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Temperament and reproductive performance in farmed sable

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The present study sought to evaluate the relationship between temperament and reproductive success in farmed sable (*Martes zibellina*). Experimental material comprised altogether 58 males and 236 females. Temperament was measured by using a stick test. About 85% of matings occurred in July. Most whelpings were in April. Over 80% of young and old males were classified as curious. Number of fearful and aggressive males was small. Among females, the amount of curious animals was much lower compared to males. Every third female was fearful. Temperament did not affect length of the gestation period which averaged 268 ± 14 days. Gestation period was longest for early breeding females ($r = –0.629$; $P < 0.001$). Aggressive females tended to be less willing to mate than fearful or curious ones. Whelping started latest in aggressive females. Whelping result was poorer in aggressive (0.2 ± 0.2 kits per breeding female; 2.5 ± 0.5 kits per whelped female) than in curious (1.2 ± 0.2; 3.1 ± 0.2) and fearful females (1.0 ± 0.3; 3.5 ±0.4). Percentage of whelped females was lowest (7.7%) and kit losses highest (28.6%) for aggressive females.

Key words: sables, *Martes zibellina*, reproductive performance, domestication, breeding

Introduction

Domestication is a long process during which a wild animal species adapts to humans and to an artificial environment. It includes not only genetic changes over generations, but also non-genetic influences experienced by individuals in each generation (Price 1984). Through the selection of breeding animals man has been able to change many traits of production animals to a specific direction. Traditional fur animals, such as the fox and the mink have been domesticated for about 100 years. Previously, genetic selection was mainly concentrated on fur properties, body size and reproductive success but, more recently, temperament has been emphasized as an important selection criterion (Hansen 1996, Malmkvist et al. 1997, Trut 1999). The reason for including temperament to selection is firstly

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because of the relation between fear and welfare (Rekilä 1999) and, secondly, because fear can influence the physiology of reproduction. Evidence has been found that confident farm foxes have better reproduction than fearful ones (Bakken 1994, Hansen 1998). Some connections between temperament and reproductive success is also been found in farmed mink. For example, a confident mink can be mated earlier than fearful or non-selected one (Malmkvist et al. 1997). It is also known that many common farm events and treatments can be stressful to animals of timid character (Hansen and Damgaard 1991, Harri et al. 1995, Jeppesen 1998).

Like the mink (*Mustela vison*), the sable (*Martes zibellina*) is a representative of the family Mustelidae. It typically has a long slender body, a long-haired pelt and a bushy tail (Nowak 1991). Because of its exceptionally valuable fur coat, the sable has been systematically hunted since at least year 1000 AD (Pavlinin 1966). Intensive hunting, unfortunately, led to the extinction of wild sable population in Europe and today it is only found in Siberia and the Far East (Ness et al. 1988). The wild sable is a relatively shy animal, which does not actively seek human proximity (Smolik 1974). It is generally considered to be more fearful than the marten or the mink (Ognev 1962).

Because of its exceptionally beautiful and valuable fur coat, sable has been adopted also as a farm animal. The first farming trials began in the former Soviet Union in the 1930s (Ness et al. 1998). Until the 1990s, sable farming was limited only to the area of former Soviet Union. Therefore, both scientific and practical knowledge on adaptation of this species to farming has been scarce in Western countries (Usenko 1989). The first farmed sables were exported after the establishment of the new Russia. There are presently two sable farms in the Nordic Countries; in Finland and in Denmark, respectively (Hansen, oral communication).

The aim of the present study was to measure the temperament and estimate its relationship to reproductive success in the sable under Finnish farm conditions.

Material and methods

Animals and general procedures

The study was carried out on commercial Gold Safir fur farm in Himanka during 1998–99. This is the only sable farm in Finland. Sables were originally born on a commercial farm in Russia and were transported to Finland in early 1998. Total numbers of young and old males were 22 and 36, respectively. Corresponding numbers for females were 88 and 148. Animals were housed in indoor conditions in a normal closed hall previously built for mink. Wire-mesh cages measured 40 cm wide x 60 cm long x 40 cm high. A wooden nestbox (22 cm wide x 30 cm long x 40 cm high) was connected to each cage. The nest had a wire-mesh net roof. Hay and straw were used for bedding in the nest boxes. Basic diet was the same as that traditionally used for the mink, i.e. slaughter-house offal, fish, fish-offal and cereals (Berg 1986). It also included a sufficient vitamin supplement. Water was freely available from an automatic drinking water dispenser.

Mating procedure and measurements

Sables were mated according to natural mating cycle of this species in July – August 1998. Mating period lasted about 7 weeks. Females not succesfully mated were tried again with a new male. In the mating procedure the female was trapped and moved to the cage of the male. The mating act was characterized by the male holding the female, biting her on the neck and taking a rounded body position over her during intromission. Whelping occurred in March – May 1999. Only old females (age 2–4 years) were mature. Young females (age less than 15 months) were not mated because they were immature and did not show any signs of heat. Heat was evaluated from vulval swelling. The whelping result was recorded at birth and at weaning (age of 8 wks) by counting the number of kits. Kit losses

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Table 1. Number and percentage of fearful, curious and aggressive animals.

Variable	Fearful	Curious	Aggressive
Number of (percentage)			
Young males	3 (13.6)	18 (81.8)	1 (4.6)
Old males	3 (8.3)	30 (83.3)	3 (8.3)
Young females	29 (32.9)	57 (64.8)	2 (2.3)
Old females	50 (33.8)	72 (48.6)	26 (17.6)

= number of kits at weaning – number of kits at birth.

Weaning was carried out in May – June and after that, on June 15, temperament of animals was measured using the stick test (Hansen 1996). The test was performed before feeding time. The observer was standing in front of the cage and inserted a wooden stick through the wire netting. The test animal reacted to close contact with the human and directed its reaction towards the stick. An immediate reaction to the stick stimulus was characterized as follows: (1) escape (fearful); the animal moved away from stimulus and backwards into the cage; (2) exploration (curious); the animal approached the stick and sniffed and/or bit at the stick; (3) aggressiviness (aggressive); the animal made a fast and intense attack at the stick and maintained the bite. Duration of the test per animal was about 10 sec. Entrance to nest box was closed during the test.

Statistical methods

Statistical analyses were performed using the SAS system for Windows release 6.12 (SAS 1990). Whelping results were tested by the Kruskal-Wallis one way analysis of variance. Frequency of lost kits and frequency of barren and mated females per behaviour group were compared with the chi-square test. Relation between gestation period and breeding date was calculated using the Pearson product moment correlation. A probability level, P, of 0.05 was chosen as the limit of statistical significance in all tests.

Results

Temperament scoring

Temperament of sables according to the stick test is shown in Table 1. Marked differences in temperament between sexes were found. In males no difference between old and young animals was found. Over 80% of young and old males were classified as curious. Number of fearful and aggressive males was slight.The amount of curious animals among females was much lower than that among males. Every third female was fearful, with a slight difference between young and old ones. Every sixth old female was aggressive. Number of aggressive individuals among young females was slight.

Reproductive performance

The number of females in heat during the first breeding week was lowest in the curious group (Table 2). During weeks 2–5 no differences among temperament groups were found. During week 6 all females of fearful groups were mated, whereas mating was still in process during week 7 in the curious and aggressive groups. Despite being in heat, breeding remained unsuccessful in aggressive females before breeding week 3 (Table 2). Breedings of fearful females were completed first, i.e. during week 6. Average number of actual matings in fearful, curious and aggressive females were 2.4, 2.1 and 2.7, respectively.

Table 2. Cumulative percentage of females in heat (H) and mated (M) at the end of different weekly breeding periods.

Period	Fearful		Curious		Aggressive	
	H	M	H	M	H	M
3–9 Jul	41.9	2.1	25.4	1.7	42.9	0
10–16 Jul	61.3	22.6	59.3	20.3	57.1	0
17–23 Jul	80.6	64.5	71.2	49.2	85.7	57.1
24–30 Jul	90.3	83.9	86.4	83.1	85.7	85.7
1–6 Aug	90.3	83.9	93.2	89.8	85.7	85.7
7–12 Aug	100	100	96.6	96.6	85.7	85.7
13–24 Aug	100	100	100	100	100	100

Average gestation period in fearful, confident and aggressive animals was 266 ± 12, 269 ± 15 and 266 ± 10 days, respectively. Lowest individual gestation period was 238 for a fearful animal and, correspondingly, the highest one was 309 for a curious animal. Length of gestation period was affected by breeding date whereby the earlier the female was bred, the longer the gestation period ($r = –0.629$; $P < 0.001$).

Whelpings in the fearful and curious groups started during the last week of March, but in aggressive animals not before April 10 (Table 3). Whelpings in the fearful animals were finished during the last week of April. In the curious group whelpings continued until mid-May.

Breeding date, i.e. the week during which the first mating was done, substantially affected the whelping result (Table 4). Females mated during the first breeding week had the best whelping success. Thereafter, whelping result as given per whelped female progressively declined week by week. The first two weeks provided best whelping result also when calculated per breeding or mated female.

Temperament of females was found to affect reproductive success (Table 5). Percentage of mated females was much lower in aggressive group in comparison to curious and fearful ones. Percentage of whelped females was very low in the aggressive group. Whelping result was poorer in aggressive females compared to curious and fearful ones. Kit losses were highest in agressive animals.

Table 3. Cumulative percentage of whelped females in 7 weekly breeding periods.

Period	Fearful	Curious	Aggressive
27–31 Mar	13.3	3.4	0
3–9 Apr	40.0	31.0	0
10–16 Apr	66.7	48.4	50.0
17–23 Apr	93.3	86.2	100
24–28 Apr	100	89.7	100
1–7 May	100	89.7	100
8–14 May	100	100	100

Table 4. Effect of mating time (weekly period) on whelping results. Data are presented as a number of kits per mated and whelped female (mean ± standard error). Number of females in parenthesis.

Period	Mated female		Whelped female	
3–9 Jul	2.3 ± 0.4	(31)	3.7 ± 0.3	(19)
10–16 Jul	1.9 ± 0.3	(27)	3.2 ± 0.3	(16)
17–23 Jul	0.7 ± 0.3	(15)	2.5 ± 0.6	(4)
24–30 Jul	0.8 ± 0.3	(12)	2.0 ± 0.4	(5)
1–6 Aug	1.0 ± 1.0	(4)	4.0	(1)
7–12 Aug	0.2 ± 0.2	(5)	1.0	(1)
13–24 Aug	0	(3)	0	(0)

Discussion

The mating season of sable is mentioned to last from mid-June to mid-August, with most of the

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Table 5. Whelping result given as a percentage of mated, whelped and 'lost kits' females or as a number of kits per female (mean ± standard error).

Variable	Fearful	Curious	Aggressive
Mated (%)	62.0[a]	81.9[b]	26.9[d]
Whelped (%)	30.0[a]	40.3[a]	7.7[c]
Lost kits (%)	3.2[a]	1.7[a]	28.6[c]
Whelping result per			
breeding female	1.0 ± 0.3[a]	1.2 ± 0.2[a]	0.2 ± 0.1[d]
mated female	1.7 ± 0.4[a]	1.5 ± 0.2[a]	0.7 ± 0.5[a]
whelped female	3.5 ± 0.4[a]	3.1 ± 0.2[a]	2.5 ± 0.5[a]

Values not sharing a common superscript differ from [a] as following: [b] = P<0.05, [c] = P<0.01, [d] = P<0.001. Mated (%) = percentage of females mated during breeding season; Whelped (%) = percentage of females whelped during whelping period; Lost kits (%) = percentage of females lost kits (from birth to weaning); Breeding female = female that was left for breeding.

matings occuring in July (Ness et al. 1988, Nowak 1991). In the present study no matings occurred in June but majority of matings were in July with about 85–90% being over before August. Latest matings were in mid-August. Thus, the timing of breedings in our sable material did not substantially differ from that described in the literature.

The sable is known to have a delayed implantation whereby the fertilized eggs remain in the blastocyst stage for a long period before the implantation (Pavlinin 1966). The length of this period depends on the day length and therefore varies in the wild between geographical areas and depends on the mating date (Ness et al. 1988). Therefore even the total length of the gestation period can vary, ranging from 250 to 300 days (Pavlinin 1966, Nowak 1991). Also in the present farmed sable material, a rather similar variation in gestation length was encountered, i.e. from 238 to 309 days. Furthermore, a distinct dependence between gestation period and breeding date was found as early mated females had longer gestations and *vice versa*. The obvious biological explanation for this phenomenon is that the sable, as a species, aims to schedule the whelpings to the rather short, most favourable period during the spring. Too early whelpings are not favoured because of cold, hazardous weather which typically occurs in its original Siberian habitat. On the other hand, too late whelpings may restrict kit development due to short summer.

According to Ness et al. (1988), most sable litters are born in April, and only very few in either March or early May. This was also the case in the present study. Litter size is described to be 3–4 kits but can vary from 1 to 10 (Ognev 1962, Pavlinin 1966). Litter size found in the present study is very consistent with the above values. Finally, to sum up all above discussed breeding, gestation and whelping information, it can be concluded that our sable material appears to be very comparable with that previously described in the literature.

Evidence has been found that primiparous vixens may have smaller litters than multiparous ones. Most pronounced this phenomenon seems to be in species with large litter sizes, for example, in blue foxes (Ilukha et al. 1997). This obviously is due to the fact that taking care of large litters can be more difficult for primiparous vixens because of their "less-developed" nursing capacity. Age of vixens in the present study varied from 2 to 4 years. Because the animal stock originally was from Russian farm, no reliable data are available on exact age of our breeding females. This makes also impossible to evaluate actual effect of females' age on breeding result. According to common farming prac-

tice, however, there is no substantial difference in whelping results between vixens aged from 2 to 4 years in the mink. Quite obviously this same holds true in case of sable but before final conclusions more research should be done. It is also worth noting that litter size of sable typically is very small (1–4 kits only) and the effect of females' nursing capacity then obviously is substantially less pronounced than in species like blue fox with large litters.

With mink a selection experiment including lines for confident and fearful animals, respectively, has been carried out in Denmark since 1988 (Hansen 1996). Two different selection lines have been established, i.e. confident and fearful. The experiment has shown that temperament-related selection affects reproduction in the mink to the extent that confident females are ready for mating about two days earlier than fearful ones (Malmkvist et al. 1997). Thus, temperament affects mating readiness in farmed mink. As regards sables, a parallel temperament effect was not found in the present study. The observed inter-species difference between the mink and the sable can be obviously explained by their different biology. It is clearly not reasonable for the sable to come into heat too early because then the gestation period is longer, and, thus the probability for kit losses also increases. Breeding season of the mink is during February-March and kits are normally born in May. This much shorter reproduction period of the mink favours animals that come into heat earlier.

In the mink, no differences in whelping result between confident and fearful animals has been found. Likewise in the present study, no differences were found in whelping results between confident and fearful sable females. It is thus possible that temperament selection towards more curious, confident animals does not increase reproductive success in either species. However, it was clearly seen that whelping result of aggressive sables was poor. Comparable reproduction data with agressive breeding females is lacking in the mink. However, it is known that farmers often do not accept aggressive females for breeding because they consider them poor reproducers. Effect of aggressive temperament on reproductive success in mink is worth further scientific clarification.

There was a marked difference in temperament between sexes with females being more fearful and aggressive than males. This difference can be due to the fact that the present temperament tests were conducted soon after weaning in June. According to Ognev (1962), only the mother remains with the young in the wild. Also on farm conditions, male sables are kept apart from kits. The more fearful and aggressive character of females can be due to their feature as "defensive mother". Further testing of this hypothesis is required, however, before final conclusions.

Long-lasting selection experiment for behavioural traits in farm mink has shown the stick test to be a valid method for temperament classification (Hansen 1996). According to the results of that test, most mink are either fearful or curious, with only a few having an aggressive temperament. A rough comparison of the temperament of mink by Hansen (1996) with the presently studied sables reveals that farmed sable actually is not more fearful than the mink. Evidence on sables' ability for mink-like-tameness in the presence of humans was also found by Ognev (1962), who mentioned that sables housed in captivity become rather tame, particularly if they are kept among humans for an extended period. Our data derives from only one sable farm and therefore, comparative material from different farms would be necessary to confirm this assumption. Similar domestication level is possible in these two species also because their farming history is nearly equally long; farming of mink was begun in late 1920s and that of sable in early 1930s.

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SELOSTUS

Tarhatun soopelin luonne ja lisääntymiskyky

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Tässä tutkimuksessa selvitettiin soopelin (*Martes zibellina*) luonteen ja lisääntymiskyvyn välistä yhteyttä.

Kokeessa oli yhteensä 56 urosta ja 236 naarasta. Luonne mitattiin keppitestillä. Noin 85 % parituksista tapahtui heinäkuussa ja useimmat penikoimiset huhtikuussa. Yli 80 % uroksista oli luonteeltaan luottavaisia, ja pelokkaita ja agressiivisia uroksia oli vähän. Luottavaisia naaraita oli selvästi uroksia vähemmän, ja joka kolmas naaras oli pelokas.

Tulosten mukaan luonne ei vaikuttanut kantoajan pituuteen, joka oli keskimäärin 268 ± 14 päivää. Kantoaika oli pisin aikaisin paritetuilla naarailla ja lyheni mitä myöhemmin paritus tapahtui. Agressiiviset naaraat eivät olleet niin halukkaita parittelemaan kuin luottavaiset ja pelokkaat. Penikointi alkoi kaikkein myöhemmin agressiivisilla naarailla. Pentutulos oli huonompi agressiivisilla (0,2 ± 0,2 pentua/siitosnaaras; 2,5 ± 0,5 pentua/penikoinut naaras) kuin luottavaisilla (1,2 ± 0,2; 3.1 ± 0.2) ja pelokkailla (1,0 ± 0,3; 3,5 ± 0,4) naarailla. Agressiivisten naaraiden penikointiprosentti oli myös pienin (7,7 %) ja pentuhävikki suurin (28,6 %).