Takamura,T. & Y.Fuyama 1980, Behav.Genet. 10:105-120; Weisbrot, R.D. 1966, Genetics 53:427-435.

Sondergaard, L. University of Copenhagen, Denmark. Mating capacity of e/e and e/+ males under non-competitive conditions.

It is well-known that the mutant ebony (e) has several pleiotropic behavioural effects. Some of these have been thought to be the reason why the e gene, in contrast to most other mutant genes, stabilizes at a certain level in population cage experiments. One factor which is rarely considered is what one might call the "Don-Juan" factor, i.e., the number of females a male can mate within a given period. A male with a very efficient courtship could be at a selective disadvantage if he needs too long a recovery period after copulation compared to a male with a less effective courtship, but with a very short recovery period. To test the mating capacity, single unexperienced ♂♂ (12-24 hrs of age) were confined for 24 hrs with 12 one-week-old ♀♀ in light or complete darkness. e/e, e/+ and +/+ ♂♂ were mated with e/e; e/+ and +/+ ♀♀also to test the effect of the female genotype on male performance. Results are shown in Table 1. The overall tendency is that e/+ and +/+ ♂♂ perform better in light, whereas e/e ♂♂ perform equally well in light and darkness when mated to e/+ and e/e ♀♀. In the light the order of the D.J. factor is e/+ > e/e > +/+, indicating overdominance for this trait.

Table 1. D.J. factor ± s.d. (see text) for males confined for 24 hrs with 12 of the indicated genotype; experiments were performed in 24 hrs light and 24 hrs of darkness. In each experiment 75-100 were tested individually.

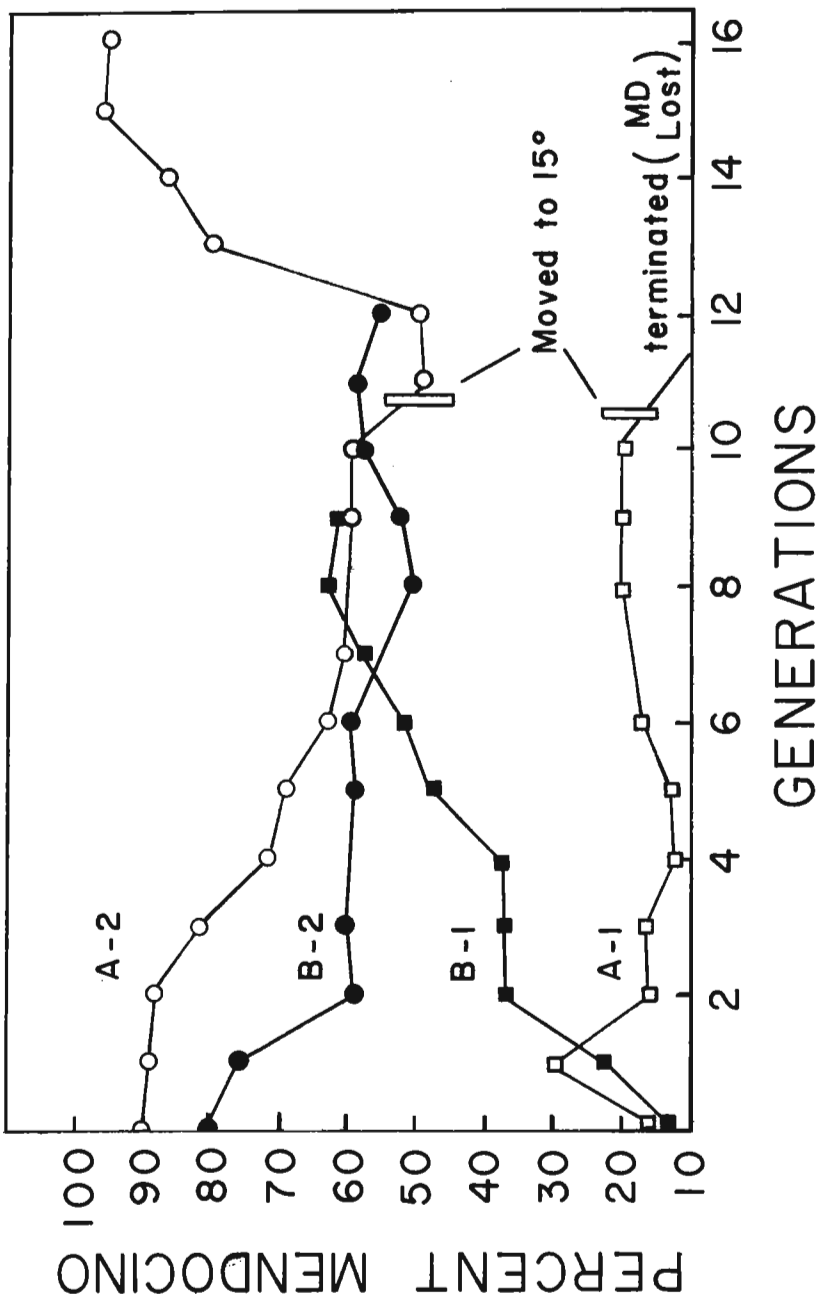
	darkness	light
+/+ ♀ x e/+ ♂	3.3±1.5	4.8±2.0
e/e ♀ x e/+ ♂	3.6±1.7	5.9±2.0
e/+ ♀ x e/+ ♂	3.4±1.9	5.7±2.4
+/+ ♀ x e/e ♂	2.9±1.3	3.7±1.9
e/e ♀ x e/e ♂	4.3±2.1	4.5±2.0
e/+ ♀ x e/e ♂	4.3±1.9	4.4±2.1
+/+ ♀ x +/+ ♂	1.8±1.1	2.4±1.6
e/e ♀ x +/+ ♂	2.5±1.3	3.1±1.5
e/+ ♀ x +/+ ♂	1.7±1.5	3.2±1.5

These observations are explainable by the fact that e/e flies are blind and that e/+ and e/e have a more efficient courtship behaviour (Kyriacou et al. 1978). However, this does not explain the observed differences between different females when tested to the same male genotype: in the light the scores are lower with +/+ ♀♀. In darkness the results are more complex: no differences were observed between ♀♀ mated to e/+ ♂♂; e/e ♂♂ show lower scores with +/+ ♀♀; +/+ ♂♂ have a higher mating frequency with e/e ♀♀. These differences could be explained by differences in female heat. A more possible explanation is a difference in the activity levels of both males and females. That is, increasing spontaneous activity in the order +/+; e/+; e/e. In the light +/+ ♀♀ do not move around as much and therefore rarely meet a male; in the darkness they move around even less. However, with e/+ males this is compensated for by the higher activity of these males also in the dark. In the experiment with +/+ ♂♂ sluggishness is only compensated for by the high activity of the e/e ♀♀ in darkness. In the dark the high activity of e/e ♂♂ compensates for differences between e/e ♀♀ and e/+ ♀♀ activity.

Reference: Kyriacou,C.P., B.Burnet & K.J.Connolly 1978, Anim.Behav. 26:1195.

Spiess, E.B. University of Illinois, Chicago, Illinois. Discrete generation populations of D.persimilis selected for female receptivity and frequencies of KL-MD karyotypes.

Population box experiments were designed in 1979 with selection for early maturation of females (D.persimilis) in order to substantiate the relative frequency changes expected of KL and MD arrangements that had been characterized for female "switch-on" of receptivity by Yu & Spiess (1978). Three strains of KL (4,11,17) with amylase variant amy-1.09 and 3 strains of MD (7,16,35) with amy-1.00 derived from a McDonald Ranch, CA, population were intercrossed within homokaryotypes and introduced into plastic refrigeration boxes ("Bennett cages") with 8 holes for as many food vials to provide oviposition area for 200 initial pairs of flies. Females were virgins of 1-2 days past eclosion while males were as old or slightly older. Initial frequencies were approximately 90%: 10% of either arrangement and four populations were monitored by electrophoresing a sample of



96 females each generation to ascertain the amy-variant as indicative of chromosomal arrangement frequency. In two of the populations (A-1, A-2), females that matured early and laid eggs within 2-3 days were favored, while in the other two (B-1, B-2) females were allowed 7-8 days for egg-laying at 25°. On the basis of the original study by Yu & Spiess (1978), it was expected that, if the KL and MD strains were going to perform with the average female time of receptivity known for the 19 kinlines we had characterized from the natural population, then the KL arrangement should increase relative to MD at 25° but reverse at cool (15°) temprature. Populations planned for 15° proved to have low productivity and long delays in female egg-laying so that they were abandoned after 2 generations; instead, we decided to transfer any population that plateaued at 25° into 15° later. From tests, low female receptivity of two strains (KL) out of the three used (reference this issue of DIS) indicated that their low performance was associated with factors included within the KL arrangement and that the expected performance of KL would be lower than the outcrossed KL typical of the remaining 17 kinlines. In Figure 1, frequencies of MD relative to KL indicate that indeed the MD arrangement has a higher equilibrium frequency than was expected. Populations that were allowed 7-8 days for egg-laying (B-1, B-2) converged on 60% MD, 40% KL within 6 generations. Of the other two populations (only 2-3 days for egg-laying the one with low KL (high MD), A-2, converged more slowly than the 7-8 day egg-laying population, B-2. The remaining (A-1) population did not change much from its original frequency, though initially it made a start in the same direction as its corresponding B-1 population. Thus, of the two selection regimes, the less restrictive (B) for time of mating and egg-laying indicated a balanced state slightly favoring the MD arrangement. The more restrictive (A) did not converge so that either fitnesses are frequency dependent in those populations or sampling error, particularly in A-1 could be responsible. Further resolution of this problem in the selection outcome for the A cages must await repeat experiments now being designed. It can be stated that selection regimes affecting limitation to maturation and egg-laying time do influence the arrangement changes.

With respect to influence of temperature, the A-2 population that had plateaued at 60% MD was transferred to 15° where the MD arrangement females were expected to have faster

receptivity than KL. Indeed MD rose rapidly to over 95% in 4 generations. Females were allowed 4-5 days for maturation and egg-laying at that temperature (time determined for fast maturation at 15° by Yu & Spiess 1978). Populations initiated at that temperature originally with strain hybrid flies had been so infertile as to be abandoned but this population had normal fertility until it was discarded after 5 generations. Thus flies bred in these conditions but at 25° did adjust to those conditions better than original strain hybrids were capable of doing.

Acknowledgements: The assistance of Lyn Guinsatao and Charles Wilke and support from NSF Grants DEB-7903259 and DEB-8113615 are gratefully acknowledged.

Reference: Yu,H.F. & E.B.Spiess 1978, Genetics 90:783-800.

Spiess,E.B. University of Illinois, Chicago, Illinois. Female receptivity and emergence of WT and ST karyotypes from the James Reserve population of D.persimilis.

New strains of D.persimilis were kindly sent to this laboratory in 1978 by Drs. John A. & Betty C. Moore (University of California, Riverside). These had been derived as 68 isofemale lines from a natural population at an elevation of 5400 ft near Mt. San Jacinto (James Reserve). They were uniquely characterized for this species by an unexpectedly high frequency of Standard (ST) arrangement of the third chromosome, nearly 80% in this population (Moore et al. 1979), with the Whitney arrangement (WT) second in frequency, and MD and KL third and fourth, respectively, but rare in this population. In contrast with the McDonald Ranch population, there have been no recorded seasonal cycles in relative frequencies of these arrangements at James Reserve (Moore et al. 1979).

Ten strains each of ST and WT were chosen to be made homokaryotypic and the amy variant identified. ST persimilis has the amy-1.00 variant generally, though in this population the amy-0.84 (slow allele typical of ST D.pseudoobscura) is found equally commonly. For contrast the WT arrangement is marked with amy-1.09. To analyze female receptivity association with chromosomal arrangements, we wished to simulate the karyotypes and genotypes of the wild population by testing female receptivity of the following combinations: (1) strain homokaryotype ST and WT females, (2) outcrossing the 10 strains of each arrangement simply by pairing strains (ST_1 x ST_2 ...ST_9 x ST_{10}) and the same for WT arrangement strains, followed by testing progeny (F_1) females, (3) outcrossing F_1 ST x F_1 WT to obtain heterokaryotypes, and (4) inbreeding the heterokaryotypes (ST_{1-2}/WT_{3-4}) to obtain and test females in 5 sets of segregating progenies (expected ratio of 1/4 ST: 1/2 WT/ST: 1/4 WT, identified by the amy variants). This design differs from that used by YU & Spiess (1978) in that control of the genetic background by marking the remaining principal autosomes was not done, but theoretically the genetic background by being uncontrolled would be sufficiently randomized to allow us to observe any control of female receptivity by the third chromosome arrangements (ST and WT), particularly in the segregating progeny of (4) above. All cultures were made both at 25° and 15° for consideration of temperature effects on female receptivity.

Table 1. Average percent females receptive from the James Reserve Population.

	25°			15°		
	WT/WT	WT/ST	ST/ST	WT/WT	WT/ST	ST/ST
Intrastrain	58.8	-----	74.6	72.1	-----	82.8
F_1 (strain hybrids)	59.9	-----	67.0	67.4	-----	69.5
Heterokar. from F_1 WT x F_1 ST	----	54.7	----	----	67.0	----
Segregating F_2	59.3	56.9	66.9	57.7	59.4	67.3
Segregating F_2 Emergence (Mating and Nonmating Females Pooled) Relative to Expected 1:2:1 Ratio (N=480 emerged at each temperature).	0.90	1.03	1.03	1.025	1.07	0.84

Flies cultured at 25° were tested for female receptivity when aged for 2 days posteclosion, while those cultured at 15° were tested when 4 days old (ages determined by Yu & Spiess for "switch on" of receptivity). Each test comprised 20 virgin females with 20 double-cross-hybrid KL males known to court intensely. For each strain or cross type, 5 repeats were run. Overall average female receptivity (% mating) for 3 karyotypes before and after crossing between strains and in F_2 progenies is given in Table 1 together with relative emergence