

The Effect of Parental Age on the Duration of Life of Mated and Non-mated Progeny in *Drosophila melanogaster*

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Introduction

The effect of mating frequency and periods of mating on the life span of the individual has long been noted. In a previous study on parental age effects in *Drosophila melanogaster* Meig. (Oregon-R strain) it was observed that continually mating offspring from old parents had a shorter adult life span than those from young parents (8). The present investigation was undertaken to determine the effects of parental age, if any, on non-mating offspring in this species.

Methods

All cultures were maintained in an incubator at 25° C. Adults of various ages from these stocks were placed in fresh culture bottles and eggs were collected for a period of 24 hours. The adults which emerged during the first 24 hours from these eggs were young from parents of various ages. Eggs were collected from these young adults during the first 48 hours following their emergence. The adults which emerged during the first 10 hours from this collection were used to set up the parental generation. The age of the parents was calculated on the basis of zero days at the time of the first adult emergence. Eggs were collected from this parental stock when the flies, allowed to mate freely from emergence, were 0 to 2 and 30 days old to set up the groups offspring from young and from old parents. The duration of the preimaginal stages was observed and the adults which emerged during the first 10 hours were divided into two subgroups consisting of mated and non-mated individuals. In this manner the virginity of the offspring was insured.

The flies were transferred to fresh culture bottles every four days. To avoid overcrowding there were never more than 30 flies per half-pint milk bottle for the mated stocks and 25 for the non-mated stocks. During this experiment a cornmeal-molasses medium was used with Dovicide^(R) solution as a mold inhibitor.

Results and Discussion

Parental age had no effect on the duration of the preimaginal stages in *Drosophila melanogaster*. This observation is in agreement with previous studies in this species (1, 8). However, it was observed in the milkweed bug, *Oncopeltus fasciatus* (Dall.), that eggs laid by young and old parents required a longer developmental time than those laid by middle-aged parents (9). Studies on the mealworm, *Tenebrio molitor* L., have shown that parental age had no effect on adult longevity in individually housed offspring from isolated pairs of parents. However, larvae from young parents required a significantly longer time to complete development and had more molts than those from old parents

(5). In the dark mealworm, *Tenebrio obscurus* F., parental age had no consistent effects on the duration of the life cycle, but larvae from older parents seemed to have a slower rate of growth (3).

In Table 1 are shown the number of adult flies used and the average survival time for each subgroup at each parental age. Continually mated offspring from old parents had a significantly shorter adult life span than those from young parents, mated females from old parents showing a greater decrease in longevity when compared to that of the males. These studies are in agreement with similar work on the housefly *Musca domestica* L. and the vinegar fly *Drosophila melanogaster* where the offspring were allowed to mate freely from emergence (10, 4). However, this parental age effect on survival of continually mated offspring, derived from 30 day old parents, was not observed in *Drosophila subobscura* Col. through eight generations of selection (2). The present findings that non-mated individuals had a significantly longer adult life span than mated individuals is in agreement with the work on *Drosophila subobscura* where mated females had a lower life span than non-mated and ovariless females (7). However, in the present work mated males from young parents did not differ significantly from non-mated males. It was also noted in this study that there was no difference in the female and total survivals of non-mated individuals from young and old parents. However, non-mated males from old parents had a longer life span than those from young parents. Here selection in the males is in the opposite direction and the results are just statistically different. These observations are in agreement with other work in this species where mating was deferred in the offspring until the 21st day of adult life. The parental groups, obtained from at least five generations of selection from early and delayed matings, were mated immediately and at 21 days following eclosion. Offspring, in which mating was deferred, from continually mated parents 21 days old had a longer life span than from young parents. If the mating of the parents was delayed until the 21st day of adult life, there was no difference in the survival of these off-

TABLE 1. Average Survival Time (days) and Number of the Adult Flies. Values Are Given With the Standard Errors.

	Offspring from Young		Offspring from Old	
	Mated	Non-mated	Mated	Non-mated
Male	43.8 $\pm$ 0.94	43.2 $\pm$ 0.93	39.7 $\pm$ 0.70	46.2 $\pm$ 0.83
N	155	149	268	260
Female	41.5 $\pm$ 0.98	50.1 $\pm$ 1.29	33.5 $\pm$ 0.98	49.6 $\pm$ 0.96
N	116	137	131	170
Total	42.8 $\pm$ 0.68	46.5 $\pm$ 0.79	37.7 $\pm$ 0.57	47.5 $\pm$ 0.60
N	271	286	399	430

spring from young and old parents. There was no differentiation of sexes in this study (4). In both of these studies the offspring were reared in groups of 10 to 25 adults. In another work on this species, the parents were kept isolated and allowed to mate only 48 hours prior to the time of egg collection, $\frac{1}{2}$ to 35 days following eclosion, the offspring also being kept isolated. Isolated offspring from old parents had a shorter survival time than those from young parents, this effect being noted when the female parent was 15 days or older (1).

Further studies in *Drosophila melanogaster* have led to the conclusion that aging and thermal effects on the rate of aging may be due to an accumulation of inhibitors and/or the exhaustion of necessary metabolites (11). It has also been noted in *Drosophila subobscura* that mated females at higher temperatures lived longer than those at lower temperatures. This is not in contradiction with the observation that poikilotherms live longer at lower temperatures, since egg production in these females at higher temperatures is about half of that at lower temperatures and these adults are less taxed physiologically (7). Comparative studies on the physiology of offspring from young and old parents in *Tenebrio molitor* have led to the conclusion that concentrations of activating ions and enzyme activity may be associated with nutrition and thus responsible for the parental age effects (6). Thus, parental age may have an effect on the nature of the metabolites in the offspring, the mating regimes involved and population densities effecting the utilization of these metabolites with subsequent effects on survival. It would seem that the offspring of *Drosophila* may reflect the physiological state of the parents and further work will involve the study of the nature and utilization of these metabolites stored in the eggs and the physiological state of the parents at the time of egg production. This assumption seems to be correct, since present work has shown a parental age effect on egg production and hatchability in these offspring.

Summary

The effect of parental age on the survival of continually mated offspring in *Drosophila melanogaster* (Oregon strain R) was compared to that of non-mated offspring. The duration of the preimaginal stages was unaffected by parental age. Continuously mated offspring from young parents had a significantly longer adult life span than those from old parents. Non-mated individuals generally had a significantly longer life span than mated individuals, non-mated females having a significantly longer survival time than non-mated males. Parental age, in general, had no effect on the longevity of non-mated offspring. However, non-mated male offspring from old parents had a longer life span than those from young parents. The results indicate that only in mating individuals does the life span decrease with an increase in parental age.

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