Genet. Res., Camb. (1981), **38**, *pp.* 93–95
With 1 *text-figures*
Printed in Great Britain

SHORT PAPERS

The genetics of tasting in mice. I. Sucrose octaacetate

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(*Received* 21 *May* 1980 *and in revised form* 18 *December* 1980)

SUMMARY

Thirty-one inbred strains were tested for their reaction to drinking water which contained a low concentration (10^{-4} M) of sucrose octaacetate (SOA). One strain, SWR, showed a strong aversion to drinking the SOA solution. The other thirty strains, and two samples of wild-derived mice, tended to prefer the SOA solution to untreated drinking water. The phenotypic difference between SWR and the other strains was shown to be determined by an autosomal gene. The allele present in SWR is dominant. The gene is not closely linked to jerker (*je*), pearl (*pe*) or waved-2 (*wa-2*).

1. INTRODUCTION

Ten years ago Warren and Lewis (1970) reported that mice of strain CFW/NIH showed a strong aversion to drinking water which contained low concentrations (10^{-3} to 10^{-6} M) of the bitter-tasting substance sucrose octaacetate (SOA). On the other hand, strains C57L/NIH, C57BL/6NIH and C3Hf/HeNIH showed no such aversion and were presumed to be non-tasters of this substance. Warren and Lewis found that the difference in tasting ability was determined by a single autosomal gene with the 'taster' allele dominant. I can trace no further publication on this gene, nor does it appear in the Mouse News Letter Gene List. In order to confirm and extend the results of Warren and Lewis I have tested thirty-one laboratory strains and two samples from wild populations, using the same experimental procedure as these authors.

2. MATERIALS AND METHODS

The strains came from the following sources: AKR, AU/SsJ, A2G, BDP/J, CE/J, C3H/He, C57L, C58, DBA/1, NMRI, NZB, NZW, SEA/GrJ, SWR, 129/RrJ (from MRC Laboratory Animals Centre, Carshalton); BALB/cPas, C57BL/6Pas, DBA/2, 129/Sv (Pasteur Institute, Paris): Simpson (Kennedy Institute, London); SM/J (Animal Breeding Research Organisation, Edinburgh); Is/Cam, CBA/Ca (Department of Genetics, Cambridge); C57BL/10ScSn (Imperial Cancer Research Fund, London); P/J, ST/bJ, C57BL/By, BALB/cBy (Jackson Laboratory, Maine); CFW (Department of Physiology, Birmingham University); C57BL/Gr, BALB/cGr (this laboratory). Seven Peru-Coppock and five recently-caught wild mice from Caithness were also tested. The linkage-testing strain L*VC* came from the MRC Radiobiology Unit, Harwell.

Between two and six mice from each inbred strain were tested. CFW, Peru-Coppock and Caithness mice were tested individually, but when testing other inbred strains there seemed to be no reason why several mice should not be tested together in one cage. Each cage therefore contained between one and six mice. Both sexes were used. Two metal drinking spouts were introduced through the wire top of each cage. One spout was connected to a burette containing tap water, and the other to a burette containing 10^{-4} M SOA in tap water. In practice it was found convenient to first dissolve the solid SOA in a small volume of ethanol (68 mg SOA in 4 ml ethanol) and then dilute this with tap water to a final volume of 1 l. The same concentration of ethanol was therefore included in the control tap water supplied from the other burette so that the choice between them would be made solely on the basis of the SOA. The positions and contents of the burette-spout units on each cage were rotated over a four-day period as described by Warren and Lewis. The degree of aversion to SOA was given by the amount of SOA solution consumed when expressed as a percentage of the total fluid intake, averaged over the four days of the test.

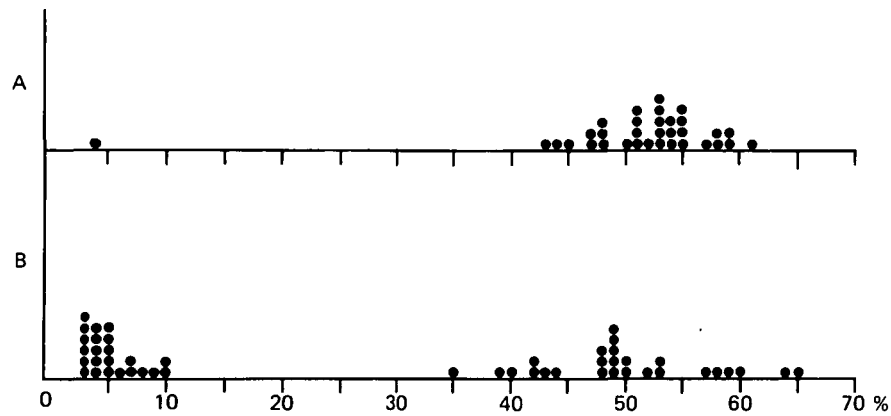

Fig. 1. SOA consumption by (A) thirty-one inbred strains and two samples from wild populations. Each symbol is the mean of between two and six mice. (B) forty-nine backcross offspring. Each symbol is one mouse.

3. RESULTS AND DISCUSSION

The result of the survey of strains is shown in Fig. 1 A. SWR was the only strain to show an aversion to drinking SOA. Six cages (14 mice) of SWR mice were tested and the results ranged from 1·1 to 10·3 with a mean of 3·6. The behaviour of the SWR mice when attempting to drink from an SOA-containing spout clearly indicated that they found the taste unpleasant. The means of each of the other thirty strains, and of the two wild populations, formed a unimodal group around a mean of 52·3. This group therefore shows a slight but significant ($t = 2{\cdot}95$, $P < 0{\cdot}01$) preference for SOA at this concentration. Perhaps they can detect a very slight degree of bitterness which is pleasurable in the same way that the quinine added to some soft drinks is agreeable to human taste buds. Warren (1963) has shown the same effect with some NIH/N mice, which were classified as tasters because they avoided SOA at 10^{-5} M but which showed a preference for it at 10^{-7} M.

None of the wild mice or the CFW mice were tasters. This latter result seems to conflict with the results of Warren and Lewis. However Staats (1970) states that 'There

are several inbred CFW lines. They should not be assumed to be identical without testing.' Warren and Lewis also found that a group of 10 North American wild mice included some tasters. A study of the dimorphism in other wild populations might be of interest.

In order to confirm the monogenic inheritance of this character SWR females were crossed with males from the linkage-testing strain L*V*C. These L*V*C males were all non-tasters. The three male and four female F_1 offspring were all tasters. F_1 females were then backcrossed to the L*V*C males, and their forty-nine offspring were found to fall into two groups, twenty-three tasters and twenty-six non-tasters (Fig. 1B). The mean values were 5·2 for the tasters and 49·8 for the non-tasters. These results confirm that virtually all the phenotypic difference between SWR and the other strains is accounted for by a single autosomal gene with the taster allele dominant. The L*V*C strain is homozygous for the recessive genes jerker (Chr. 4), waved-2 (Chr. 11) and pearl (Chr. 13). In the backcross offspring no linkage was detected between any of these genes and the SOA tasting gene.

I have suggested elsewhere (Lush, in press) that the symbol *Soa* would seem to be appropriate for this gene, with Soa^a (aversion) and Soa^b for the alleles present in SWR and the other strains respectively. Clearly the Soa^a allele is rather rare among inbred strains. However its presence in the widely-used SWR strain means that it is now obtainable for linkage or other studies.

I am grateful to Dr A. Davis, University of Birmingham, for sending me the CFW mice and to Miss Isobel Baker and Miss Sally Gray for technical assistance.

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