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Oviposition site preferences by *D. melanogaster* and *D. simulans* related to acetic acid concentrations.

Drosophila melanogaster and *D. simulans* encounter in their natural environment not only ethanol, but its oxidation product acetic acid as well (Hageman *et al.*, 1990; McKenzie and McKechnie, 1979). The significance of acetic acid for both *Drosophila* species has not been examined like ethanol. Three strains of *D. melanogaster*, homozygous for Adh^F (FFN), Adh^S (SSN) and *b* Adh^{n4}, and a *D. simulans* strain (Eisses and Den Boer, 1995) were used in oviposition site preference experiments. Multiple choice discs with 18 holes gave the possibility to present a number of patches with similar and different food conditions simultaneously (Eisses, 1991, 1997; Eisses and Bets, 1992). Two-way, three-way and multiple choice experiments have been performed with various combinations of concentrations of acetic acid, supplemented to standard medium. The experiments with *D. melanogaster* and *D. simulans* were on separate days, but all combinations of concentrations have been tested simultaneously and in duplicate. Flies from at least ten population bottles were collected, randomized, and distributed over the discs in approximately equal numbers, without anesthetizing the flies. The numbers of females per disc were counted after the experiment. Approximately 40 females per disc oviposited for about 2-4 hours.

Figure 1 shows the results of multiple concentration choice experiments. Experiment 1 lasted for 3.5 h with an egg production of 1.6 eggs/FFN fly/h and 2.1 eggs/SSN fly/h, whereas experiment 2 lasted for 2.5 h because of a higher egg production with 4.3 eggs/FFN fly/h and 4.6 eggs/SSN fly/h. In both experiments the oviposition preference of FFN females was more skewed to the lower concentrations than the oviposition preference of SSN females.

In three-way choice experiments, SSN and FFN flies choose in a different mode much more obviously (Figure 2). Again a much higher fraction of FFN eggs (33.4 and 54.2%, respectively) compared with SSN eggs (6.6 and 11.7%, respectively) were oviposited on non-supplemented medium in the two combinations of concentrations. In both cases SSN flies laid by far the majority of eggs (84.3 and 53.6%, respectively) on the highest concentrations of acetic acid supplemented medium (3 and 5% (v/v), respectively). FFN females deposited only 11.1% of the eggs on 5% (v/v) acetic acid supplemented medium.

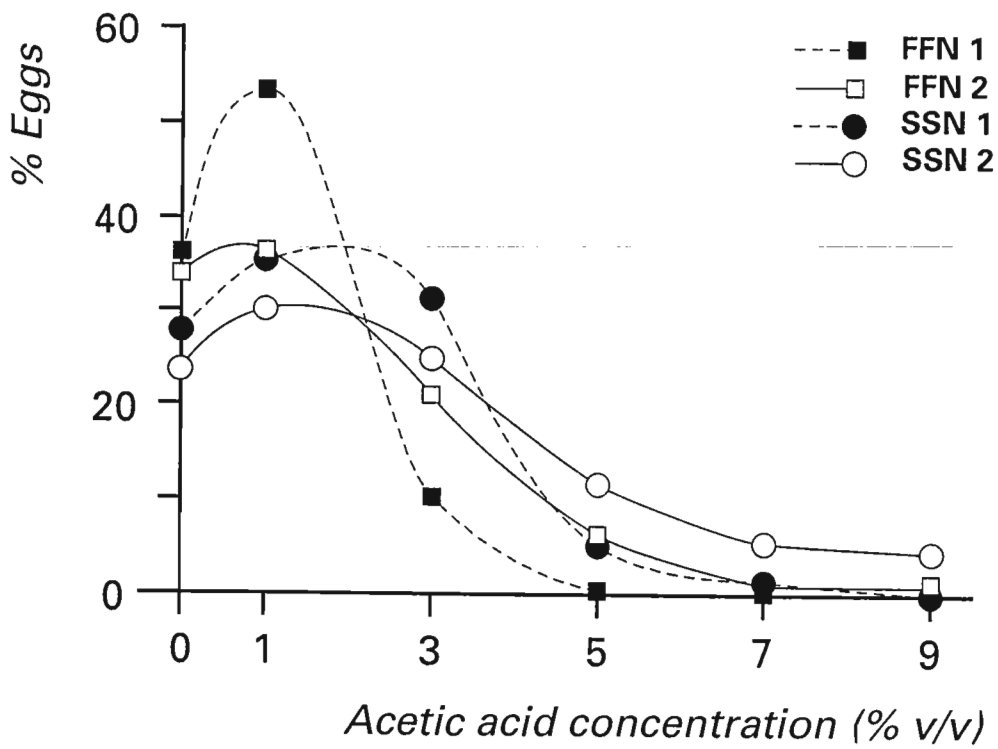

Figure 1. Oviposition site preferences of *D. melanogaster* strains, homozygous for Adh^F (FFN) and Adh^S (SSN) toward a range of acetic acid concentrations. The data are presented as fractions of the total number of eggs per experiment. Experiments 1 and 2 lasted 2.5 and 3.5 hr, respectively.

D. simulans showed yet another type of oviposition behavior. In two-way choice tests with standard medium and acetic acid supplemented medium the preference for 1% (v/v) acetic acid was much larger than for 3% (v/v). In a three-way test the presence of

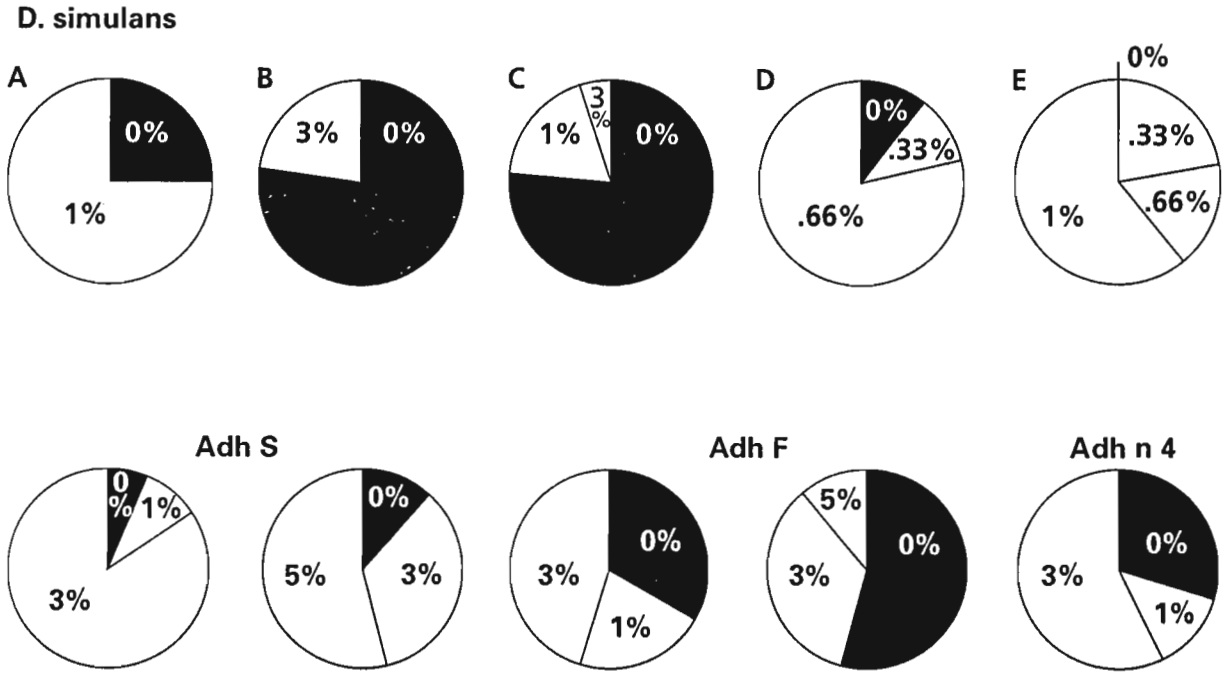

Figure 2. Oviposition site preferences of *D. simulans* and *D. melanogaster* strains, homozygous for Adh^F (FFN), Adh^S (SSN) and *b* Adh^{n4}, in two-way and three-way choice experiments with various combinations of concentrations of acetic acid, supplemented to standard medium.

patches with 3% (v/v) acetic acid negatively influenced the choice of patches containing 1% (v/v) acetic acid (compare Figure 2C with Figure 2A). In a concentration range below 1% (v/v), 78% of the eggs were laid on medium patches supplemented with 0.66% (v/v) acetic acid (Figure 2D).

Our *D. melanogaster* strains, homozygous for different *Adh* alleles, and *D. simulans* showed different adult tolerances toward acetic acid (Eisses and Den Boer, 1995), as has been shown before with other strains (McKenzie and McKechnie, 1979; Parsons, 1982). The same pattern has been repeated in the oviposition site preferences toward various concentrations of acetic acid. This phenomenon could indicate that flies search for oviposition sites they are pre-adapted for. Although flies prefer to lay eggs in medium patches consisting of acetic acid, newly-hatched larvae tried to escape these patches in a multiple choice situation and crawled into ethanol supplemented patches or into patches with standard medium (Eisses and Bets, 1992). The multiple choice situation probably mimics the situation in decaying fruit with inverse gradients of acetic acid and ethanol, respectively, perpendicular to the surface of the pile of rotting grapes (McKenzie and McKechnie, 1979).

References: Eisses, K.Th., 1991, Dros. Inf. Serv. 70: 241-242; Eisses, K. Th., 1997, Behav. Genet. 27(3) (in press); Eisses, K.Th., and P. Bets 1992, Dros. Inf. Serv. 71: 188-189; Eisses, K.Th., and A.A. den Boer 1995, J. Evol. Biol. 8: 481-491; Hageman, J., K.Th. Eisses, P.J.M. Jacobs, and W. Scharloo 1990, Evolution 44: 447-454; McKenzie, J.A., and S.W. McKechnie 1979, Oecologia 40: 299-309; Parsons, P.A., 1982, Aust. J. Zool. 30: 427-433.

Weisman, Natalya Ya, and Ilya K. Zakharov. Institute of Cytology and Genetics, Russian Academy of Science, Siberian Division, Novosibirsk, 630090, Russia. Penetration of a new minus allele isolated from a wild population of *Drosophila melanogaster*.

The presented research is part of a scientific program on localization and identification of mutants isolated from wild populations (Weisman *et al.*, 1995; Weisman and Zakharov, 1995).

Isolation of mutation. The visible mutation #89381 was found and isolated from the offspring of a *Drosophila melanogaster* female fertilized in nature, from Uman in 1989. Mutants often have reduced body. Bristles vary in number and size. The hairs are also truncated and thinned in comparison with the norm. Some individuals have reduced number of hairs and their disposition is