

EFFECTS OF AGE AND STRAIN OF FEMALE, AND OF ETHYLENE DICHLORIDE EXTRACTED WHEAT GERM OIL ON REPRODUCTION IN MINK (*MUSTELA VISON*)*

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Summary. One hundred and sixty female mink of four colour strains (Pearl, Cameo, Dawn Pastel and Violet) were assigned to eight groups according to age and colour. One-half of each group received wheat germ oil extracted with ethylene dichloride, while control mink received corn oil supplemented with mixed tocopherols. Mean performance data for the control and treated groups respectively were as follows: days from first attempted mating until actual first mating, 3.0 and 2.1; conception rate, 66.3 and 60.0%; young born/pregnant female, 2.29 and 2.45; weight of young at 3 weeks of age, females 93.6 and 95.5 g, and males 101.7 and 105.1 g. Differences between control and treated groups were not statistically significant. Highly significant differences were observed between strains for conception rate, number of male and female young and total young/pregnant female. A significant interaction was noted between wheat germ oil treatment and strain in the number of days required to achieve mating. Previous reproductive history of the females (parous or non-parous) had little effect on the characteristics studied.

INTRODUCTION

Reproduction in the common mink (*Mustela vison*) is characterized by failure of many females to mate, failure to conceive if they do mate and small litter size accompanied by high embryonic mortality if they conceive. These characteristics have been surveyed in the classic studies of Hansson (1947) and Enders (1952). The reproductive process is further complicated by the phenomenon of delayed implantation resulting in wide variations in gestation length between females. Therefore gestation length is affected both by the time of season that copulation occurs and by the size of the litter carried (Hansson, 1947; Enders, 1952).

The role of ethylene dichloride extracted wheat germ oil (EDC-WGO), although used by mink ranchers for over 25 years, has never been subjected to a controlled test in this species. EDC-WGO significantly improved reproduction in repeat breeder dairy cattle (Marion, 1962) and sheep (Dukelow & Matalamaki, 1963).

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A 28-carbon straight chain saturated alcohol (octacosanol) has been isolated from ethylene dichloride extracted wheat germ oil (Levin, Collins, Varner & Mosser, 1962). This substance, as well as the oil from which it is derived, exerts a significant gonadotrophic response when tested by the Dorfman chick-comb growth technique (Levin, 1963).

The objectives of the present study were to determine reproductive performance in: (1) female mink of four colour strains, (2) in parous and non-parous females, and (3) in untreated mink and in mink receiving EDC-WGO.

EXPERIMENTAL PROCEDURE

One hundred and sixty breeding females were allotted to eight groups according to age and strain (colour phase). The four strains studied were the Pearl (pp bpbp alal), Cameo (alal bm^Hbm^H), Dawn Pastel (bb bsbs) and Violet (pp alal bmbm). Half of the females in each of the parous and non-parous groups were assigned at random to the control group and the remainder to the experimental group. All mink received a standard ration consisting of 55% meat, 12% cereal and 33% water supplemented with vitamin A (1,560,000 i.u./ton of dry feed) and a bacterial-fungal enzyme (Nopco Chemical Co., Harrison, New Jersey, 4 lbs/ton of dry feed). Beginning 10th February 1963, 4 weeks before the breeding season, the experimental ration was supplemented with a quantity of EDC-WGO calculated to provide 5 ml wheat germ oil/seven mink daily. The control ration received an identical quantity of corn oil fortified with mixed tocopherols at a level equivalent to that found in the wheat germ oil. The feeding of the oil supplements continued until 18th April 1963.

Matings were attempted on 25% of the breeding herd each day, starting on 10th March. The same number of females in the control and treated groups were tried daily. Similarly, an equal number of females of each strain (in control and treated groups) were tried daily. The ratio of females to males was 8 : 1 and equal numbers of females in each strain were bred to each male. Half of the males were 2 years old and the remaining one-half were kits.

The first kits were born on 2nd May 1963. Because of the excitability and cannibalistic nature of lactating females, the number and weights of young were recorded at 3 weeks of age instead of at birth. The measurements taken included: (1) days to achieve mating (number of days from when mating was first attempted until copulation was achieved), (2) conception rate (number of females producing a litter/females mated), (3) numbers and mean weights of live male and female kits/pregnant female and (4) total live kits/pregnant female. All data were treated by analysis of variance.

RESULTS AND DISCUSSION

Mean values for all characteristics studied are shown in Table 1 and mean squares of the analysis of variance in Table 3. There was a significant difference ($P < 0.05$) between the two age groups in the number of male kits alive at 3 weeks of age/pregnant female. The older females tended to have larger litters.

Distinct differences were noted between colour strains in reproductive ability. These differences were highly significant ($P < 0.01$) for conception rate,

TABLE 1
REPRODUCTIVE CHARACTERISTICS OF MINK (*Mustela vison*)

Characteristic	Treatment		Age of female		Strain				
	Control	EDC-WGO	Young	Aged	Pearl	Cameo	Dawn	Pastel	Violet
No. of females	80	80	80	80	92	20	28	20	
Days to achieve mating	3.0	2.1	2.7	2.5	2.4	1.9	4.1	1.8	
Conception rate (%)	56.3	60.0	56.3	60.0	53.3	60.0	85.7	40.0	
Average No. of male kits at 3 weeks/pregnant female	1.29	1.34	1.05	1.58	1.09	1.30	2.50	0.70	
Average No. of female kits at 3 weeks/pregnant female	1.00	1.11	0.98	1.14	0.92	1.15	1.82	0.50	
Total kits at 3 weeks/pregnant female	2.29	2.45	2.03	2.72	2.01	2.45	4.32	1.20	
Average weight of male kits at 3 weeks (g)	101.7	105.2	100.7	105.4	102.4	104.0	101.5	112.9	
Average weight of female kits at 3 weeks (g)	93.6	95.5	94.6	94.4	96.4	92.2	91.8	95.6	

TABLE 2
MEAN NUMBER OF DAYS TO ACHIEVE MATING

Strain	Control (days)	EDC-WGO (days)
Pearl	2.6	2.2
Cameo	1.3	2.4
Dawn Pastel	5.2	2.9
Violet	3.3	0.3

EDC-WGO = ethylene dichloride extracted wheat germ oil.

TABLE 3
MEAN SQUARES FOR FACTORS STUDIED

Source of variation	d. f.	Mean squares						
		Days to achieve mating	Conception rate	Female kits at 3 weeks	Male kits at 3 weeks	Total kits at 3 weeks	Male kit wt	Female kit wt
Total	159	—	—	—	—	—	—	—
Treatment (T)	1	29.75	0.05	0.01	0.05	1.05	11.45	1350.83
Colour strain (C)	3	9.11	1.00**	17.22**	8.12**	48.66**	6316.86	9214.94**
Age (A)	1	1.40	0.05	11.02*	1.05	18.90	3316.04	1959.30
T × C	3	40.55**	0.13	1.19	3.70	9.01	904.55	5805.95
T × A	1	12.67	0.17	1.60	1.08	5.26	1453.23	2.04
C × A	3	24.92	0.13	7.99*	2.83	10.79	6339.65	1294.43
T × A × C	3	9.64	0.04	0.92	0.67	0.06	1019.57	783.54
Error	144	12.01	0.24	2.48	1.67	5.70	2921.91	2259.42

* $P < 0.05$; ** $P < 0.01$.

numbers of male and female kits, total litter size/pregnant female, and female kit weight. The Dawn Pastel strain, while requiring more days to achieve mating, exhibited a higher conception rate and had larger litters than any of the mutant strains. This does not necessarily imply a genetic effect. Failure to cull poor breeders of the more popular colour strains would greatly influence results of this nature. It is also reasonable to assume that genes other than those affecting colour may affect reproductive performance. These data indicate the importance of diversification of strains to provide optimum reproductive efficiency.

The differences between the control and wheat germ oil groups were not significant for any of the characteristics studied. A highly significant ($P < 0.01$) interaction between treatments and strains for the days to achieve mating was observed (Table 2).

Treatment with EDC-WGO reduced the number of days required to achieve mating in different strains. The greatest improvement in this characteristic occurred in those strains which required a longer time to achieve mating in the control group (Dawn Pastel and Violet).

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REFERENCES

- DUKELOW, W. R. & MATALAMAKI, W. (1963) Effects of ethylene dichloride extracted wheat germ oil on reproductive efficiency of the sheep. (Abstract). *J. Anim. Sci.* **22**, 1137.
- ENDERS, R. K. (1952) Reproduction in the mink (*Mustela vison*). *Proc. Am. phil. Soc.* **96**, 691.
- HANSSON, A. (1947) The physiology of reproduction in mink (*Mustela vison*, Schreb.) with special reference to delayed implantation. *Acta zool.* **28**, 1.
- LEVIN, E. (1963) Effects of octacosanol on chick comb growth. *Proc. Soc. exp. Biol. Med.* **112**, 331.
- LEVIN, E., COLLINS, V. K., VARNER, D. S. & MOSSER, J. D. (1962) Compositions comprising octacosanol, triacontanol, tetracosanol, or hexacosanol, and methods employing same. *U.S. Patent Office* 3031376.
- MARION, G. B. (1962) Effects of wheat germ oil on reproductive efficiency in repeat-breeder cows. *J. Dairy Sci.* **45**, 904.