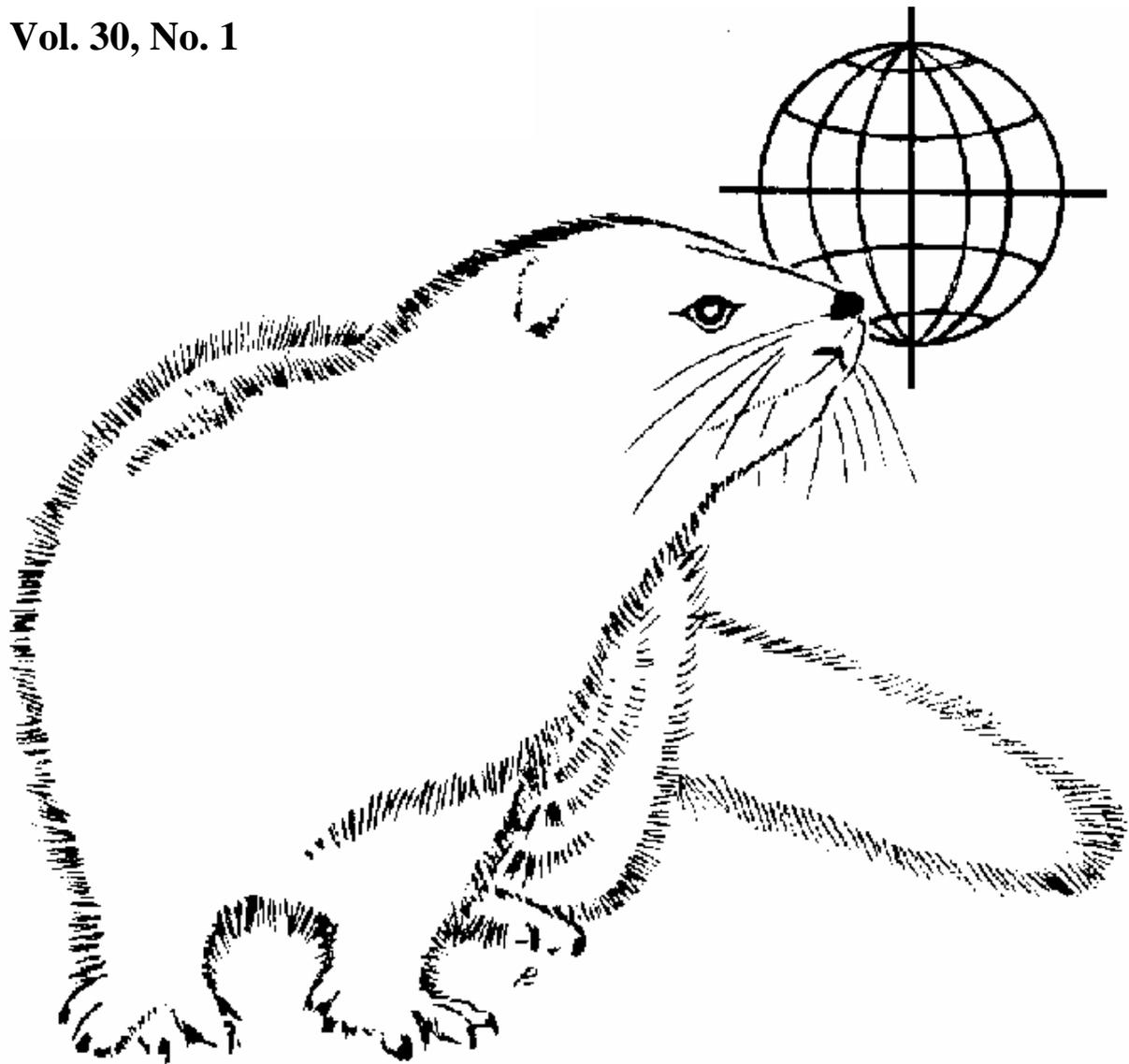


# SCIENTIFUR

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Vol. 30, No. 1



INTERNATIONAL FUR ANIMAL SCIENTIFIC ASSOCIATION

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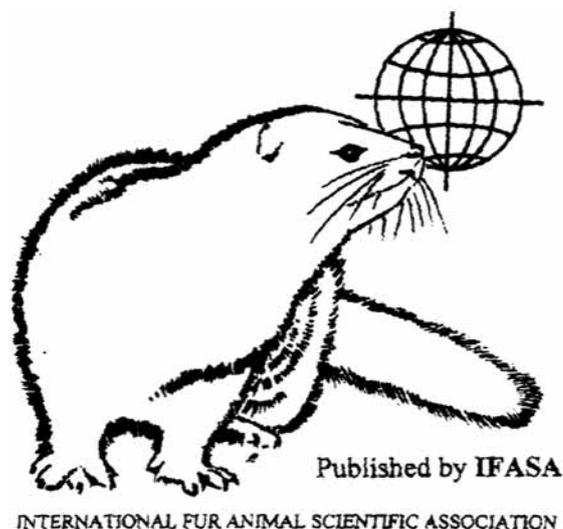
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<b>1.</b>	<b>Contents</b>	<b>1</b>
<b>2.</b>	<b>Notes</b>	<b>5</b>
<b>3.</b>	<b>Abstracts</b>	<b>7</b>
	<b>Utilization of the breeding value in the improvement of reproductive traits in the mink.</b> <i>I. Rucinska, G. Jezewska, G. Zieba</i>	<b>7</b>
	<b>Influence of gaseous air pollutants on the mineral element level in polar fox blood</b> <i>(Alopex lagopus). B. Nowakowicz-Debek, A. Chmielowiec-Korzeniowska, L. Saba, H. Bis-Wencel</i>	<b>7</b>
	<b>Preliminary results of application of chosen DNA sequence primers of <i>Canis familiaris</i> in amplification of <i>Nyctereutes procyonoides</i> genom parallel loci.</b> <i>B. Slaska, G. Jezewska, G. Zieba</i>	<b>7</b>
	<b>Effect of basic herd size on profitability of chinchilla breeding.</b> <i>M. Calka, A. Filistowicz, J. Kuzniewicz</i>	<b>7</b>
	<b>Seasonal sexual activity of chinchilla females on the oldest Polish farms.</b> <i>O. Szeleszczuk, E. Rogoz</i>	<b>8</b>
	<b>Evaluation of melanin content in the hair coat of Greenland nutria.</b> <i>M. Piorkowska, G. Jezewska</i>	<b>8</b>
	<b>Estimation of changes in the numbers and exploitation of hare population</b> <i>(Lepus europaeus Pall.) in the Mazovian province.</i> <i>E. Bombik, A. Wysokinska, S. Kondracki</i>	<b>8</b>
	<b>Behavioural observations of female rabbits caged on deep litter.</b> <i>D. Kowalska</i>	<b>9</b>

	<b>Effect of mink genotype on the selected parameters of reproductive performance and hair coat quality.</b> <i>P. Bielanski, M. Piorkowska, A. Zon</i>	9
	<b>Effect of shortening daylight on the course of folliculogenesis in the ovaries of blue fox (<i>Alopex lagopus L.</i>).</b> <i>O. Szeleszczuk, S. Jarosz, A. Urban</i>	10
	<b>Observations of young rabbit behaviour at different cage densities.</b> <i>D. Kowalska, P. Bielanski</i>	10
	<b>Activity of some enzymes in fresh and thawed semen of raccoon dogs.</b> <i>P. Niedbala, O. Szeleszczuk</i>	10
	<b>Anatomy and topography picture of cervico-cranial part of the sympathetic trunk in chinchilla.</b> <i>T. Wojnar</i>	10
	<b>Negative effects of standard chinchilla darkening.</b> <i>B. Barabasz</i>	11
	<b>Prolactin (PRL) influences onset of hair growth, hair density and size of hair follicles in mink (<i>Mustela vison</i>).</b> <i>J. Rose, S. Larson, J. Hunt</i>	11
<b>4.</b>	<b>New books</b>	<b>13</b>
	<b><u>Annual Report 2005, Danish Fur Breeders' Research Center</u></b>	13
	<b>Anticipatory behaviour and welfare in mink.</b> <i>A. Geisler, L.L. Jeppesen</i>	13
	<b>Welfare in mink – small changes matter.</b> <i>L.L. Jeppesen</i>	14
	<b>Effect of alternative placement of the water nipple on litter size, behaviour and weight development.</b> <i>L.L. Jeppesen</i>	14
	<b>Roughage in wintertime III. Effect of adding sugar beet pulp to the feed.</b> <i>S.W. Hansen, T.N. Clausen</i>	14
	<b>A preliminary linkage map of the mink chromosomes.</b> <i>K. Christensen, R. Anistoroaei</i>	15
	<b>Mink selected to produce on a low protein content in the feed. Status for growing period 2004 and lactation period 2005.</b> <i>T.N. Clausen, C. Hejlesen, P. Sandbøl</i>	15
	<b>Separation of breeding and management in fur breeding.</b> <i>B.K. Hansen, P. Berg, S.H. Møller</i>	16
	<b>Protein to mink in the nursing period and in the period of early kit growth. Continued investigations.</b> <i>T.N. Clausen, P. Sandbøl, C. Hejlesen</i>	16
	<b>ZnO to mink kits in the weaning period.</b> <i>T.N. Clausen, P. Sandbøl</i>	16
	<b>Optimal amount of protein to mink in the growing-furring period. Effect of methionin source.</b> <i>T.N. Clausen, P. Sandbøl, C. Hejlesen</i>	17
	<b>Sulfur containing aminoacids and methyl donors to mink in the furring period.</b> <i>T.N. Clausen, P. Sandbøl, C. Hejlesen</i>	17
	<b>Protein to mink in the furring period. Importance of fat and carbohydrate.</b> <i>T.N. Clausen, P. Sandbøl, C. Hejlesen</i>	17

<b>Physico-chemical properties of fibre-rich feedstuffs and their effect on digestion in the gut of mink.</b> <i>H.N. Lærke, M.S. Hedemann, C. Hejlesen</i>	18
<b>Effect of dried sugar beet pulp on eating time and mean transit time in energy restricted mink (<i>Mustela vison</i>) females.</b> <i>C. Hejlesen, H.N. Lærke</i>	18
<b>Effect of acids in feed on pH in mink urine.</b> <i>S. Lisbjerg</i>	18
<b>Fasting of mink kits fed different feed rations and its effect on liver fat content, plasma metabolites and enzymes.</b> <i>T.N. Clausen, P. Sandbøl</i>	18
<b>Investigations of neonatal death in mink kits.</b> <i>M. Michel, A.S. Hammer, V. Weiss, M.U. Hansen, T.N. Clausen</i>	19
<b>A new wild type canine distemper virus infection model in mink</b> <i>T.H. Jensen, M. Lund, T.D. Jensen, B. Aasted, M. Blixenkronne-Møller</i>	19
<b>Biochemical investigations of reasons to outbreak/resistance against the disease complex “wet mink kits”.</b> <i>T.N. Clausen, K. Mortensen, A.D. Sørensen, J.C. Sørensen, H. Sørensen</i>	19
<b>Correlation between feed consumption in the breeding and nursing period to greasy kits, lactation length and nursing sickness.</b> <i>H. Bækgaard, M. Sønderup, T.N. Clausen</i>	20
<b>Screening of mycotoxins in vegetable feed ingredients for mink.</b> <i>P. Sandbøl, T.M. Lassén, M.U. Hansen</i>	20
<b>Lost litters – investigations in practice.</b> <i>M. Hansen, V. Weiss, H. Bækgaard, M. Michel</i>	21
<b>The effect of ad libitum and restricted feeding on feed intake curves and feed efficiency curves in mink.</b> <i>V.H. Nielsen, S.H. Møller, B.K. Hansen, P. Berg</i>	21
<b>Fat condition of mink.</b> <i>T.N. Clausen</i>	21
<b>Separation of slurry.</b> <i>J.H. Risager, H.H. Møller</i>	21
<b><u>Other new books</u></b>	23
<b>Skin quality as improvement criterion for domestic herd of chinchillas (<i>Chinchilla lanigera M.</i>).</b> <i>Malgorzata Sulik</i>	23
<b>The use of probiotics in arctic fox (<i>Alopex Lagopus L.</i>) nutrition.</b> <i>Andrzej Gugolek</i>	24
<b>Effect of breed and management system on productive traits of broiler rabbits.</b> <i>Pawel Bielanski</i>	25
<b>Protein turnover and milk production in lactating mink (<i>Mustela vison</i>) fed different levels of protein.</b> <i>Anna K. Rasmussen</i>	27



## Notes from the Group of Editors

This issue of *Scientifur*, Volume 30, No 1, contains a number of interesting abstracts provided by some of our regional representatives. Included are also the abstracts of three Polish postdoctoral degrees (habil.) as well as a Danish master thesis.

We are very grateful to our *Scientifur* representatives for their provision of information on

fur animal science. Their input makes it easier for us to offer our readers an informative periodical worth reading.

However, we also rely on our readers to submit articles for reviewing, short communications, abstracts etc. to be able to publish a quality periodical on fur animal science.

On behalf of the  
Group of Editors

Birthe Damgaard



### **Utilization of the breeding value in the improvement of reproductive traits in the mink**

*I. Rucinska, G. Jezewska, G. Zieba*

Evaluation of possibility of utilizing the estimates of minks' breeding value, during the females' choice to the reproduction her was the aim of the conducted analyses. Reproduction evaluation was carried on 12455 litters, born by 7228 herd females. Variance as well as covariance components of litter size were by evaluated REML method, basing on the individual model, with respect to random effects: additive effect of animal additive effect of animal's mother, effect of specific environment of animal, as well as permanent effects: effect of year of whelping, effect of mother's age and effect of whelping season. Breeding values of animals were estimated by the BLUP method. Estimated rank correlations between the female-origin litter size (the selection criterion), and their litter sizes were small and amounted to 0.10. Convergence of rank between the females' breeding value and their mothers' value amounted to about 0.7. Similar values between the breeding values of females and their fathers (0.76), were obtained. The high rank correlation (0.93) between females' genetic value and total value their parents was affirmed. Animals' choice to basic herd could be based on total breeding value of their parents.

*Scientific Annals of Polish Society of Animal Production, 2005: 1, 62.*

### **Influence of gaseous air pollutants on the mineral element level in polar fox blood (*Alopex lagopus*)**

*B. Nowakowicz-Debek, A. Chmielowiec-Korzeniowska, L. Saba, H. Bis-Wencel*

The investigations were conducted to determine the impact of air gaseous pollutants on a level of some mineral elements in polar fox blood. The animals kept at the farm constituted the control, while the treatment group was maintained in the closed chamber with outer air flow supplied. Throughout the experimental period the foxes received the same balanced feed rations in accordance with the feeding standards and age requirements for furry animals. The significance of the maintenance conditions as a determinant of mineral elements content in serum

was confirmed by the magnesium and phosphorus concentration analyses. A magnesium level proved to be statistically far higher in the case of the treatment group compared to the control. In case of inorganic phosphorus, the statistically higher levels were reported in the control group. A Ca content in the fox serum in both groups corresponded to the reference values, while the Fe level was higher than these values.

*Scientific Annals of Polish Society of Animal Production, 2005: 1, 219.*

### **Preliminary results of application of chosen DNA sequence primers of *Canis familiaris* in amplification of *Nyctereutes procyonoides* genom parallel loci**

*B. Slaska, G. Jezewska, G. Zieba*

The purpose of the study was to evaluate usefulness of primer sequences designed for amplification of genes' fragments and microsatellite loci of *Canis familiaris* to analyze analogous loci in genom of *Nyctereutes procyonoides*. After isolation of DNA from raccoon dogs blood, its quantitative and qualitative evaluation, the amplification of DNA by the PCR method was conducted.

*Scientific Annals of Polish Society of Animal Production, 2005: 1, 259-260.*

### **Effect of basic herd size on profitability of chinchilla breeding**

*M. Calka, A. Filistowicz, J. Kuzniewicz*

In this paper an attempt to determine the profitability in chinchilla breeding, depending on the size of basic herd, was undertaken. Four sizes of basic herd in chinchilla farm breeding were suggested. They are as follows: 50, 100, 250 and 500 females. The economic analysis was carried out for each variant. The aim of this analysis was to indicate the most profitable size of the basic herd. The main analytic tools were: full calculation of economic efficiency and profitability of animal production. Enumerating all cost positions according to full account calculation including

amortization, we find out that for the size of 50 females there is an economic loss in such activity. On the other hand, the herd sizes of 100 females, 250 and 500 females generate positive results and are profitable. Every zloty spent brings about 18 gr, 40 gr and 50 gr nett profit, respectively. For each suggested size of basic herd the threshold profitability of production of one skin was calculated. This provided a scale of minimum price. The most profitable coefficient was found for the most numerous herd and it was equal to 80 PLN (about 25 USD). The least profitable one was for 50 females herd and in this case it was 133 PLN (about 42 USD).

*Scientific Annals of Polish Society of Animal Production, 2005: 1, 280.*

#### **Seasonal sexual activity of chinchilla females on the oldest Polish farms**

*O. Szeleszczuk, E. Rogoz*

The aim of the study was to examine the seasonal changes in the sexual activity of chinchilla females maintained in the three oldest Polish farms, located in the south, north and central parts of the country. The investigations were conducted on 1877 litters from 346 females mated and kidded over the years 1973-1993. The examination of chinchilla reproductive performance revealed a considerable seasonal differences in reproductive activity of females. The most intensive kidding was observed in the spring and autumn months. The chinchillas bred on the examined farms displayed distinct periods of a decreased sexual activity, resulting in the low numbers of produced litters.

*Scientific Annals of Polish Society of Animal Production, 2005: 1, 342.*

#### **Evaluation of melanin content in the hair coat of Greenland nutria**

*M. Piorkowska, G. Jezewska*

Hair coat colour is the most conspicuous element that largely determines the attractiveness of fur products, the demand for skins and their price. Hair

colour is determined by the type of skin pigment and its distribution in all types of hair and in individual hairs. The two main types of melanin are eumelanin, a black or brown pigment, and pheomelanin, a red or yellow pigment. Although hair coat colour is an important determinant of fur quality evaluation, no accurate method for evaluating this parameter has been developed. The assessment is made organoleptically under uniform background and lighting conditions. The aim of the present study was to quantify pigments in the hair coat of Greenland nutria and to find the relationship between melanin level and age of the skins obtained. Seventy skins of the light and dark variety of Greenland nutria were investigated. The skins were taken from cage-reared animals, killed between 3 and 9 months of age. Hair samples for melanin determination were taken from three topographic parts of the skin (back, side and belly). Pigment content of hair was determined in the ultraviolet using a WAP Lightwave spectrophotometer. A Sigma melanin standard was used in the study. It was found that the average melanin content of the nutria hair coat varied according to age group, colour type and site of sampling. Animals with the light colour type had the highest level of eumelanin on the belly during the first 8 months of age and that of pheomelanin on the side. For animals with the dark colour type, melanin level in hair coat showed greater variation depending on the topographic area of skin and age of animal.

*Scientific Annals of Polish Society of Animal Production, 2005: 1*

#### **Estimation of changes in the numbers and exploitation of hare population (*Lepus europaeus* Pall.) in the Mazovian province**

*E. Bombik, A. Wysokinska, S. Kondracki*

The aim of the study was to evaluate the changes of numbers and utilization intensity of the hare population in hunting-ground abundance in the Mazovian province. The experiments were carried out in 6 hunting-ground seasons from 1998/1999 to 2003/04 in 8 districts belonging to the Mazovian province. The analysis was conducted in districts as follows: Warszawa, Biala Podlaska, Ciechanow, Ostroleka, Plock, Radom, Siedlce and Skierniewice. Material and information from documents kept in

the Experimental Station PZL in Czempin were used. The number of hares and hare bag from hunting-grounds in 6 hunting-ground seasons in each district were estimated. The considerable variability of hunting-ground abundance of hare in the Mazovian province was found. It was indicated by the different number of hares and different density of the population in particular hunting-ground districts as well as by the different exploitation intensity of the population. The declining tendency in the utilization intensity of the hare population with the slight changes in density of the population were proved. It was not unlikely that the restricted intensity of hare shooting was a conducive factor to keep the stable number of hares and density of the population.

*Scientific Annals of Polish Society of Animal Production, 2005: 1, 404.*

#### **Behavioural observations of female rabbits caged on deep litter**

*D. Kowalska*

Different systems of rabbit breeding and production have been established over decades. The long-time preferred cage system without straw bedding is increasingly replaced with the litter system, which is a modified form of pen rearing. This system provides animals with comfortable lying areas for resting (straw bedding) and allows nest boxes to be constructed directly on bedding, which is the normal behaviour of animals under natural conditions. The aim of the present study was to observe the behaviour of pregnant and nursing does during rearing of young rabbits in the cage system on deep litter, with or without nest boxes. All observations were aimed to define the condition of animals in the new environment to ensure the mental and physical comfort of rabbits by changing certain parameters of this environment. The findings indicate that no nest boxes are necessary under the litter system. However, breeders who carry out intensive breeding should consider the possibility of wooden shelves being placed in cages. They should be hung approximately 30 cm above the litter to allow a doe to rest away from her young. This would allow her to regenerate before the next parturition and would eliminate aggressive behaviour that is often a reaction to stress.

*Scientific Annals of Polish Society of Animal Production, 2005: 1, 413.*

#### **Effect of mink genotype on the selected parameters of reproductive performance and hair coat quality**

*P. Bielanski, M. Piorkowska, A. Zon*

In Polish fur farms, one of the largest populations are standard mink, accounting for approximately 55% of the entire population. Polish Scanblack mink are characterized by a relatively high body weight and unfavourably longguard hair. Another type of standard mink is the American mink, possessing better hair coat parameters (density, silkiness) and desirable guard hair. The aim of this study was to determine the effect of mating mink having different hair coat types on the reproductive parameters, growth, and hair coat quality of young mink. The study was conducted at the Experimental Station of the National Research Institute of Animal Production in Chorzelow. There were 3 groups, each having 20 females. Group I included standard American mink, group II – standard Scanblack mink, and group III – animals obtained from mating of the American males with the Scanblack females. The highest percentage of whelping females and lowest pup mortality during the first period of life were found in Scanblack mink. Average number of pups born alive was the highest in group I, with a statistically significant difference in relation to the other groups. Litters of American mink were the largest throughout the period of rearing with mothers. Weaning weight of the mink varied within groups and sexes, with greater fluctuations noticed in males. Standard American mink had markedly better density of hair coat (trait 4). When assessing the conformation of mink from group II (Scanblack), the panel of experts did not award minus points for hair length. Animals of group III had markedly shorter hair in relation to the initial material.

*Scientific Annals of Polish Society of Animal Production, 2005: 1, 429-430.*

### **Effect of shortening daylight on the course of folliculogenesis in the ovaries of blue fox (*Alopex lagopus* L.)**

*O. Szeleszczuk, S. Jarosz, A. Urban*

The experiment was carried out on 30 blue fox (*Alopex lagopus* L.) females divided into two genetically uniform groups. The females from experimental group (D) were subjected to a decreased daylight period between August the 1<sup>st</sup> and November the 3<sup>rd</sup>. The control group (K) was kept in traditional pens. The most intense growth and development processes of the ovarian follicles occurred in both groups in December and January.

*Scientific Annals of Polish Society of Animal Production, 2005: 1, 531.*

### **Observations of young rabbit behaviour at different cage densities**

*D. Kowalska, P. Bielanski*

Behaviour is a complex system of body reactions to environmental signals. Specific patterns of animal behaviour that are typical of an organism and make survival possible, are manifested in response to the changes that take place. Weaning of rabbits from their mothers is a key period of animal growth. Many scientists and breeders find it appropriate to wean mothers while leaving the young rabbits in the same cage or pen in which they were born. This is due to stress that occurs in rabbits being moved and results in developmental anomalies and reduced immunity of the animal to disease. In practical breeding, rabbit weaning is used the most often. The number of animals moved into one cage depends on its size. Cage stocking density is one of the major factors affecting the rate and consistency of rabbit growth. The aim of the present study was to observe the behaviour of infant rabbits during the postweaning period (days 35-90) of age at different cage densities. The study showed that intensive commercial breeding modifies behaviour as new behavioural forms overlap the old forms. In the examined group of animals, behavioural anomalies resulting from the stress were found. The present study may provide guidelines for newly established farms concerning the conditions that have to be created to make animals easily adapted to a new

environment. The results obtained may help Polish producers to improve the profitability of slaughter rabbit production.

*Scientific Annals of Polish Society of Animal Production, 2005: 1, 567-568.*

### **Activity of some enzymes in fresh and thawed semen of raccoon dogs**

*P. Niedbala, O. Szeleszczuk*

The aim of the study was to evaluate the changes of AspAT and acrosin activity in cryopreservation process of breeding raccoon dogs' spermatozoa. Two methods of dilution differing in the contact time of spermatozoa with glycerol were used. The diluent made on the basis of EDTA with different level of glycerol was used. It was stated that cryopreservation process of raccoon dogs' spermatozoa caused increased (even many times after thawing) efflux of AspAT and acrosin into the environment. Longer contact of spermatozoa with glycerol together with an increase of its addition caused a decrease of AspAT activity. Longer contact of spermatozoa with glycerol caused an increase of acrosin activity, but its higher share in diluent caused a decrease of acrosin activity.

*Roczniki Naukowe Zootechniki, 2005: Supl., z. 22, 279-282.*

### **Anatomy and topography picture of cervico-cranial part of the sympathetic trunk in chinchilla**

*T. Wojnar*

Thirty-three chinchillas were investigated. The cervico-cranial ganglia and stellate ganglion in the cranialo-cervical part of the sympathetic trunk had stable position. Middle cervical ganglia appeared variably: bilaterally in sixteen cases (48,5%), on the left side in seven cases (21,2%), and on the right side in five cases (15,1%). It is affirmed that in the remaining five cases no middle cervical ganglia were found. There are 6 patterns of the cervical part occurrence in the sympathetic trunk with vagus

nerve. In ganglia there were small, medium and large nerve cells.

*Roczniki Naukowe Zootechniki, 2005: Supl., z. 22, 459-463.*

### **Negative effects of standard chinchilla darkening**

*B. Barabasz*

A sudden increase of number of produced Dark and XXXDark skins achieved by means of their crossbreeding with black velvet chinchillas is probably the reason for more often occurring color defects and thus lower prizes at Copenhagen Fur Center Auctions. To confirm such suggestion, the analysis of breeding procedures associated with darkening of standard chinchillas, the auction's prices and review of larger lot of standard skins prepared for trade, was carried out. A lot of 1862 Polish skins prepared for auction was subjected to assessment. Studies revealed that there was 0.86% of darkest skins, but they were defectively colored with no apparent hair zonation.

*Scientific Messenger of Lviv National Academy of Veterinary Medicine (Ukraine), 2005: t. 7, 3 (26), cz. 3, 111-114.*

### **Prolactin (PRL) influences onset of hair growth, hair density and size of hair follicles in mink (*Mustela vison*)**

*J. Rose, S. Larson, J. Hunt*

In mink,  $\approx$  10-20 hair follicles develop from a common follicular canal into bundles of; *G-type*: one large guard hair plus a variable number of underhairs, *I-type*: one intermediate size guard hair plus a variable number of underhairs, and *U-type*: underhairs only. Winter anagen is correlated with reduced serum prolactin (PRL) levels, and maximum hair density, whereas summer anagen is correlated with elevated serum PRL levels and minimum hair density. Our objectives were to determine if PRL has effects on anagen initiation, hair diameter and/or density, and if the effects are mediated equally between fiber or bundle type (G, I or U). Mink (4/group) in telogen (Feb 20), were

treated as; Haloperidol (HAL), Melatonin (MEL), or Controls, and the dorsal skin plucked of hair to induce anagen. Onset of anagen in HAL (Mar 27) and MEL (Mar 29) treated mink occurred earlier than controls (April 9;  $P < 0.05$ ). Serum PRL levels were  $5.6 \pm 0.91$  ng/ml (Control),  $7.8 \pm 1.1$  ng/ml (HAL;  $P < 0.05$ ), and undetectable in MEL-treated mink. Density of I-Guard hairs ( $4.93 \pm 0.05/\text{mm}^2$ ) was greater than G-guard hairs ( $3.15 \pm 0.05 / \text{mm}^2$ ;  $P < 0.05$ ), but the diameter of G-guard hairs ( $127.5 \pm 1.53 \mu\text{m}$ ) was greater than I-type ( $51.0 \pm 0.34 \mu\text{m}$ ;  $P < 0.01$ ). There was no difference in guard hair density or diameter in response to treatments. Density of underhairs in all bundle types was reduced by HAL and increased by MEL ( $P < 0.05$ ). Underhair diameters did not differ between G, I & U bundles within treatments groups, but increased in response to HAL ( $18.7 \pm 0.78 \mu\text{m}$ ) and was decreased by MEL ( $9.5 \pm 0.56 \mu\text{m}$ ) compared to controls ( $14.1 \pm 0.082 \mu\text{m}$ ;  $P < 0.01$ ). Finally, underhair diameters of mink in spontaneous summer anagen ( $13.0 \pm 0.14 \mu\text{m}$ ) were greater than those of mink in winter anagen ( $10.6 \pm 0.14 \mu\text{m}$ ;  $P < 0.001$ ). We propose that during the summer, PRL initiates anagen and increases follicular size in a portion of the underhair follicles, which results in reduced fur density. In contrast, during winter, low PRL levels results in reduced follicular size, but a greater number of follicles entering anagen.

*J. Invest. Dermatol., 121, 809.*

*Reference is also made to:*

<http://www.isu.edu/%7Erosewill/SID%20poster.html>

*(poster presented at the International Investigative Dermatology Meetings and the North American Hair Research Society Meetings).*



## Faglig Årsberetning

2005

Pelsdyrerhvervets Forsøgs- og ForskningsCenter



## Annual Report

2005

Danish Fur Breeders Research Center

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### Reports on: Behaviour

#### Anticipatory behaviour and welfare in mink

*A. Geisler, L.L. Jeppesen*

Anticipatory behaviour is performed when animals know that they will soon obtain a reward. The

amount of anticipatory behaviour is supposed to reflect the value of the expected reward, and also to reflect the basic welfare level of the animals, since poorly stimulated animals that experience bad welfare will perform more anticipatory behaviour in reaction to a standard reward. The purpose of the present experiment was (1) to examine if mink, trained to expect cat food, perform more

anticipatory behaviour than mink trained the same way but without obtaining cat food, and (2) to examine if access to a cage with a running wheel is a greater or smaller reward as compared to cat food. The results confirm that cat food is perceived as a reward and shows that access to a known additional cage with a running wheel is also perceived as a reward. A meaningful comparison of the value of the two rewards for the mink was not possible. Half of the running wheels could be used for running, they were free; the other half were fixed but frequently entered and used as a lying place. There was no essential difference on the amount of anticipatory behaviour elicited by the two types of wheels, and the results, therefore, suggest that they might have the same rewarding value to the mink.

*Annual Report 2005, 7-16, Danish Fur Breeders' Research Center, Holstebro, Denmark.*

### **Welfare in mink – small changes matter**

*L.L. Jeppesen*

Several small initiatives, each separately shown to improve welfare, were implemented on one half of a private farm in order to examine if the initiatives could be implemented in practice, without harming productivity and with a good effect on the welfare. The other half of the farm served as control, and were managed in a more conventional way. The implemented initiatives were: selection for confident animals, additional feeding during winter-time, placement of mated females in every second cage, later weaning and later placement of kits in male-female pairs, and fitting out cages with shelves and detached occupational objects. The results showed that reproduction and pelt parameters were at least not impaired by the implemented initiatives, and that the welfare was improved. Welfare was measured on the basis of behaviour, temperament and pelt gnawing. The welfare improvement was considerable, and much bigger than usually seen in experiments involving more radical changes such as access to swimming water, group housing, and larger cages. These bigger changes may even impair welfare. On that basis it is recommended that the starting point for welfare improvements for mink is the existing, well-functioning cage-system, and that changes are implemented only to the extent that measurable improvements for the mink are

documented. The initiatives that were tried out here were practicable and beneficial.

*Annual Report 2005, 17-24, Danish Fur Breeders' Research Center, Holstebro, Denmark.*

### **Effect of alternative placement of the water nipple on litter size, behaviour and weight development**

*L.L. Jeppesen*

In standard mink cages, the water nipple is placed at the back of the cage, as far away from the nest box as possible. Mink kits, kept in such cages, usually start eating farm feed sooner than they start drinking water. This may result in a passing dehydration. The kits seek to prevent that by licking saliva from the dam's lips. The dehydration may harm the weight development of the kits and of the dam during lactation, and increase the fighting among the kits, since frustrated drinking may increase aggression. Aggression increases the risk of damages and losses. Easier access to drinking water via a nipple that is placed closer to the nest box, induces kits to start drinking earlier and to lick saliva less frequent. In this project it was further demonstrated that the behavioural effect of such an alternative placement is most comprehensive when the water supply to the traditionally placed nipple is closed, so that the alternative nipple is used by both by the dam and the kits. The project also showed, that the alternatively placed nipple, as opposed to the expectations, did not influence fighting, weight development, and number of weaned kits. This may be due to the fact that these factors was examined while the dam did not use the alternative nipple, which caused the kits to use it later and to a lesser extent.

*Annual Report 2005, 25-30, Danish Fur Breeders' Research Center, Holstebro, Denmark.*

### **Roughage in wintertime III. Effect of adding sugar beet pulp to the feed**

*S.W. Hansen, T.N. Clausen*

The objective of the study was to examine if sugar beet pulp in the feed would result in a reduction of

the incidence of stereotypies in female mink during winter. The control group (KON) was fed a diet of 0% sugar beet pulp (188 kcal/100 g), group R2.5% was fed a diet of 2.5% sugar beet pulp (169 kcal/100 g) and group R5% was fed a diet of 5% sugar beet pulp (157 kcal/100 g). The feed was allocated according to conventional feeding practices, thus the condition of the animals was assessed subjectively and the amount of feed was adjusted to slim the animals moderately during January and February.

The experimental diets did not affect the weight of the females, nor did it affect the reproduction results. The diet of 5% sugar beet pulp did reduce the time without feed and the level of activity of the mink as compared with the mink in the control group. However, adding 5% sugar beet pulp to the diet did not result in a reduction in stereotypic behaviour; rather, the stereotypies increased for all groups during the experimental period. The reason for this may be that from the very start of the experiment the mink were stimulated to develop stereotypies as a result of a too drastic feed reduction, or maybe for quite some time the amount of feed allocated was too low to prevent the mink from developing stereotypies. It is likely that such types of roughage should only be used for short periods (approximately 2 weeks), during which the mink females are slimmed considerably to have them react positively to flushing.

*Annual Report 2005, 31-40. Danish Fur Breeders' Research Center, Holstebro, Denmark.*

## Reports on: Breeding and reproduction

### A preliminary linkage map of the mink chromosomes

*K. Christensen, R. Anistoroaei*

Genetic and physical maps have been used for the identification of genes that modulate monogenic traits, or for the identification of chromosomal regions which contain genes having a major effect on economically important traits (QTL's). Despite the economic importance of mink production in Northern Europe and North America, mink genomics research is lagging far behind other livestock species. The objective of our work is to create the first generation of linkage map of the

mink genome with a resolution of at least 20 cM. A 200-300 markers would be needed to reach this resolution. This map will serve as a basis for further refinement. Genotypes of a reference population consisting of four males, nine females and 72 F1 progeny were typed at 103 informative polymorphic markers (microsatellite loci). These markers were assigned to several linkage groups using Crimap software; the largest linkage group contained 7 markers.

A more complete map is expected to be produced within the next year; it will be possible by means of the map and homology between species to retrieve information from the extensive map for man and mouse. One of the first applications of the map will be identification of the biological function of the colour genes segregating in the mink. In connexion with the development of the new markers 800000 base pairs has been sequenced, and it has been possible to define the SINE and parts of the LINE element in the mink.

*Annual Report 2005, 41-46. Danish Fur Breeders' Research Center, Holstebro, Denmark.*

### Mink selected to produce on a low protein content in the feed. Status for growing period 2004 and lactation period 2005

*T.N. Clausen, C. Hejlesen, P. Sandbøl*

A selection experiment was initiated to investigate the possibility of breeding mink with a good fur quality when the content of protein in the feed was low, without negative consequences for reproduction and pelt length.

In the growing furring period 2004 the weight of the animals at pelting in the selection group was lower than the control group, but the skin length was the same, and increased with 2 – 3 cm in both groups compared to 2004. The fur quality was best in the selection group.

In the breeding period 2005 the selection group gave birth to and weaned more kits than the control group. The weight of the kits at weaning was higher in the control group than in the selection group, the difference could not be explained by a difference in litter size at day 42, and should be examined closer.

Female body weight in the trial group was lowest in December in February there was no difference.

*Annual Report 2005, 47-56. Danish Fur Breeders' Research Center, Holstebro, Denmark.*

### **Separation of breeding and management in fur breeding**

*B.K. Hansen, P. Berg, S.H. Møller*

Genetic and environmental trend of body weight and litter size can be illustrated based on output from the breeding value estimation. This gives the farm advisor a more precise picture for the breeding work and management on the farm. Three selection lines from Research centre Foulum are used as an example. The lines are a part of the project 'Selection for large animals without negative consequences'. The lines are on the same farm, but have been fed differently. The control line (FF) has been fed according to normal farm procedure, the ad libitum line (AL) have been individually fed after how much they could eat, while the restricted line (RF) got less feed than the other lines. The genetic and the environmental trend of male body weight in November and litter size counted from 11 to 21 days after birth are illustrated for the period from 2003 to 2005. The control line was selected randomly, while the breeding animals in the ad libitum and restricted lines were selected for large body weight with a threshold value for litter size. The genetic trend in each of the three lines reflects the breeding objectives. The management curves show the differences between lines due to different feeding strategies.

The genetic trend and the management curves will give the advisor an overview of the general status on the farm and support him in making suggestions for future changes by separating genetic and management trends.

*Annual Report 2005, 57-64. Danish Fur Breeders' Research Center, Holstebro, Denmark.*

### **Reports on: Nutrition and feeding**

#### **Protein to mink in the nursing period and in the period of early kit growth. Continued investigations**

*T.N. Clausen, P. Sandbøl, C. Hejlesen*

To investigation the need for protein in the winter and lactation periods, we used 6 groups of each 128 scanbrown mink females. The females were fed feed from the local feedkitchen until April 20. Thereafter one group P52 had feed with 52 percent of the metabolizable energy from protein (52 MEp), the others were feed 31 MEp. P52 continued on 52 MEp until day 56 in the nursing period, the others changed feed in the period May 26 to May 30, to different contents of MEp from 32 to 47 (P32, P35, P40, P44, P47).

The results showed that females receiving 32 MEp reduced their body weight less in the period April 28 to day 28 than females feed 52 OE<sub>p</sub>, but their kit weights day 28 were better. From day 28 to day 42 the kits need from 44 to 47 MEp for optimal growth, and from day 42 to day 56 the kits need 40 MEp or more for optimal growth, wit the applied nutrient composition.

*Annual Report 2005, 65-70. Danish Fur Breeders' Research Center, Holstebro, Denmark.*

#### **ZnO to mink kits in the weaning period**

*T.N. Clausen, P. Sandbøl*

ZnO to mink kits in the weaning period May 24 to June 24 was investigated to see if there was any positive effect of high amounts of ZnO on kit growth. Three groups each consisting of 130 black females were fed feed from the local feed kitchen with the addition of 0 ppm (KON), 500 ppm (Zn500) and 1000 ppm (Zn1000) of ZnO. The kits were weighed at the age 28 and 56 days.

The variations in connection with taking out samples and analyzing the mineral content were up to 18 percent. Increasing Zn in feed gave increased Zn in faces and liver, and increased Cu in faces in the Zn1000 group. In Zn1000 there was a great reduction in Cu in the liver dry matter. In this

investigation, we did not find any positive effect on kit growth of the addition of ZnO, on the contrary female kits receiving 1000 ppm ZnO had a reduced weight increase.

*Annual Report 2005, 71-74. Danish Fur Breeders' Research Center, Holstebro, Denmark.*

### **Optimal amount of protein to mink in the growing-furring period. Effect of methionin source**

*T.N. Clausen, P. Sandbøl, C. Hejlesen*

An investigation was performed to evaluate whether MHA (Methyl Hydroxy Analog) can be used as a methionin source to mink kits in the early growth period. To the investigation we used 5 groups each consisting of 135 male- and 135- female mink kits of the brown type. Three groups were feed 20, 24 and 28 percent respectively of metabolizable energy (ME) from protein with the addition of dl-methionin. Two groups were feed 20 and 28 percent of ME from protein and the addition of MHA.

The results showed that MHA can replace methionin for growth from July to medio August or the need of methionin for growth is much lower than recommended.

*Annual Report 2005, 75-80. Danish Fur Breeders' Research Center, Holstebro, Denmark.*

### **Sulfur containing aminoacids and methyl donors to mink in the furring period**

*T.N. Clausen, P. Sandbøl, C. Hejlesen*

Six groups of black mink each consisting of 120 male- and 120 female mink kits, were in the period September 15 to pelting used to investigate whether the methionin (met) / cystine (cys) proportion in the feed in the pelting period can be changed from the used norm. Furthermore to investigate if the norm for methionin can be lowered, with or without the addition of methyl donors.

The investigated met / cys proportion was 0,16/0,06 – 0,14/0,08 – 0,12/0,10 – 0,12/0,06. Further two

groups with met/cys 0,12/0,06 and the addition of betain or cholincloride was used.

The results showed that the optimal proportion of met/cys for skin length and fur quality (not significant) in the period Sept. 15 to pelting was 0,16/0,06. However skin length was the same if met was reduced to 0,12 and cys remained 0,06. In this investigation betain and cholin clorid had no effect on skin length and fur quality.

*Annual Report 2005, 81-88. Danish Fur Breeders' Research Center, Holstebro, Denmark.*

### **Protein to mink in the furring period. Importance of fat and carbohydrate**

*T.N. Clausen, P. Sandbøl, C. Hejlesen*

Earlier investigations showed that the protein content in the furring period may be reduced from 30 % of metabolizable energy (ME) from protein to 25, when the carbohydrate content was from 17 to 19 % of ME. To find the optimal fat / carbohydrate relationship, an investigation in the period September 15 to pelting was made. The variation in ME from protein was from 18 to 30 %, ME from fat varied from 40 to 58 %, and carbohydrate varied from 18 to 36 % of ME.

Production results: The results showed the best weight gain from September to pelting when the ME content from protein was 24 – 27 %, with fat from 52 – 58 % and carbohydrates from 18 – 24 %. The quality of the pelts was good at the same amounts of ME from fat and carbohydrates, but from 24 – 30 % of ME from protein. The chose of carbohydrate source at low ME from protein (18 %) seemed to have an influence on the clarity of the skins.

Blood and liver parameters: There was no effect of feeding on the ALAT and ASAT content in the blood or the liver fat content, when the animals were fasted ½ day before sampling.

*Annual Report 2005, 89-98. Danish Fur Breeders' Research Center, Holstebro, Denmark.*

## Reports on Physiology and analytical techniques

### Physico-chemical properties of fibre-rich feedstuffs and their effect on digestion in the gut of mink

*H.N. Lærke, M.S. Hedemann, C. Hejlesen*

Three groups of 8 adult male mink were fed diets containing dried sugar beet fibre (2 %), crystalline cellulose (1.3 %), or citrus fibre (6.6 %) in order to study the physico-chemical properties in feed and gastrointestinal contents at even fibre levels, and their effect on enzyme activity, intestinal morphology, digestibility of the feeds, and effect on eating time. In spite of large differences in the physico-chemical properties of the fibre-rich ingredients, no effects were seen in the diets except for the amount of water added – and thereby on energy diluting effects. Citrus fibre increased the water binding capacity of the small intestinal contents slightly. The amount and dry matter content of faeces was reduced in the group fed cellulose. At this relatively low level of dietary fibre in the diets no major differences were found in the activity of gastrointestinal enzyme activity and morphology, except for a reduced proliferation of cells in mink fed sugar beet fibre and a reduced sucrase activity in mink fed citrus fibre, and no effect on digestibility of macro nutrients were seen. There was a general trend for a faster and higher feed intake in mink fed sugar beet fibre than mink fed the two other diets.

*Annual Report 2005, 99-106. Danish Fur Breeders' Research Centre, Holstebro, Denmark.*

### Effect of dried sugar beet pulp on eating time and mean transit time in energy restricted mink (*Mustela vison*) females

*C. Hejlesen, H.N. Lærke*

Three similar diets, except for the content of the fibrous dried sugar beet pulp, (LF: 0 %, MF: 2.5 % and HF: 5.0 %) were allotted to 3 groups of female mink from of January 6th to March 7th 2005. Energy allotment was restricted individually resulting in a weight loss of 20 % of there weight mid November. The time the females spend eating the restricted quantity of energy was measured 8

times and the mean transit time (MTT) and the time of first appearance (TFA) of a marker (plastic pearls) was measured 5 times.

Addition of 2.5 % dried sugar beet pulp reduced the time the females spend eating the restricted quantity of energy by 0.7 hour, whereas addition of 5 % increased it by 1.5 hours. Addition of 2.5 % and 5.0 % dried sugar beet pulp to the feed decreased both TFA and MTT. TFA and MTT were lowest at a 5.0 % inclusion of dried sugar beet pulp.

*Annual Report 2005, 107-114. Danish Fur Breeders' Research Center, Holstebro, Denmark.*

### Effect of acids in feed on pH in mink urine

*S. Lisbjerg*

6 acids/acidifiers were screened for the effect on urine-pH in mink males. Adipic Acid, Succinic Acid, Glutaric Acid, Benzoic Acid and Potassium disulfate were tested at 3 different levels. Ammoniumchlorid (0,35%) served as a positive control. Succinic Acid, Glutaric Acid, Potassium disulfate and Ammoniumchlorid had a negative effect on feed intake with increasing inclusion. This corresponds with earlier observations on Ammoniumchlorid. When correcting for feed intake, Adipic Acid showed the best effect on lowering urine-pH, resulting in a pH below the critical level for development of urinary stones (Struvit stones).

*Annual Report 2005, 115 – 118. Danish Fur Breeders' Research Center, Holstebro, Denmark.*

### Fasting of mink kits fed different feed rations and its effect on liver fat content, plasma metabolites and enzymes

*T.N. Clausen, P. Sandbøl*

At pelting, we investigated the effect of fasting time and/or different feed rations on the liver fat infiltration, the plasma concentration of different metabolites and enzymes. Fasted vs. fed mink kits reduced the relative liver weight and increased the liver fat percent. Mink fed a low protein diet and

fasted for 48 hours developed a fat infiltration in the liver faster than mink fed a high protein diet. Responses in plasma metabolites and enzymes are discussed. The change in metabolism depends on the time of fasting and also seems to depend on the prior feeding history.

*Annual Report 2005, 119-124. Danish Fur Breeders' Research Center, Holstebro, Denmark.*

## Reports on: Health

### Investigations of neonatal death in mink kits

*M. Michel, A.S. Hammer, V. Weiss, M.U. Hansen, T.N. Clausen*

In the breeding seasons 2003 and 2004 an increased mortality among neonatal mink kits were observed on several Danish mink farms. The problem seemed to be limited to the first few days postpartum, where numerous litters were lost or significantly reduced. During the breeding season females with lost or reduced litters, and mink kits from lost or significantly reduced litters were collected. The material was subjected to pathological and microbiological analyses in order to investigate possible causal factors and to evaluate the usefulness of various pathological, histopathological and microbiological tools in the diagnostic investigation of neonatal death in mink kits.

*Annual Report 2005, 125-132. Danish Fur Breeders' Research Center, Holstebro, Denmark.*

### A new wild type canine distemper virus infection model in mink

*T.H. Jensen, M. Lund, T.D. Jensen, B. Aasted, M. Blixenkronne-Møller*

A new laboratory method for isolation and titration of virulent canine distemper virus was described. Subsequently the method was used to establish an infection model in mink with a new wild type of canine distemper virus. Mink inoculated with wild type canine distemper virus from 2004 developed generalised virus infection with marked viremia and lymphopenia. Canine distemper viral antigen was

detected in lung tissue of all inoculated mink. Furthermore viral RNA was found in the brain of 4 out of 6 mink.

*Annual Report 2005, 133-138. Danish Fur Breeders' Research Center, Holstebro, Denmark.*

### Biochemical investigations of reasons to outbreak/resistance against the disease complex "wet mink kits"

*T.N. Clausen, K. Mortensen, A.D. Sørensen, J.C. Sørensen, H. Sørensen*

The disease complex "wet mink kits" is a serious problem for the mink production in Denmark and other countries with corresponding climates. The affected kits develop a greasy sticky surface on the skin, starting on the paws, in the neck and tail region with a red and swollen perianal region, and in addition, often with diarrhoea, and distressed behaviour with an invariable meaving. In severe cases, the final outcome can be death of the kits. The reason to the disease seems to be reduced resistance against attack of microorganisms, bacteria and virus among the mink kits affected by the disease. A great number of investigation have also been directed at revealing the possible effects of microorganisms, bacteria, virus, management, feed and immunology of the animals and/or environmental factors on outbreak/resistance toward the disease. No one of these areas seems to give a solution or answer to what could be the reasons to outbreak or resistance against the disease. Biochemistry and molecular based research have in the present project the focus directed at properties of biomolecules, which give basis for resistance or lack of resistance against bacteria and virus attack at mink kits affected by the disease. Possible sites for microbial/bacteria/virus attack in mink kits sensitive to the disease are either the respiratory system with the content of prostaglandins, immunoglobulins, xenobiotic enzymes, virus or antibacterial protection systems, or in the digestive system with relation to the components in especially colostrum/milk. Results obtained in comprehensive investigations of colostrum/milk from mink with and without wet mink kits, have resulted in focus directed at lactoferrin. The content of iron in milk is thus nearly totally bound to this glycoprotein, which occur in granulocytes and it is released at bacterial infection

resulting in lactoferrin effective against microbial/bacteria/virus processes. These types of processes comprise binding of iron resulting in inhibition of microbial growth, and iron is correspondingly essential for the Fenton reactions and the thereby produced active oxygen compounds with high activity as antimicrobial biomolecules. The results obtained have shown that lactoferrin is present in nearly equal concentration levels in colostrum/milk from mink with and without wet kits. Lactoferrin in colostrum/milk from minks with wet kits has, in contrast to lactoferrin from colostrum/milk from mink without wet kits, a weak/insufficient binding of ferri ions. This will as discussed above result in mink kits with reduced resistance against bacteria and virus induced diseases under some feed and environmental conditions.

*Annual Report 2005, 139-148. Danish Fur Breeders' Research Center, Holstebro, Denmark.*

### **Correlation between feed consumption in the breeding and nursing period to greasy kits, lactation length and nursing sickness**

*H. Bækgaard, M. Sønderup, T.N. Clausen*

Development of the new feeding system, individual feeding, has given new opportunities for investigating the influence of feeding on the individual mink. In the present study, five farms from praxis has been studied with regards to the significance of the amount of feed the females gets allocated on, "sticky kits", nursing sickness and the length of the lactation period. Two farms were excluded from the study because of different difficulties. On the farms the weight of the females in November was measured. Furthermore were the amounts of feed allocated per day registered from ultimo March to primo June. Dates for birth and litter size were noted. Sticky kits and nursing sickness were registered with date. To examined the females ability to produce milk, 300 litters (6-9 kits) from each farm were evaluated on a scale from 1-4, where 1 was the lowest grade (poor kits) and 4 the best (very nice kits). To see the correlation between the evaluation of the kits and the actual weight, we weighed the male and female kits separately. We found a good correlation between the evaluation and the weight of the kits and we therefore think that

evaluation of kits is a good tool on the farm. We found no correlation between the amount of feed allocated per females and "sticky kits". With increasing value of the kits we found that there were also an increasing allocation of feed for the female. There seem to be a connection between the females weight in November and the evaluation of the kits, so the heaviest females in November have either the best or the worst kits in June. We further found that the females that got nursing sickness on average weighed less in November (Not significant) than females that did not get nursing sickness.

*Annual Report 2005, 149-154. Danish Fur Breeders' Research Center, Holstebro, Denmark.*

### **Reports on: Management**

#### **Screening of mycotoxins in vegetable feed ingredients for mink**

*P. Sandbøl, T.M. Lassén, M.U. Hansen*

In connection with the latter years cases of a higher incidence of barren females and increase in early kit mortality, mycotoxins have been pointed to as one possible explanation.

After a short general description of occurrence and consequences of mycotoxins and an ongoing Danish surveillance of Fusaria toxins in winter wheat, the available literature on mycotoxins and mink is reviewed.

In a screening of 23 samples of cereal products, maize gluten and soya fibres, only two samples of maize gluten where found to be positive for zearalenone (183 and 637.5 ppb respectively).

At a typical inclusion of 3 % these values are 500 to 5,000 times lower than the levels reported to having caused problems in mink.

On the basis of the present screening vi conclude, that there is no acute risk of production losses due to mycotoxins.

However, based on the results reported for Danish winter wheat as well as our own results for maize gluten, we recommend the initiation of a project

with focus on fewer raw materials and the influence of annual variation as well as storage conditions. *Annual Report 2005, 155-162. Danish Fur Breeders' Research Center, Holstebro, Denmark.*

### Lost litters – investigations in practice

*M. Hansen, V. Weiss, H. Bækgaard, M. Michel*

In 2004 a questionnaire was conducted among all farmers in Denmark to uncover how many lost kits there were on the Danish mink farms in the first days after birth. This questionnaire showed that there were special problems with lost kits among the farms that bought their feed from a feed kitchen in the middle of Jutland. In 2005 there were conducted another questionnaire supplemented with a complete questionnaire on farms that had lost a high percentage of kits.

This questionnaire did not show any clear conclusions, but did indicate that there might be a connexion to the body condition and appetite of the females at birth.

*Annual Report 2005, 163-168. Danish Fur Breeders' Research Center, Holstebro, Denmark.*

### The effect of *ad libitum* and restricted feeding on feed intake curves and feed efficiency curves in mink

*V.H. Nielsen, S.H. Møller, B.K. Hansen, P. Berg*

Feed intake and feed efficiency were studied in lines of mink on farm feeding (FF), *ad libitum* feeding (AL) and restricted feeding (RF). The results show that feed intake curves and weight gain modeled as a function of cumulated feed intake can be described by a fourth degree polynomial specific to line. Significant differences were found among the lines for feed intake ( $P < 0.0001$ ) and feed efficiency ( $P < 0.0001$ ). Feed intake and feed efficiency were largest in the AL-line and smallest in the RF-line. The results suggest that the feeding strategies provide the basis for a differentiated response to selection for high November weight on *ad libitum* and restricted feeding.

*Annual Report 2005, 169-174. Danish Fur Breeders' Research Center, Holstebro, Denmark.*

### Fat condition of mink

*T.N. Clausen*

Selecting breeding animals from their weight at pelting can result in very fat rather than big animals. That can give problems with weight reduction in the winter period. In the pelting period 2004 male mink kits were weighed, their condition score was evaluated on a scale from 1 – 5 and their fat percent was measured. The relationship between fat percent, condition score and BMI (Body Mass Index, calculated as  $\text{weight (kg)} / (\text{body length (m)})^3$ ) was calculated.

The results showed that the relationship between the fat percent of the animals and their weight was not good, the relationship between fat percent and their condition score was better and the relationship between fat percent and BMI was the best. Taking out breeding animals should include evaluation of their condition score so that very fat animals are excluded. The advantage in using evaluation of condition score is that it is fast, easy to learn and gives a very good evaluation of how fat the animals are.

Bringing females in good condition for mating and breeding could also be done by evaluating condition score on a scale from 1 – 5. It is fast, easier than weighing the animals and gives a good evaluation of whether the females are fat or just big.

*Annual Report 2005, 175-182. Danish Fur Breeders' Research Center, Holstebro, Denmark.*

### Separation of slurry

*J.H. Risager, H.H. Møller*

Technique for separation of slurry from mink farm with 4.100 females was tested through a period of one year from 2004 to 2005. The aim of the project was to test a method that separates part of the phosphorus from the slurry into the solid fraction. The liquid fraction of the separation can be brought

out at the fields with up to 140 kg of nitrogen per hectare and still have balance with phosphorus. Two times during the period analyses was made on the slurry, the separated solid and the liquid fractions. At the end of the period the total amounts of the two separated fractions was measured and analysed. The conclusion is, that the liquid fraction with a supply

of 140 kg nitrogen per hectare brings out 21.5 kg of phosphorus, which is under the maximum target of 25 kg per hectare in the current case.

*Annual Report 2005, 183-190. Danish Fur Breeders' Research Center, Holstebro, Denmark.*

**Skin quality as improvement criterion for domestic herd of  
chinchillas (*Chinchilla lanigera* M.)**

by

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During 1997-2001, studies were carried out on the directions of improvement of chinchilla herd in Poland. The material comprised the auction sale results of 20915 standard chinchilla skins produced by 287 breeders), carried out by intermediary of the Copenhagen Fur Center (CFC).

The quality of chinchilla herd in Poland has been evaluated, a problem of chinchilla skin defect has been presented, and the main directions of improvement, as well as chinchilla skin ranking as a measure of the quality of the animals bred in Poland were elaborated. The study comprised broker's evaluation of chinchilla skins of Polish origin sold at 26 auctions. The skins sold at consecutive auction

sessions were grouped according to seasons that were characterised by the most similar prizes. Another criterion of skin assignment to categories was their quality evaluated on the basis of broker's prize applied at the CFC auctions, which include four categories: size, colour type, fur quality, and colour purity.

The study demonstrated that auction prize of skins is to a large extent determined by their size and quality. In the on-farm breeding practice, the breeders should be recommended to take into account economic weights for individual skin traits: 0.35 for size; 0.25 for colour type; 0.30 for fur coat quality; 0.10 for colour purity of the fur.

## The use of probiotics in arctic fox (*Alopex Lagopus L.*) nutrition

by

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*Key words: arctic fox, nutrition, probiotic, growth, digestibility, pelt, reproduction*

The studies on the use of probiotic supplements in arctic fox nutrition were conducted in the years 1998-2001 on three farms located in north-eastern Poland.

The aim of the studies was to determine the effects of two probiotic preparations, P1 and P2, on the growth, fur parameters, nutrient utilization and reproduction results of arctic foxes.

Production experiments were followed by the determination of the blood cell count and the health state of the animals – on the basis of anatomopathological examinations of selected internal organs and alimentary tract segments, and changes in the alimentary tract microflora. The studies were performed on 304 growing foxes and 150 females in the reproduction period.

In the years 1998-1999 the experimental factor was probiotic preparation P1, containing 84% of a mixture of *Enterococcus faecium*, *Lactobacillus acidophilus* and *Saccharomyces cerevisiae*, 8% of *Yucca schidigera* extract and 8% of a 10% zinc bioplex. In the years 2000-2001 the experimental factor was probiotic preparation P2, containing *Enterococcus faecium* and *Lactobacillus acidophilus*, without yeast. The probiotic cultures was micro-capsulated and lyophilized.

The results obtained indicate positive effects of feed supplements containing probiotics (both in the form of bacterial cultures of *Enterococcus faecium* and *Lactobacillus acidophilus*, and their mixtures with yeast *Saccharomyces cerevisiae*) on the parameters analyzed.

# **Effect of breed and management system on productive traits of broiler rabbits**

by

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Rabbits are multi-purpose farm animals raised primarily for valuable and healthy meat.

Different forms of production (breeding in free-standing cages outdoors or indoors) and great differences between breeds result in the final product (carcass) of varying quality.

The high export potential and the new circumstances on the Polish market have encouraged studies to identify the most useful breed, feeding system and housing system of rabbits to obtain carcasses and meat of high quality.

The purpose of this study was to find out to find out which of the most popular breeds and lines of rabbits in Poland can best satisfy the demands of producers in terms of growth rate, the intake of complete diets, the use of farm-produced feeds, and the environmental conditions that have to be met to achieve the desired production results. The study was also designed to determine the effect of the environment in its widest sense in slaughter performance and quality of the end product (meat).

The experiment was carried out in a rabbits farm of the National Institute of Animal Production in Balice and at the Experimental Station Chorzelow Ltd.

The investigated rabbits represented the following breeds and lines: Termond White (TB), New Zealand White (NB), California (K), Alaska (A), Grand Chinchilla (SzW), New Zealand White meat line (NB-LM), and French hybrid line (LH).

Each breed was housed in four systems:

1. in outdoor cages in the spring-summer season;
2. in outdoor cages in the autumn-winter season;
3. in indoor cages;
4. in indoor pens.

Two types of feeding were used for each system: complete pelleted diets and farm-produced feeds.

By far the best growth results were obtained when the complete pelleted diet was fed to rabbits caged indoors. The fact that animals of three breeds and lines (New Zealand met line, e feeding system hybrid line and New Zealand White) achieved 2600 g live weight before 86 days of age is considered a very good results.

Rabbits of all breeds and lines, kept outdoors in the open system in three-tier cages, achieved far better growth rate and lower mortality in the autumn-winter season, regardless of the feeding system.

The studies with seven breeds and lines of rabbits have confirmed that a significantly higher rate of

weight gain is achieved when complete pelleted diets rather than balanced farm-produced feeds are used whatever the management system and breed of animals.

The highest rate of weight gain and the lowest feed intake per kg body weight, regardless of the management system, are characteristic of the New Zealand White meat line and the hybrid line rabbits.

Under Polish rearing conditions, it is possible to obtain daily gains of 40 g with a very low feed

intake of 3,3 kg per 1 kg weight gain. The highest performance values were obtained by the hybrid line, Alaska, New Zealand White and grand Chinchilla rabbits. A negative effect of feeding the complete pelleted diet fatness of rabbits was found.

The present research showed great variation in the content of total cholesterol, which was 20 to 30 % higher for rabbits caged indoors than outdoors.

The best physico-chemical indicators of meat quality and fatty acid profile in the muscle tissue were characteristic of California rabbits.

**Protein turnover and milk production in lactating mink  
(*Mustela vison*) fed different levels of protein**

Master Thesis

by

**Anna K. Rasmussen**

*Protein Turnover and Milk  
Production in Lactating Mink  
(Mustela vison) fed different levels of protein*

Master Thesis  
by  
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The Royal Veterinary and Agricultural University  
Copenhagen, 2005

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2005

The objective of the present investigations was to study the effect of different protein levels in the feed on the protein turnover in lactating mink and on the chemical composition of milk in week 1-6 of lactation. Furthermore variations in milk composition from parturition (colostrums) until 1 week after parturition were investigated.

The experiment was performed using mink dams with 7 kits each. The dams were fed *ad libitum* with diets containing 41% (M) or 28% (L) of metabolisable energy originating from protein.

Protein turnover was measured in 12 dams 1-4 week after parturition by use of balance and respiration experiments as well as tracer experiments with administration of a single dose of  $^{15}\text{N}$ -glycine and measurements of excretion of  $^{15}\text{N}$  in the urine.

The experiment showed a decreased N-excretion in dams fed the L diet and an increased growth rate in the kits during week 4 of lactation compared to dams fed the M diet. The M group had a higher  $^{15}\text{N}$  recovery in the urine and a higher N-flux than the L

group. But no difference was found between the two groups in either protein synthesis or degradation.

Colostrum and the following produced milk was investigated in milk samples collected from 13 milk dams as close to parturition as possible, from 3 dams 24 and 48 hours after parturition and from 12 dams 1 week after parturition.

Colostrum had a higher dry matter and protein content than milk produced in the following week. Also the fat content was higher in colostrums than milk collected 24 and 48 hours after parturition. The amino acid composition also differed between colostrum and the later produced milk. The content of phenylalanine, isoleucine and threonine decreased during the first week, whereas the content of cysteine increased during the days following parturition.

Furthermore 12 dams were used for weekly milk sampling 1-6 weeks after parturition. These dams were fed either M or L diet during the first 4 weeks of lactation. After this half the dams changed to the

opposite diet, resulting in 4 groups: MM, ML, LL and LM where first letter indicate the diet the first 4 weeks of lactation and the second letter indicate the diet during the last 2 weeks.

Dry matter, protein and fat content in milk increased during the first 5 weeks of lactation. Carbohydrate content increased during the first 4 weeks followed by a decrease during the last 2 weeks of lactation. Also the protein content of the diet affected the protein content of the milk, resulting in reduced protein content in milk from dams fed the L diet.

It was concluded that reduced protein content in the diet to lactating milk results in reduced N-excretion and flux, but no effect is observed in either protein synthesis or degradation. Colostrum had a higher protein content and different amino acid composition than milk produced later in the first week of lactation. The protein and fat content of milk increased as lactation progressed and reduced protein content in the diet fed to the dams resulted in reduced protein content of the milk.

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