livers among the kits were 27.8 and 20.8% in the groups fed 0.1 and 0.5% choline chloride, respectively. This might indicate that an increased level of choline chloride is needed to obtain a reduced level of lipids in the livers of kits compared to full grown males. However, this was only based on 3 and 5 kits in the two groups, respectively. There was no difference in kidney and lever weight in relation to

body weight between the groups and no abnormalities were observed. There was a tendency to decreased weight loss with increased level of dietary choline chloride specially, when full grown males and kits were investigated separately.

Annual Report 2010, 85-92, Danish Fur Breeders Research Center, Holstebro, Denmark.

Dietary preferences in mink offered increasing level of oat hulls

Schulin-Zeuthen, M.

Series of three palatability trails, a trial using operant conditioning method and an eating time trial were conducted to measure preferences in mink for the same diets: control, diets with 3, 6, 9 or 11.3% oat hull meal or 11.3% barley hull meal. Results from all three methods showed that the dietary preferences increase in mink when the inclusion of dietary fibre decreases the first time they were presented to the diets. After an adaption period, results from the palatability trial were unchanged but in contrast to the eating time trials, where the results showed that an adaption to the diet took place.

Annual Report 2010, 93-105, Danish Fur Breeders Research Center, Holstebro, Denmark.

Reports on: Physiology and analytical techniques

Dissection of fat deposits as a method for estimating total body fat in mink

Mayntz, D., Sørensen, A., Møller, S.H., Jensen, S.K., Damgaard, B.M., Sandbøl P. and Nielsen, V.H.

We evaluated the feasibility of using dissected fat deposits as an estimate of total chemical fat content in wildtype mink. We found the best prediction of fat content by using the sum of perirenal and subcutaneous groin fat. This measure explained 76% of the variation in males and females compared to 66% by the variable, body mass. We found a better prediction in females compared to males, possibly because females were smaller and less fat compared to males. Previous selection history of mink did not affect the prediction.

Annual Report 2010, 107-111, Danish Fur Breeders Research Center, Holstebro, Denmark.

Reports on: Health

Immunization of mink with variants of the Mink Astrovirus capsid protein: identification of suitable vaccine candidate for protection against disease induced by mink astrovirus

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

In previous studies we have shown that the full-length capsid (C) protein of mink astrovirus (MiAstV) protected kits against clinical manifestations of mink astrovirus infection when administered to pregnant mink. The protein in its original form was, however, not amenable for large-scale production as a vaccine candidate. In the present studies we have generated five shorter forms of the C protein and tested three of them for induction of antibodies in adult mink. The proteins were expressed in mammalian cells and identified by western blot analysis with anti-peptide sera against the MiAstV C protein. Three of these proteins were administered to groups of seronegative adult mink. Serum samples were collected pre, two and four weeks after administration for determination of specific antibodies by ELISA. One of the proteins induced an antibody response comparable to that stimulated by the complete capsid protein. The results show that this shortened form of the protein maintains the immunogenic characteristics of the original C protein. In addition, they provide an indication that the immunodomains of the C protein reside in this part of the protein. The findings enable identification of versions of the capsid protein suitable for vaccine development.

Annual report 2010, 113-118, Danish Fur Breeders Research Center, Holstebro, Denmark.

Weaning of black mink kits day 42, day 49 or day 56

Clausen, T.N.

The consequences for females and kits of weaning day 42, day 49 or day 56 was investigated in tree

groups of 130 black mink litters each. Kit weight increase from day 42 to 49 is reduced when they are weaned day 42 compared to later. Further, more dead kits are found in that period when we use early weaning. There was no difference between kits with bite marks dependent on day of weaning. Concerning the female weight changes in the period, it seems that 42 days is too early, however we found no difference in the number of animals with nursing sickness.

Annual Report 2010, 119-121, Danish Fur Breeders Research Center, Holstebro, Denmark.

Activity, health and nutrient metabolism in mink with high and low feed efficiency

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

The body weight of the mink has been increasing during the last years and investigations have documented the possibility of increasing the feed efficiency by selection programs. The aim of the present study was to investigate activity, health and nutrient metabolism in mink with high and low residual feed intake (RFI) during restricted and ad libitum feeding. The study included 30 mink, the half of the mink had high RFI and the other half had low RFI. The results showed that the difference in RFI between the two groups can not unequivocally be attributed to differences in mean activity between the two groups. During the winter period there was a tendency (P=0.092) to a higher activity for group RFI-High than for group RFI-Low. Restricted feeding of mink with high RFI resulted in immune suppression. Restricted feeding during the winter period led to mink concentrated its activity to the period before feeding at the expense of activity at other times of the day. A metabolomic approach was applied to the blood samples. It was not possible to identify differences in the metabolites between the two groups of animals.

Annual report 2010, 123-130, Danish Fur Breeders Research Center, Holstebro, Denmark.

Preliminary investigations of possible causal relationship between shaking mink syndrome and astrovirus infection in mink kits – preliminary results of field study

Hammer, A.S., Christensen, L.R., Harslund, J.L.F., Baule, C., Ullman, K., Jensen, T.H. and Chriel, M.

Since 2000, farmed mink kits in Denmark have been affected by sporadic outbreaks of a neurological disorder given the name shaking mink syndrome. The characteristic clinical signs included shaking and staggering movements. The cause of the disease remains unknown despite investigative efforts. Recently an astrovirus was detected in the brain tissue of three experimentally infected mink kits in a study using random amplification and large-scale sequencing. This virus also was found in the brain of three mink kits naturally displaying the disease but not in the six healthy animals investigated.
Here we report the preliminary results of a field study involving farms experiencing outbreaks of shaking mink syndrome. In this study 40 mink (from three farms) if which 13 had neurological symptoms and histopathological findings corresponding to the diagnosis shaking mink syndrome. PCR testing of the 13 mink found eleven positive for astrovirus.
None of the mothers of the kits showed neurological symptoms and all samples from the mothers were negative, while brain tissue samples from 4 of 8 (50 %) of clinically disease free siblings to shaky mink tested positive for astrovirus and 4 of 11 (36%) control mink which died of other causes (without neurological symptoms) during the sampling period also tested positive for astrovirus in the brain.
These results are of interest not only because they represent a further confirmation that astrovirus may be the etiological agent of the shaking mink syndrome but also because there are only few descriptions of astrovirus found in the central nervous system of animals.

Annual Report 2010, 131-135, Danish Fur Breeders Research Center, Holstebro, Denmark.

Implementation and validation of a sensitive PCR detection method in the eradication campaign against Aleutian mink disease virus

Jensen, T.H., Christensen, L.S., Chriél, M., Uttenthal, Å. and Hammer, A.S.

A one step PCR amplifying a 374-base fragment of the NS1 gene of AMDV was compared to the counter-current immune electrophoresis routinely (CIE) used in the serological screening programme.

Mink organs (n=299) obtained from 55 recently infected farms and 8 non-infected farms from 2008-2010 were tested by PCR, and the results were found to have a high correlation with the serological status of the mink. The relative diagnostic sensitivity of the PCR was 94.7%, and the relative diagnostic specificity was 97.9% when read off in parallel with the CIE. PCR positive samples were sequenced and phylogenetic analysis revealed high similarity within the analysed AMDV strains and to previously described AMDV strains.

Annual Report 2010, 137-140, Danish Fur Breeders Research Center, Holstebro, Denmark.

Reports on: Management

Survival and body weight in mink kits born in nest boxes of different size and different nest material

Hansen, B.K., Lund, V.H., Sønderup, M., Bækgaard, H. and Clausen, T.

The nest box is always important, but especially in the suckling period. The question is whether the size of nest box and type of nest material can have an effect on survival or wellbeing of kits. In this farm trial 9 farms including 5130 females with 34303 kits were involved.

Size of nest box was reduced using an inner screen in the nest. As nest material was used *Easy Stroe* or traditional cutted straw. Nest with and without screen were compared, and *Easy Stroe* was compared with traditional cutted straw. The Number of living kits from 2 to 5 days of age and the number of kits alive at 3 to 4 weeks of age were recorded. Litters of 5-9 kits between 6 to 24 days of age were weighed, females and males separately.

In the analyses of litter size and kit survival, the fixed effects were dam age, farm, type of nest box or type of nest material. In the analyses of kit body weight, (female average, male average and the average of all kits in the litter), the fixed effects were the same as for litter size, but in addition also kit age and litter size were included as covariates.

Nests with screen showed no difference in litter size compared with nests without screen. However, kits born in a nest with screen were heavier in week two after birth than kits born without screen. This applied especially female kits. The farm trial confirms the effect of dam age on litter size and kit growth. Adult dams give birth to larger litters and their kits are heavier. Litter size has a negative effect on body weight; kits born in large litters are smaller.

Body weight of kits, recorded as the average weight of each sex in the litter, seems to be suitable to illustrate the effects of the design of the nest box and the nest material. These results shows, that it is possible to use commercial farms to such trials.

Annual Report 2010, 141-151, Danish Fur Breeders Research Center, Holstebro, Denmark.

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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.

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

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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.

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