This is the fourth in a series of research reports compiled to provide the fur animal industry with the results of studies pertaining to fur bearing animals conducted by researchers in the Animal Science Department at Michigan State University. The articles and abstracts presented in this report pertain to basic and applied research conducted during the last three years. The results of several of the studies are presented as comprehensive reports, while the abstracts are of research that has been presented at scientific meetings or published in scientific journals. Reprints (or copies) of the published articles are available from:

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A limited number of copies of the *Handbook of Biological Data for Mink* is also available.

The information contained in this report should be of use to fur farmers, as well as allied fur industry personnel, veterinarians, teachers, pathologists, nutritionists, wildlife biologists, toxicologists, and others interested in these animals.

Effect of supplemental dietary salt (NaCl) on the reproduction performance of female mink and the growth and survival of their kits

R.J. Aulerich, S.J. Bursian, A.C. Napolitano, T.B. Oleas

MSU Fur Animal Research, Report 2000, pp. 1-6, 4 tables, 11 refs. Abstract not included..

The use of copper or formaldehyde as anti-bacterial agents for chickens processed for feeding mink: effects on dietary bacterial numbers and mink growth and furring

D.C. Powell, S.J. Bursian, A.C. Napolitano, C.R. Bush, R.J. Aulerich

MSU Fur Animal Research, Report 2000, pp. 7-16, 6 *tables, 1*4 *refs. Abstract not included.*.

Use of formaldehyde as a preservative for mink feed. I. Effects on bacterial growth

C. Li, S.J. Bursian, D.C. Powell, R.J. Aulerich

Mink feed is an ideal environment for bacterial growth because of the raw animal by-products used in the typical mink diet. Many of these organisms are potential disease producers. Formaldehyde (FA) may be used as an antimicrobial agent to kill bacteria, fungi, and parasites. Experiments were carried out to investigate the effect of incorporating different concentrations of FA into mink feed on growth of gram-negative bacteria and gram-negative plus gram-positive bacteria. In the first experiment, feed containing 0, 550, or 1100 ppm FA was re-frigerated for up to 7 days. The number of colonies of total and gram-negative bacteria derived from the feed was examined each day utilizing enriched blood agar and MacConkey's agar, respectively. In the second experiment, diets containing the same concentrations of FA were incubated at 30°C for 24 hours and bacteria colonies cultured on enriched blood agar and MacConkey's agar were counted at 0, 12, or 24 hours of feed incubation. The results of the first experiment showed that counts of both total and gram-negative bacteria in the FA-treated (550 and 1100 ppm) feed were significantly lower than control counts on a daily basis. In the second experiment, FA at both concentrations was effective in significantly reducing bacterial counts in feed maintained at 30°C over the 24 hour period when compared to control counts.

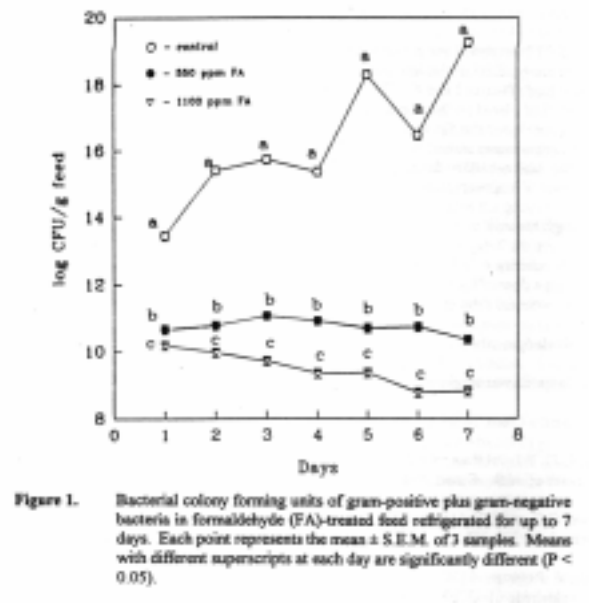

Figure 1. Bacterial colony forming units of gram-positive plus gram-negative bacteria in formaldehyde (FA)-treated feed refrigerated for up to 7 days. Each point represents the mean ± S.E.M. of 3 samples. Means with different superscripts at each day are significantly different ($P < 0.05$).

MSU Fur Animal Research, Report 2000, pp. 17-24, 4 figs., 7 refs. Authors' summary.

Use of formaldehyde as a preservative for mink feed. II. Effects on mink feed consumption, reproductive performance, and early kit growth

C. Li, S.J. Bursian, D.S. Powell, R.J. Aulerich

Two feed consumption trials were conducted to determine the highest concentration of formalin (FA) in mink feed which would be tolerated by mink (*Mustela vison*) and to determine if mink would prefer FA-treated feed to non-treated feed kept refrigerated for a period of up to 7 days. In addition, a long-term feeding trial was conducted to determine the effect of FA on mink reproduction and early growth of offspring. In the first trial, diets containing 0, 1100, 1650, 2200, or 2750 ppm FA were fed to mink for 2 weeks. Feed consumption was recorded daily and mink were weighed at the beginning of the trial and at the end of weeks 1 and 2. The results of this trial indicated that consumption of all the FA-treated diets was significantly lower than consumption of the control diet in a dose-related manner. Similarly, there was a dose-related decrease in body weights and the end of the 2-week period. In the second feed consumption trial, mink were fed diets containing 0, 550, or 1100 ppm FA. The results showed that

consumption of the 1100 ppm FA diet was significantly lower than consumption of the control diet on days 1, 2, 4 and 5, but body weight was not affected in this trial.

Fig. 5. Effects of formaldehyde on kit mink fur. The kit on the left is a control animal and the kit on the right showing "cotton fur" is from the 1100 ppm FA group.

In the reproductive trial, mink were fed diets containing FA at concentrations of 0, 550, or 1100 ppm from 1 month prior to mating (January 27, 1997) until kits were weaned at 6 weeks of age (mid-June, 1997) for a period of approximately 135 days. In this trial, consumption of FA-treated diets had no effect on mating success, but kit survival at birth was adversely affected in the group consuming 1100 ppm FA. There were also significant decreases in hemoglobin concentration, hematocrit, mean corpuscular volume, and mean corpuscular hemoglobin in the high dose kits at 6 weeks of age. There were no significant differences in any of the parameters between the control animals and those consuming the 550 ppm FA diet.

MSU Fur Animal Research, Report 2000, pp. 25-50, 12 tables, 4 figs., 26 refs. Authors' summary.

Use of formaldehyde as a preservative for mink feed. III. Effects on mink growth, furring, and hematologigic parameters

C. Li, S.J. Bursian, D.C. Powell, R.J. Aulerich

This trial was a continuation of Part II of this study in which kit mink and their dams were continued on their respective dietary treatments from weaning through pelting on December 11, 1997. Hematologic parameters, body weights, and pelt quality were evaluated. Hemoglobin and hematocrit values for the kits in the group fed 1100 ppm formaldehyde (FA) were significantly less compared to the control and 550 ppm FA groups at pelting. There were no significant differences in female kit or adult female body weights among the groups during the trial, although male kit body weights in the 1100 ppm group became significantly less than the control and 550 ppm group kit males as the trial progressed. Fur quality was highest in the controls and lowest in the 1100 ppm group.

MSU Fur Animal Research, Report 2000, pp. 51-54, 3 tables. Authors' abstract.

Toxicity of ergot to mink

P.M. Weinstein, R.J. Aulerich, S.J. Bursian

MSU Fur Animal Research, Report 2000, pp. 55-59, 1 table, 14 refs. Abstract not included..

Development of behavioural tests for neonatal and growing mink

C.R. Bush, A.J. Zanella, R.J. Aulerich

This study proved baseline data for mink kits in righting times, tail-pinch response scores, open-field latencies, and learning ability. From these results, ethologists can investigate whether neonatal animals are perhaps more sensitive than older, larger animals to noxious or painful stimuli, such as castrating or tail-docking. And, with the modifications suggested, the behavioural tests used in this study may be sensitive enough to detect behavioural alterations in mink so that a correlation between exposure to environmental contaminants and behavioural development may be established.

MSU Fur Animal Research, Report 2000, pp. 60-71, 3 tables, 4 figs., 17 refs. Abstract not included..

Maxillary and mandibular profliferation of osteoinvasive periodontal squamous cells in mink fed 3,3',4,4',5-pentachlorobiphenyl (PCB 126)

J.A. Render, R.J. Aulerich, S.J. Bursian, A. Napolitano

This report characterizes squamous cell proliferation in young farm mink (*Mustela vison*) fed a diet supplemented with 0.024 ppm 3,3'4,4',5-pentachlorobiphenyl (polychlorinated biphenyl [PCB] congener 126). One to 2 months dietary exposure to PCB 126 resulted in gross lesions of the upper and lower jaws consisting of mandibular and maxillary nodular proliferation of the gingiva and loose teeth. The maxillae and mandibules of the PCB-treated mink were markedly porous due to loss of bone. Histologically, the localized osteoporosis was caused by squamous cell proliferation that caused osteolysis of aveolar bone and effaced mandibular and maxillary bone by infiltrating cords of neoplastic cells. This report clearly documents the fact that the environmental contaminant, PCB 126, can cause osteoinvasive squamous proliferation in young mink although the dose used in the present study was an order of magnitude higher than what is typically encountered in contaminated fish or bird eggs.

Fig. 1. Mouth of a mink fed PCB 126. Notice the swollen mandibular gingiva and displaced teeth.

MSU Fur Animal Research, Report 2000, pp. 72-79, 5 figs., 19 refs. Authors' abstract.

Dietary exposure to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) induces proliferation of periodontal squamous epithelium in mink

J.A. Render, J.R. Hochstein, S.J. Bursian, R.J. Aulerich

The maxilla and mandible from two adult female mink fed 0.5 ppb 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) for 6 months were grossly unremarkable, but histologically had nests of squamous epithelium within the periodontal ligament. There was osteolysis of the adjacent alveolar bone.

MSU Fur Animal Research, Report 2000, pp. 80-83, 1 fig., 10 refs. Authors' abstract.

The association between genotype, stereotypes, and fecal steroids in mink

M. Tauchi, Y. Yuan, R.J. Aulerich, A.J. Zanella

MSU Fur Animal Research, Report 2000, pp. 91-92. Abstract not included..

The validity of urinary cortisol profiles to assess the hypothalamic-pituitary-adrenal axis activity in farmed mink (*Mustela vison*).

A.J. Zanella, A. Martin, T. Oleas, R.J. Aulerich

MSU Fur Animal Research, Report 2000, pp. 93-94. Abstract not included..