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BRIEF NOTE

ABSENCE OF THE WHITTEN EFFECT IN CERTAIN INBRED STRAINS OF MICE

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Abstract

Strain differences in the Whitten effect were examined among six inbred strains of mice, NC, KK, DDK, SS, RR and DDY. Two or 3 virgin female mice caged together with a litter brother at 50-80 days of age examined for copulation every morning for a week. The Whitten effect was evident in the NC, KK and SS strains, copulation rates increased greatly on the 3rd night. By contrast, DDK and RR strains showed no such effect, while DDY females exhibited the higher copulation rate on the 1st night. These findings appear to show wide differences in manifestation of the Whitten effect by female mice among different strains.

INTRODUCTION

Smell is a potent factor involved in mammalian social life. In female mice, olfactory stimulus may cause significant modifications in the reproductive cycle. van der Lee and Boot[13] reported that groping together of female mice leads to mutual disturbance of the estrous cycles by intervention of spontaneous pseudopregnancy if the groups are small (Lee-Boot effect). Whitten[9,10,11] also showed syncronization of estrous cycles in response to stimuli associated with male (Whitten effect). On the other hand, if a newly mated female mouse is removed from the stud male and exposed to strange or alien males within 4 days after mating, pregnancy is blocked to a large extent[1,2] (Bruce effect). In further experiment, strain differences in Bruce effect and related phenomena were demonstrated[3,4,5,6,7,8,14], suggesting that spectra of odorous substances from males or the sensitivity of females to olfactory stimuli caused by strange or alien males differ among different strains. The present studies were undertaken to examine strain differences in the Whitten effect among several inbred strains of mice.

MATERIALS AND METHODS

Six inbred mouse strains, NC, KK, DDK, SS, RR and DDY, were used in these studies. All these strains were established in Japan and maintained

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in the Division of Laboratory Animal Science, National Institute of Animal Health, Japan (Jah). Animals from the Jah colonies were housed in a temperature-controlled room (23–27°C) and fed Oriental Laboratory Chow (Oriental Yeast Co. Ltd., Tokyo) and water *ad libitum*. From 21 (weaning) up to 50–80 days of age, 3–6 females were kept together in separate alminum cages, $20 \times 30 \times 10$ cm, when the number of females were reduced to 2 or 3 per cage and a litter brother was introduced. The cages were bedded with clean wood shavings. Copulations were checked by the presence of vaginal plug every morning for a week. Daily and cumulative copulation rates in each strain were calculated and strain differences were statistically tested by X^2-test.

RESULTS

Daily and cumulative copulation rates in a week in each strain are presented in Table 1. Cumulative copulation rates within a week varied considerably among different strains, from 48.4% in the DDK strain to 85.3% in the NC strain. And strain differences were statistically significant as shown in Table 1. Daily copulation rates (Table 1 and Fig. 1) were low in the NC, KK and SS strains on the 1st night, but were much higher on the 3rd night, amounting to 36.0% in NC, 37.2% in KK and 35.2% in SS strain. By contrast, in the RR and DDK strains no peak of rates occurred on the 3rd night. In these two strains, daily copulation rates remained low, being 11.5% and 11.3%, respectively, on the 3rd night. Thus, the Whitten effect was not manifested by the females. In the DDY strain 29.6% of females mated on the 1st night after introduction of male and no further peak of daily copulation rate appeared afterwards.

TABLE 1. Daily and cummulative copulation rates in a week in females of six inbred strains of mice

Strain	N	Copulation Rate (%)							Cum-mulated
		1st	2nd	3rd	4th	5th	6th	7th	
NC	75	13.3	9.3	36.0	14.6	2.6	6.6	2.6	85.3
KK	59	8.4	8.4	37.2	16.9	0.0	1.6	3.3	76.2
DDK	291	12.7	4.7	11.3	8.2	5.8	3.0	2.4	48.4
SS	68	11.7	16.1	35.2	7.3	2.9	2.9	1.4	75.0
DDY	341	29.6	4.9	9.6	6.4	4.1	5.8	6.4	67.2
RR	69	7.2	7.2	11.5	14.4	2.8	5.7	5.7	55.0
X^2-value		47.4**	1.4*	75.1**	1.3*	5.3*	4.6*	8.4*	55.1**

**: $p < 0.001$, *: $0.1 < p$ (df=5)

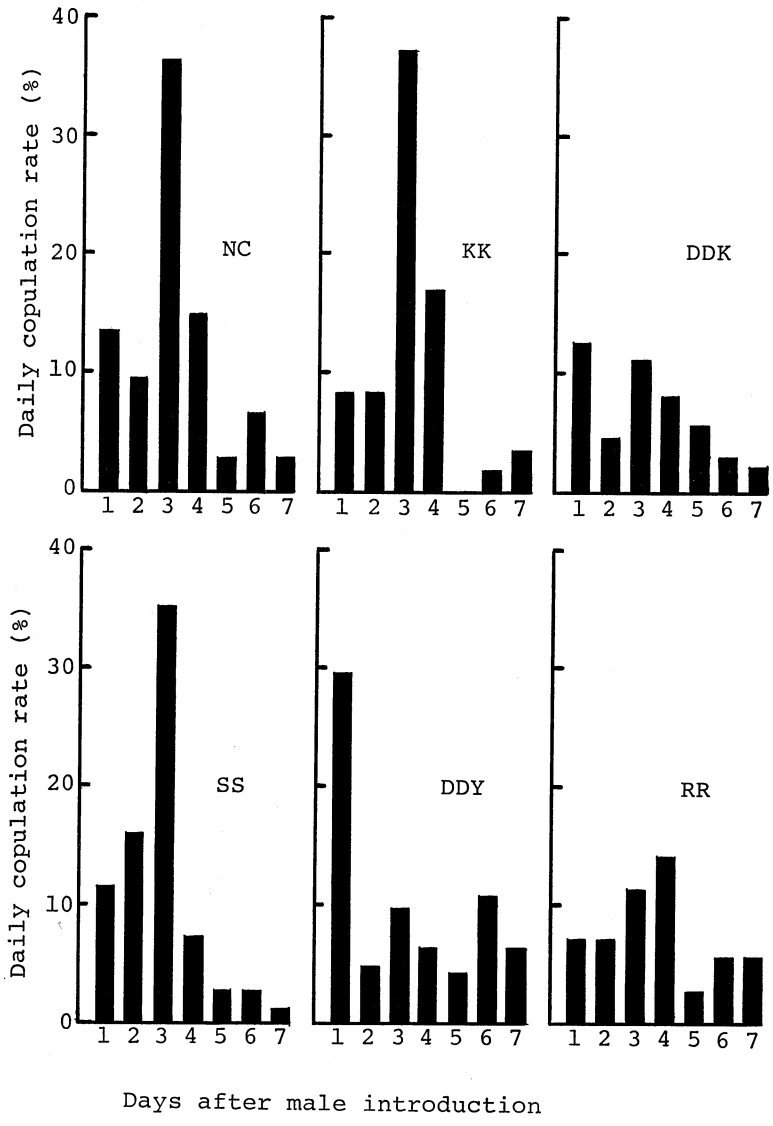

Fig. 1. Percentage of mice mating on each of 7 days after male introduction in 6 inbred mouse strains.

DISCUSSION

In unmated female mice estrus regularly occurs every 4–6 days if not phenomonically affected[1,2,9,10,11,13]. Whitten[9,10] pointed out syncronization of estrous cycles in a group of female mice exposed to pheromonic stimuli from

male (Whitten effect). In the present study, the Whitten effect was observed in the NC, KK and SS strains. More than 35% females mated on the 3rd night after introduction of a male. In the RR and DDK strains, however, the Whitten effect was not observed. Further more, in the DDY strain, 29.6% females mated on the 1st night, and no later peak took place.

These findings indicate significant strain differences in manifestation of the Whitten effect, in agreement with those of Krzanowska[8] and Whitten[12].

Strain differences in the Bruce effect were also reported by Bruce[3], Godowicz[4,5,6], Whitten[12] and Furutate *et al.*[7]. Zarrow *et al.*[14] recently reported marked strain differences in pheromornal facilitation of PMS-induced ovulation in mice, and suggested a strong genetic influence.

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