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INDUCTION OF ABORTION BY STRANGE MALES IN PINE VOLE FEMALES
THAT ARE: 1) TEN DAYS PREGNANT OR 2) PREGNANT AND LACTATING

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Pregnant voles react to the presence of unfamiliar males by aborting the offspring they are carrying, entering estrus and mating with these new males. This phenomenon was first described in pine voles by Marks and Schadler (1979). At that time we reported that 84% of females that were four days along in their first pregnancy were induced by strange males to reject their embryos. These findings encouraged us to continue our investigations and this paper reports results on the abortion response caused by strange males in females ten days along in their first pregnancy (Experiment I) and on experienced pine vole mothers that are pregnant and are at the same time nursing a litter (Experiment II).

EXPERIMENTAL METHODS

In Experiment I, virgin females were placed in a cage with stud males. They were examined daily for the presence of sperm in smears taken from their vaginas as an indication that mating had occurred. Mated females were assigned to either a control group or an experimental group. Controls (N=24) were left in the cage with the stud male throughout the 24 day gestation period. Experimental females (N=20) were removed from the stud male and placed in a cage with a strange male after ten days of pregnancy.

Abortion was assumed to have occurred in those females that delivered young 24 or more days after mating with the strange male which was more than 36 days after mating with the stud male.

Experiment II females were pregnant and lactating. They were all experienced mothers that had previously been successful in rearing one or more litters. These females were caged with their stud males prior to the onset of the experiment. On the day of the birth of their young, females were assigned to a control or an experimental group. In the controls (N=26) the stud male that was caged with the female remained in the cage throughout the experiment. In the experimental group (N=42) the stud male was removed and replaced by a strange male on Day 2 of the post partum period. A second strange male replaced the first on Day 6 and a third replaced the second on Day 10. Otherwise both groups were handled in an identical manner.

In Experiment II, the timing of the birth of litters sired by stud males or by strange males again served as the

criterion of abortion. Timing of the births of litters of experimental animals was compared with that of the controls for Experiment II and with data collected from the normal breeding colony. In all cases data was collected only on those females that had litters within 50 days post-partum.

RESULTS AND DISCUSSION

Results of Experiment I (Table 1) showed that 95% (18 out of 19) of the controls that delivered young had them 24-26 days after mating with the stud male. Five control animals (21%) and 4 experimentals (20%) delivered no young despite the fact that sperm was seen in the vaginal smear indicating they had mated. Past experience has indicated that virgin pine voles have only about an 80% incidence of successful matings. One control animal gave birth 40 days after mating with the stud male. She may have aborted spontaneously and remated or she may have missed conceiving with the original mating and subsequently had a successful mating.

Table 1. Abortion induced by strange males in inexperienced females that are ten days pregnant.

GROUP	NUMBER	NUMBER FEMALES DELIVERING YOUNG	NUMBER FEMALES DELIVERING 24-26 DAYS AFTER STUD MALE MATING	NUMBER FEMALES DELIVERING 36 PLUS DAYS AFTER STUD MALE MATING
Control	24	19	18	1*
Experi- mental	20	16	4	12

*See text for explanation

Four of the experimental animals that delivered young (25%) had them 24-26 days after mating with the stud male. The remaining 12 (75%) gave birth 24 or more days after mating with the strange male which was 36 or more days after they had mated with the stud male. In addition to the births of their litters sired by strange males these females also showed other signs of abortion. These were the presence of a thick, bloody discharge from the vagina two or three days after the females were placed with strange males and/or sperm from the strange male mating in the vaginal smear.

Females in Experiment II also showed a high incidence of abortion (Table 2). Based on data from the breeding colony, 87% of females housed with males can be expected to conceive 1-3 days post partum, 4% during 4-21 days post-partum and 7% more than 21 days. Controls for Experiment II were, because of the nature of the experiment, handled

more than the normal breeding colony. They had a somewhat lower incidence of conception immediately following parturition. Seventy seven percent of these animals conceived 1-3 days post partum, 11.5% on 4-21 days post partum and 11.5% after 21 days. In the experimental group, however, only 31% delivered young conceived 1-3 days post partum while 62% had young conceived on days 4-21 when they were caged with strange males. Seven percent conceived after 21 days (Table 2).

Table 2. Abortion induced by strange males in experienced, pregnant females that are nursing a litter.

GROUP	NUMBER	PERCENT FEMALES CONCEIVING 1-3 DAYS POST- PARTUM	PERCENT FEMALES CONCEIVING 4-21 DAYS POST- PARTUM	PERCENT FEMALES CONCEIVING AFTER 21 DAYS POST- PARTUM
Breeding colony	132	87	4	7
Controls	26	77	11.5	11.5
Experi- mentals	42	31	62	7

The induction of abortion in pine voles by strange males is dramatic. Not only do females in the early (possibly pre-implantation) stages of pregnancy lose their embryos but those in the later stages also abort. This occurs regardless of whether the females are pregnant with their first litters or if they are experienced mothers that are pregnant and nursing a litter at the same time.

The results of Experiment I were not unexpected. Loss of pregnancy in females that are in the later stages of pregnancy has been reported for other voles by Stehn and Richmond (1975).

Results of Experiment II were, however, a surprise. Several authors have reported that lactation and/or the presence of circulating prolactin (the pituitary hormone that stimulates lactation) effectively block the abortion response. Lactation may have had some inhibitory effect. Thirty one percent of the experimental animals did deliver young sired by the stud male. But when this is compared with the 77% delivery in control animals and 87% in the normal breeding colony, it is clear that the inhibition was minimal. Abortion and remating occurred in 62% of the experimental animals that delivered young conceived on post partum days 4-21. They were housed with strange males during that time and could only have delivered young sired by these strange males.

The abortion response induced by strange males in

inexperienced pine voles confirms reports previously published. We believe, however, that this paper constitutes the first report of an abortion response induced by unfamiliar males in experienced pregnant and lactating voles.

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