

THE EFFECTS OF FORMALIN UPON DEVELOPMENT IN THE BAR-EYED RACE OF *DROSOPHILA MELANOGASTER*

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On June 18, 1936, fresh banana-agar-yeast food to which 5 c.c. of sorghum had been added was made and placed in 8 dram homeopathic vials. Fleishman's yeast was used. On the following day flies from Dr. Zeleny's stock H357B of the bar-eyed race of *Drosophila melanogaster* at the University of Illinois were transferred to it for egg-laying. On June 25 twelve virgins were secured from these vials. They were mated, one pair being placed in each of twelve vials. They were examined to see that they did not vary in somatic characteristics to any great extent from normal for this species. When imagoes emerged from these matings on July 6, 7, and 8, they were removed every 24 hours, those of the same age being put together in a vial.

When the flies were five days old, they were put in one-half pint urinalysis bottles covered with milk bottle caps on which food had been placed 48 hours before. Fifteen pairs were placed in each bottle. One teaspoonful of powdered lamp black was added to the food for the purpose of facilitating egg transfer. A few drops of acetic acid were added also to stimulate egg laying. The flies were placed in an incubator of type 2 made by the Chicago Surgical and Electric Company in a room in which the temperature is kept constant by steam coils and brine coils. The room temperature maintained was 25°C., varying not more than .5°C. at any time. The incubator temperature was 27°C. The flies were kept in the incubator two hours for egg laying. Two more egg laying periods of two hours length were conducted similarly.

Preliminary experiments indicated that the lethal amount of formalin for eggs is in the vicinity of 1.5 c.c. of formalin to 100 c.c. of water, in the food. It was decided to determine the effects of formalin in the food 80%, 60%, 40%, and 20% below the lethal amount for eggs on the somatic characteristics of the adults. During the periods of egg laying food was prepared containing the following proportions of formalin:

1.2 c.c. of formalin to 100 c.c. of water
 .9 c.c. of formalin to 100 c.c. of water
 .6 c.c. of formalin to 100 c.c. of water
 .3 c.c. of formalin to 100 c.c. of water

A control set was also prepared. Shell vials of 20 dram capacity were used. One set of 5 vials was used for each concentration of formalin. Twenty eggs were transferred to each vial by means of a dissecting needle, care being taken that the eggs being transferred to one set of vials came from one egg laying period. One hundred eggs were thus transferred to each set of vials having the same amount of formalin. These were kept in the temperature control room at a temperature of 25°C. The temperature did not vary more than a degree at any time.

The adults that emerged were preserved in 85% alcohol. The mean facet counts of the flies raised on food containing these different percentages of formalin and of those raised in the control set are given in table I. The eye facets were counted with a Leitz microscope with a number 4 ocular and a number 3 objective. The facet count of the flies raised in 80% of the lethal amount of formalin for eggs shows a definite drop in the number of eye facets. The number of flies that reached the adult stage, twelve, was too small to give conclusive evidence, however. The larvae, pupae, and adults appeared to be increasingly smaller as the amount of formalin was increased in the food.

Later the experiment was repeated for the purpose of determining the effects of the various amounts of formalin upon the length of the different stages of the life cycle. Observations were made hourly after the eggs were transferred until they had hatched, and also at the time of change from larva to pupa, and from pupa to adult. There seems to be little correlation between the amount of formalin in the food and the length of the egg stage. The lower concentrations of formalin seem to have more effect on the length of the egg stage than the higher concentrations. The controls hatched before

TABLE I.

Percent of lethal amount of formalin used	Amount of formalin used (C. C.'s)	Sex	Number of flies	Mean facet count	Probable error	Standard deviation
80.....	1.2	Males...	4	60.25
		Females..	8	52.00
60.....	.9	Males...	28	65.78	.20	8.28
		Females..	40	62.62	.13	7.85
40.....	.6	Males...	22	71.95	.35	11.70
		Females..	28	60.89	.25	10.59
20.....	.3	Males...	26	68.50	.26	10.20
		Females..	45	66.00	.11	7.38
Controls.....	None	Males...	24	70.50	.63	22.36
		Females..	22	65.18	.21	6.90

any of those in food containing formalin.

The mean length of the larval period of flies in the control set was 84.82 hours, while the mean length of the larval period of those in food containing .3 cc. of formalin was 11.64 hours shorter. The mean length of the larva period of those in food containing .6 cc., .9 cc., and 1.2 cc. of formalin had larval periods 40.54 hours, 169.2 hours, and 192.45 hours longer than that of the control set, respectively.

The mean number of hours in the pupal stage was increased 2.47 hours in

food containing .6 cc. of formalin, and 1.99 hours in food containing .9 cc. of formalin. Higher amounts of formalin killed the pupae.

The length of ten pupae which developed in each percent of the lethal amount of formalin was measured by means of an ocular micrometer, and the average length was computed. Table II shows the average length of the pupae measured. There was a definite decrease in the length of the pupae with a corresponding increase in the amount of formalin in the food.

TABLE II.

Percent of lethal amount of formalin in food	Amount of formalin in food (C. C.'s)	Average length of pupa cases in millimeters
<i>Controls</i>		
20.....	<i>None</i>	3.42
40.....	.3	3.05
60.....	.6	2.68
80.....	.9	2.39
100.....	1.2	2.30
	1.5	2.24

The conclusions drawn from these experiments are summarized as follows:

1. The lethal amount of formalin for eggs of this race of *Drosophila* is in the vicinity of 1.5 cc. to 100 cc. of water in the food.

2. The eye facet number is increased slightly by 20% of the lethal amount of formalin, and definitely decreased by 60% or more of the lethal amount of formalin.

3. The length of the egg stage is increased by 20% and by 40% of the lethal amount of formalin in the food.

4. The lengths of the larval and pupal periods are increased by 40% or more of the lethal amount of formalin in the food on account of retarded development.

5. The size of larvae, pupae, and adults is reduced in direct proportion to the percent of the lethal amount of formalin in the food.