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Sampsell, B.<sup>1</sup> and B. Latham.<sup>2</sup> 1-Roswell Park Memorial Institute, Buffalo, New York USNA. 2-Chicago State University, Illinois USNA. Survival of ADH thermo-stability variants on naturally-occurring alcohols.

Wild *Drosophila melanogaster* probably feed and breed on a variety of fermenting fruits and other substances derived from human activities. Examination of the alcohol content of several rotting fruits showed that ethanol was the most common alcohol present with concentrations ranging up to 4%, while 1-propanol and 2-propanol occurred in concentrations of 1% or usually

less (McKechnie & Morgan 1982). Ethanol concentrations as high as 12% were observed in certain portions of a pile of grape residues outside a winery (McKenzie & McKechnie 1979). We have measured the ability of flies with various Adh genotypes to survive on several alcohols presented singly and in combination over a range of concentrations.

Alcohol tolerance was measured using a modification of the method of Starmer et al. (1977). Newly-emerging adults were collected from uncrowded breeding vials and transferred to fresh food vials to age for 7 days. The flies were then lightly etherized and groups of 20 males or females selected. They were returned to an empty vial for 4 hours to recover from the ether. They were then transferred to a 35 ml food vial, empty except for a 1-inch square of filter paper on which 0.1 ml of an alcohol solution of the indicated concentration (v/v) had been absorbed. From this point on in the experiment, this alcohol solution served as the sole source of nourishment and moisture. It should also be noted that flies were exposed to the alcohol by inhalation as well as ingestion. The vials were covered with parafilm, and observations were made at regular intervals to count the number of dead flies. After more than 50% of the flies in a given vial had succumbed, the number of hours to 50% mortality was determined by interpolation between observed points. Each point in the graphs represents the average of 6 vials (3 of males and 3 of females). Females generally lived somewhat longer than males; a fact that is probably the result of their larger body size and hence greater store of food. Three strains of flies, each homozygous for one of the three common alleles, were tested. The strains were Sf 1 (Adh-Fr), Ore (Adh-Fm), and SSS (Adh-Sm). Information about these strains may be found in Sampsell & Steward (1983). All tests were conducted at room temperature.

As previously reported, certain alcohols can serve as nutrients for the flies prolonging their life beyond that possible on plain water. In the case of ethanol, survival peaks occurred at 4-8%; however, survival time decreased sharply at concentrations above this level. On 1-propanol, the survival peak was seen at much lower concentrations of only 0.5 to 1%. Either this alcohol offers less nutritive benefit than ethanol or higher concentrations are more toxic. Survival on a combination of the two alcohols suggested that the latter explanation is probably correct. When ethanol and 1-propanol were both present in a 10:1 ratio, survival times peaked in the 2-4% ethanol range. 2-propanol was apparently even more toxic, since on this alcohol alone, flies did not survive longer than on plain water. Presented in combination with ethanol, 2-propanol's toxic effect was again apparent from the fact that peak survival occurred at around 4% ethanol. Finally when all three alcohols were present (with ethanol concentrations 10X that of either of the other two alcohols) a peak in hours to 50% mortality occurred at 2% for all three strains. The most interesting thing about these findings is the fact that the alcohol concentrations at which longest survival times were observed are very similar to those observed in natural food sources.

Comparisons among the strains for differential survival times were hampered by the small sample sizes, but several conclusions can be drawn. Based on measurements of ADH activity levels in which Ore > Sf 1 > SSS, we might have expected survival times to parallel these differences. In fact, SSS (Adh-Sm) flies generally had shorter survival times when there were any significant differences among the strains. Sf 1 (Adh-Fr) survival times, however, were generally equal to or longer than those of Ore (Adh-Fm). The Adh-Fr allele occurs in most natural populations, but only at low frequencies (1-16%). Flies with this allele, however, do not seem to have impaired alcohol tolerance compared to individuals with

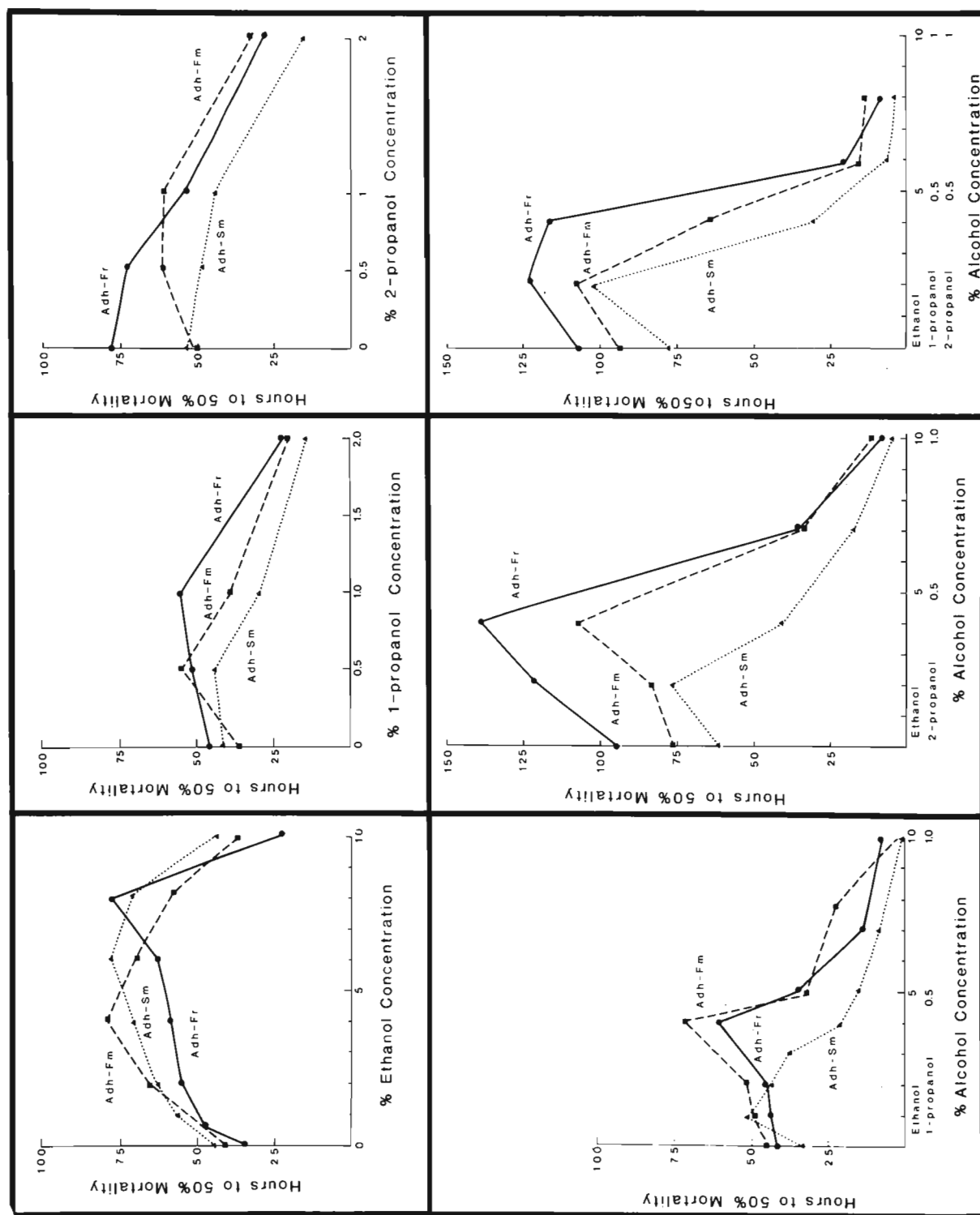


Figure 1. Survival of flies with different *Adh* genotypes on various combinations of naturally-occurring alcohols.

either of the more common forms, at least under the conditions tested. Explanation of the frequency of this ubiquitous, but uncommon, allele awaits further experimentation. (Supported by NIH Grant RR-08043-10)

References: McKechnie, S.W. & P. Morgan 1982, *Aust. J. Biol. Sci.* 35:85-93; McKenzie, J.A. & S.W. McKechnie 1979, *Oecologia* 40:299-309; Sampsel, B. & E. Steward 1983, *Biochem. Genet.* 21: 1071-1088; Starmer, W.T., W.B. Heed & E.S. Rockwood-Sluss 1977, *Proc. Natl. Acad. Sci. USA* 74:387-391.