

About 0.7% of the F_1 paternal gametes irradiated with a dose of 3000R carried the expected centric autosomal translocations, all with the Y-chromosome. It appears that with the slightly higher dose of 3500R as many as 10% of the irradiated sperm carried CAYT, and that the increase in radiation dose caused also a steep increase in the frequency of many other chromosomal aberrations, that resulted in dominant lethality, thus allowing the recovery of only a few F_1 daughters.

Farmer, J.L. Brigham Young University, Provo, Utah USNA. Expression of ey in *Drosophila pseudoobscura*.

The eyeless mutation (ey) was found in a wild population by Bryant (1980). When I obtained the stock from the center at Austin, Texas, the penetrance of ey was extremely low compared to the value reported by Bryant (1980).

Since no other laboratory had the stock, I tried to increase the penetrance by selective breeding. Single-pair matings and close inbreeding of progeny did produce a few flies which were unilaterally eyeless, but when these progeny were interbred, they had a very low fertility and a stock could not be established. Backcrosses of the unilaterally eyeless flies with their wild-type sibs produced a few progeny with the same phenotype, but they also were infertile in crosses with each other.

In an attempt to overcome the infertility, I outcrossed the unilaterally eyeless flies with a vigorous wild-type stock which carried the TL inversion (obtained from W.W. Anderson). As expected, the F_1 was all wild-type and had a high fertility. (The fertility remained high through all succeeding generations.) Unexpectedly, the F_2 was also all wild-type. The F_3 produced a few eyeless flies (approx. 5%) from both single-pair matings and from mass matings.

After four generations of intensive selection and close inbreeding of only completely eyeless flies (no facets and no detectable pigment below the integument in the normal position of the eyes) penetrance was higher. At 25°C about 5 to 10% are completely eyeless, about 5 to 10% are nearly completely eyeless (ranging from a single facet to a small number of facets on one or both sides or patches of pigment beneath the integument without facets), with the remainder about equally divided between unilaterally eyeless flies (with the same range of expressivity noted above) and wild-type flies. The unilaterally eyeless flies have one eye that is morphologically completely normal except that in many flies the color is duller than wild-type, as though the drosopterins were reduced.

The eyeless phenotype seems to be due to a major gene with modifiers, although further crosses would have to be done to verify that hypothesis.

If eyeless flies are allowed to lay eggs for a short time in a bottle, their progeny eclose in the order: completely eyeless first, wild-type last, other phenotypes in between but strongly overlapping each of the first two phenotypes.

The penetrance of ey is greatly enhanced at 18°C, approaching 100% completely or nearly completely eyeless flies.

The ey stock called SHB-5 which is currently maintained at the Mid-America *Drosophila* Stock Center (Bowling Green) is the stock which I derived from the crosses described above.

Reference: Bryant, S.H. 1980, DIS 55:212.

Fogleman, J. University of Denver, Colorado USNA. The ability of cactophilic *Drosophila* to utilize soaked soil as larval substrates.

Both rearing records and aspiration records indicate a very high degree of host plant specificity among the cactophilic *Drosophila* of the Sonoran Desert (Fellows & Heed 1972) with little species overlap (Heed 1978).

Recently, investigations into the ecology of

D. mettleri have shown that it utilizes a greater variety of substrates than had been previously thought. In addition to its normal substrates of soil which has been soaked by saguaro or cardon rot exudate, *D. mettleri* can tolerate the alkaloids in senita cactus that have been shown to be toxic to all other species tested except the resident species, *D. pachea* (Kircher et al. 1967; Fogleman et al. 1982). Field experiments have demonstrated that *D. mettleri* will use soil which has been soaked with senita rot juice as a breeding substrate when available. *D. mettleri* has also been reared from organpipe soaked soil (Fogleman et al. 1981).

D. mettleri is a rather unusual *Drosophila* in that it is one of only two species that have been reported as utilizing soaked soils as breeding substrates. The other species, *D. heedi*, is found in a xeric region on the island of Hawaii (Kaneshiro et al. 1973). The closest relative to *D. mettleri* is *D. eremophila* which has been found associated with cactus (*Opuntia* pads) but never reared from them (Heed 1977). The similarity between *mettleri* and *eremophila* in both adult and larval morphology has led to the speculation that *eremophila* is also a soil breeder. The experiments reported here were designed to answer two questions: (1) can *D. eremophila* (like *mettleri*) utilize soaked soil as a larval substrate, and (2) do any of the other cactophilic *Drosophila* endemic to the Sonoran Desert (*nigrospiracula*, *mojavensis*, and *pachea*) possess the capability of utilizing soaked soil substrates.

Experiments were performed in plastic petri dishes (100 x 15 mm). Cactus and soaked soil substrates were produced as follows: frozen cactus tissue was thawed, homogenized in a blender, autoclaved, and inoculated with a suspension of 10 of the major cactophilic yeasts plus the bacterium, *Erwinia carnegieana*. After one week, petri plates were filled with 25gm of the necrotic tissue and the remainder was filtered to provide the juice used to soak soil samples. Forty grams of soaked soil per plate (15% moisture by weight) was approximately the same volume as 25gm of cactus. The weight of each substrate plate was recorded and maintained throughout the experiment by periodic addition of more juice. 100 first instar larvae (24 hr old) of one of the 5 *Drosophila* species were transferred to each plate (5 replicates/test except where noted). The results are shown in Table 1.

Table 1. Average viability (in percent \pm standard deviation) of five species of cactophilic *Drosophila*.

SUBSTRATE	NIGRO. ^{1,2}	METTLERI	DROSOPHILA SPECIES		
			EREM.	MOJ.	PACHEA
AGRIA	***	24.6 \pm 7.2	54.6 \pm 13.9	73.0 \pm 5.7	***
AGRIA SOIL	***	1.9 \pm 3.9	0.3 \pm 0.9	0.1 \pm 0.3	***
ORGANPIPE	***	71.8 \pm 8.1	76.8 \pm 6.5	77.2 \pm 13.0	***
ORGANPIPE SOIL	***	3.0 \pm 2.1	4.8 \pm 2.8	4.8 \pm 5.2	***
SAGUARO	68.4 \pm 9.8	78.0 \pm 4.1	76.4 \pm 7.2	---	***
SAGUARO SOIL	0.4 \pm 0.4	30.0 \pm 4.7	11.0 \pm 2.8	---	***
SENITA	***	15.8 \pm 3.5	-0-	***	71.4 \pm 6.0
SENITA SOIL	***	7.8 \pm 4.3	3.4 \pm 1.4	***	0.6 \pm 1.9 ¹

1= ten replications/test. 2= data from Fogleman et al. 1982.

--- = test not performed-viability unknown.

*** = test not performed-viability presumed to be zero based on previous studies.

From the data in this table, the average viability of a species in its typical cactus substrate is about 75%. Less than 5% viability can probably be considered a negative response. As such, it seems reasonable to conclude that *mojavensis*, *pachea*, and *nigrospiracula* cannot utilize soil which has been soaked by rot juice from their normal cactus host. Also, *agria* soaked soil appears to be a particularly inhospitable substrate. It is important to point out, however, that the viabilities measured in the soil substrates might be generally depressed, perhaps due to overcrowding. A previous report of the viability of *mettleri* in saguaro soil (lab experiments, 10 reps) was 57% (Fogleman et al. 1982) compared to the 30% measured here. In addition, *mettleri* has been reared from both *senita* soil and *organpipe* soil and yet the measured viabilities are very low. Therefore, conditions used in these experiments may have been more stringent than those in nature, and the data in Table 1 should be viewed as reflections rather than estimates of viabilities in natural substrates.

A two way ANOVA using arcsin transformed viability data of *mettleri* and *eremophila* on the various substrates showed that these two species are significantly different ($F=161.09$; $df=7.74$; $P<0.001$). A highly significant species x substrate interaction was also evident. Nevertheless, one can compare the mean viability of an individual species. e.g., *mettleri* or

eremophila, on one substrate to the mean viability of all species averaged over all soil substrates (excluding mettleri-saguaro soil and the individual case involved in the comparison). These comparisons indicate that the viabilities of mettleri in senita soil and eremophila in saguaro soil are significantly higher than the overall average viability in soils (mettleri: $F=4.683$; $df=1.13$; $P<0.05$ -- eremophila: $F=21.514$; $df=1.13$; $P<0.001$). This supports the statement that eremophila, like mettleri and unlike the rest of the cactophilic *Drosophila*, can use certain soaked soil substrates.

Substantiation of the use of soil substrates by eremophila could take the form of collections of soaked soils from under *Opuntia* and other cacti in areas of Mexico where eremophila is common and/or laboratory experiments which test the behavioral preference of eremophila for ovipositing on soaked soil versus cactus.

References: Fellows, D.P. & W.B.Heed 1972, *Ecology* 53:850-858; Fogleman, J.C., K.R. Hackbarth, & W.B.Heed 1981, *Am.Nat.* 118:541-548; Fogleman, J.C., H.W.Kircher, & W.B.Heed 1982, *Comp.Biochem.Physiol.* 71A:413-417; Heed, W.B. 1977, *Proc.Ent.Sco.Wash.* 79:649-654; Heed, W.B. 1978, pp109-126 in *Ecological Genetics: the interface* (P.F.Brussard, ed.) Springer-Verlag; Kaneshiro, K.Y., H.L.Carson, F.E.Clayton & W.B.Heed 1973, *Am.Nat.* 107:766-774; Kircher, H.W., W.B.Heed, J.S.Russell & J.Grove 1967, *J.Insect Physiol.* 13:1869-1874.

Gartner, L.P. University of Maryland, Baltimore, Maryland USNA. The effects of 4000 and 8000 R of X-irradiation on *Drosophila* life span.

Numerous studies have demonstrated that high doses of ionizing radiation have deleterious effects on *Drosophila* life span (see review: Ducoff 1975). Interestingly, the amount of radiation necessary for such effects vary among the various laboratories. Some studies, using

doses as high as 40 kR were unable to demonstrate life span shortening (Blair & Baxter 1970; Sonnenblick & Gartner 1967; Gartner 1973a; Westerman & Parsons 1972), while others, utilizing doses in the 20 kR range, reported considerable life span shortening (DeReggi 1975; Giess & Planel 1977). Still others claim that low and very low doses of radiation increased life span of *Drosophila* (Strehler 1959, 1962, 1964; Nothel, 1965; Lamb 1964, 1965), and these claims have been seriously questioned (Sonnenblick & Grodis 1963; Blair & Baxter 1970; Atlan, Miquel & Welch 1970). The purpose of the present investigation was to examine the effects of very low doses of X-irradiation on adult *Drosophila melanogaster*.

Oregon-R strain of *Drosophila melanogaster* was housed in a mass bred situation in pint sized milk bottles, on a corn meal-molasses-agar medium (Gartner 1973b), at 20°C. Experimental populations, derived from young parents, were placed in shell vials, five males and five females per vial. Flies were irradiated on the fourth day of imaginal life with 250 kVcp X-rays (15 mA, HVL-0.94mm Cu + 3mm Al) at 1332.5 R/min, for a total exposure of 0, 4000 and 8000 R. Subsequent to radiation, the flies were monitored daily, five days per week, and deaths were recorded by sex. Flies were transferred to fresh media on a weekly basis.

The results of the present investigation demonstrate that neither 4000 R nor 8000 R of X-irradiation have an appreciable effect on *Drosophila* imago life span. The unirradiated females of this report had a mean longevity of 90.5 days, while the irradiated females lived for 90.1 (4000 R) and 84.3 days (8000 R). Control males had a mean life span of 81.0 days, while their irradiated counterparts lived for 81.7 and 77.8 days, at 4000 R and 8000 R, respectively. Although females have a consistently longer average life span than males, the maximum length of life was the same for both sexes at all exposures.

Hence, the present study can offer no suggestions as to the prima cause of radiation induced life span prolongation, if indeed such exists. Instead, it must argue against any such life span lengthening effects, and must urge that further studies be initiated to investigate the matter to a greater extent by utilizing other insect species.

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References: Ducoff, H.S. 1975, *Exp.Gerontol.* 10:189; Blair, H. & R.Baxter 1970, *Radiat. Res.* 31:287; Sonnenblick, B. & L.Gartner 1967, *Radiat.Res.* 31:612; Gartner, L. 1973a, *Gerontologia* 19:295; Westerman, J. & P.Parsons 1972, *Int.J.Radiat.Biol.* 21:145; DeReggi, M.