COMPLEX CBWA MOUSE HYBRIDS: A NEW MODEL FOR MEDICAL AND BIOLOGICAL RESEARCH

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Data on the biological features of tetrahybrid CBWA mice are given. These mice have a stable range of genetic variation, increased viability, high fertility, a low range of variation for various characters, and also a low embryonic mortality.

Genetically uncontrolled noninbred animals with increased viability, and sometimes with greater phenotypic equality than inbred animals, are used at the present time for some research purposes [4, 6].

Heterozygous animals with properties of this type, but with a stable range of genetic variation, can be obtained by crossing animals of several inbred lines with each other. Mouse populations of this type are used for medical and biological research in the West [5]. For instance, for his radiation experiments, Green [7] used a genetically heterogeneous population obtained by crossing four strains of mice: C57BL/6, BALB/c, DBA/2, and C3HeB/Fe. Complex hybrids (tetrahybrids) have been obtained at the laboratory of Experimental Biological Models, Academy of Medical Sciences of the USSR, by crossing mice of strains BALB/c, C57BL/6, CC57W, and A/SnCBWa [1]. The tetrahybrids can be regarded as the first generation of an artificial model population whose genetic variation is determined by the different genotypes of the strains used [10] and the preservation of its range of genetic variation is guaranteed by the breeding method.

Details of the biological characteristics of the tetrahybrid CBWA mice are given below. Their breeding has begun at the central nursery in accordance with the scheme suggested in [1], but with replacement of the pigmented strain C57BL/6 by the nonpigmented congeneic strain B10.CW.

EXPERIMENTAL

The investigation was carried out in the "Kryukovo" division of the Central Nursery, Academy of Medical Sciences of the USSR. The following lines were used to obtain the CBWA hybrids: CC57W (abbreviated to W), F68, genotype H-2^b, aa bb cc; BALB/c, (abbreviation C), F125, H-2^d, bb cc AA; A/Sn (abbreviation A), F58, H-2^a, aa bb cc; B10.CW (abbreviation BN), 9F2, H-2^b, aa BB cc.

The scheme of crossing was as follows:

P_2	♀BALB/c × ♂B10. CW	♀ CC57W × ♂A/Sn
P_1	♀ F_1 (CB) ↓	× ↓ ♂F_1 (WA)
F_1		♀ + ♂ F_1 (CBWA)

Fertility was determined individually from each CB/F_1 × WA/F_1 pair during three matings. The animals were weighed at the ages of 21, 40, and 56 days and their body size was measured at the age of 56 days. The color genotype of 100 CBWA females, crossed with DBA/1 males (aa bb dd), was estimated from the phenotype of the progeny from each female individually.

To estimate the biological reproductive potency, 50 pregnant CBWA females in the first pregnancy were autopsied on the 16th-17th day after fertilization.

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TABLE 1. Body Weight and Size of CBWA Hybrids

Age (in days)	Females				Males			
	No. of mice	mean weight	σ	CV	No. of mice	mean weight	σ	CV
21	108	9,39±0,13	1,33	14,16	100	10,8±0,14	1,37	12,68
40	141	19,83±0,13	1,63	8,21	137	22,04±0,17	2	8,92
56	135	21,5±0,13	1,63	7,57	137	26,06±0,19	2,33	8,93
Length (cm)								
Length								
of trunk.	135	16,95±0,01	0,66	3,89	137	17,51±0,06	0,7	3,99
of tail	135	8,24±0,04	0,47	5,7	137	8,54±0,04	0,52	6,08

Legend: σ) Standard deviation; CV) coefficients of variation (in percent.

EXPERIMENTAL RESULTS

Fertility. The mean size of the litter obtained by crossing double hybrid CB females with WA males was 10.5 ± 0.17 mice, and the number surviving until removal from the mother was 9.8 ± 0.4 (91.2% of the number born). The female-to-male ratio was that expected from a 1 : 1 segregation ($0.50 > P > 0.20$). This high fertility and the increased viability until the time of removal from the mother are the main arguments which justify breeding the tetrahybrids from an economic point of view.

If necessary the tetrahybrids can be reproduced over a limited number of generations without significant loss of heterozygosity. Loss of heterozygosity and, correspondingly, the permissible number of generations depend on the number of animals reproducing [5]. The figures for the biological reproductive potency show that CBWA mice possess high biological fertility. The mean number of embryos per female is 9.44±0.3 and the mean number of corpora lutea 10.44±0.19. The extremely low level of embryonic mortality will be noted, both before (1.8%) and after implantation (4.3%), indicating a high level of heterozygosity in the hybrid females and embryos obtained by this cross. The preimplantation mortality is much lower than that of noninbred mice, and the postimplantation mortality is almost the same [2]. The level of embryonic mortality in the tetrahybrids is also much lower than in the inbred mice [8].

Color Genotypes. CBWA mice have a white fur. However, considering the genotypes of the original strains [10], segregation for two color genes A and B was expected. The CBWA hybrids ought to have four color genotypes in the ratio 1 Aa Bb cc : 1 aa bb cc : 1 aa Bb cc : 1 Aa bb cc. On the one hand, the theoretically expected calculations were confirmed, i.e., the CBWA mice had four color genotypes. On the other hand, a deviation was observed ($P < 0.01$) from the theoretically expected segregation, namely: 21 AaBb cc : 37 aa bb cc : 15 aa Bb cc : 19 Aa bb cc, with the predominant genotype aa bb cc. The reasons for this result are not yet clear and will be investigated further.

Body Weight and Size. The data for the body weight and size are given in Table 1. No positive correlation was found in these investigations between the size of litter and the body weight ($z = -0.01$).

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