

## Further Study of the Population Effect on the Daily Periodic Emergence of *Drosophila*

By

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(Received June 17, 1959)

The author has reported that as the population of *Drosophila* larvae in a culture tube gets larger so the time of the maximum emergence in the course of a day is delayed, that is to say, the population effect exists in the phenomenon of emergence rhythm (MORI, 1954). That the cause of this delayed rhythm of emergence may be found in the lowered metabolism of larvae induced by the accumulation of excrements or deficiency of food during the life of crowds was suggested by the experiment employing PEARL's food medium containing  $\text{CuSO}_4$ . In this copper medium also the similar feature of delay in the time of emergence was observed.

In this case, however, the question may be presented whether the same cause is really operating in the effect due to dense population and that due to toxic action of  $\text{CuSO}_4$ , at least physio-ecologically, or not. The present report was attempted to clarify this point, and the deficient nourishment was prepared by decreasing the content of beer yeast in CARPENTER's food medium.

### Material and Method

*Drosophila melanogaster*, Oregon strain, which had been reared in our laboratory for about 215 generations with PEARL's medium as food, was used as the material. Food medium used in this experiment was CARPENTER's medium, the standard composition of which was beer yeast 10 gr, sugar 10 gr, agar 2 gr, tartaric acid 0.4 gr and water 100 cc. To make poor of the nutrient condition, the relative quantity of beer yeast was reduced to 1/3 of the standard medium.

Twenty to thirty flies (1 to 4 days after emergence) were put into a glass tube (length 15 cm, diameter 3 cm) and a slide glass, on which the standard CARPENTER's medium was placed, was inserted into the tube. Twenty glass tubes for oviposition were prepared at the same time. Female flies deposited the eggs on CARPENTER's medium most actively in the evening and the 1st instar larvae used to appear in the next afternoon. The slide glasses were renewed once in a day.

Fifty 1st instar larvae were carefully transferred with a needle to a small glass bottle (volume about 50 cc), each containing 15 cc of the food medium. The food media were two kinds, one was the standard medium (1st series) and the other was the insufficient medium as above described (2nd series). The number of the

test bottles used in each series was 20, so that the larvae employed were 1,000 respectively. These bottles were placed in a thermostat maintained at 25°C and subjected to the normal day-night light change.

About 9 days later in the 1st series and 12 days later in the 2nd series the flies began to emerge, and continued 3 days in the former and 5 days in the latter. The number of emerging flies was counted at every 3 hours till the last fly appeared.

### Result and Discussion

The result is shown in Table 1.

Table 1. Number of flies emerged within every 3 hours in the 1st (rich medium) and 2nd series (insufficient medium) of experiments. Gothic figures indicate the actual numbers and italic figures show the percentages.

Medium	Date of emergence	Time								Total
		0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-0	
Standard (rich) medium	1957 25-27/IV	<b>74</b>	<b>220</b>	<b>135</b>	<b>95</b>	<b>100</b>	<b>157</b>	<b>119</b>	<b>33</b>	<b>933</b>
		<i>7.9</i>	<i>23.6</i>	<i>14.5</i>	<i>10.2</i>	<i>10.7</i>	<i>16.8</i>	<i>12.8</i>	<i>3.5</i>	<i>100</i>
Insufficient medium	1957 28/IV-2/V	<b>33</b>	<b>165</b>	<b>223</b>	<b>180</b>	<b>169</b>	<b>98</b>	<b>17</b>	<b>28</b>	<b>912</b>
		<i>3.5</i>	<i>18.1</i>	<i>24.5</i>	<i>19.7</i>	<i>18.5</i>	<i>10.7</i>	<i>1.9</i>	<i>3.1</i>	<i>100</i>

General features of the emergence curve are different between 2 series; that of the 1st series (using rich medium) is bimodal, whereas that of the 2nd series (using poor medium) is monomodal, and especially, 3 hours difference in the time of the maximum emergence in the course of a day must be noticed, that of the 1st series is seen during 3 to 6 a.m., whereas that of the 2nd series is seen during 6 to 9 a.m. This tendency seems to verify the suggestion published previously, i.e. as the food becomes more inadequate or poor in nourishment, so the maximum emergence takes place later in a daily time schedule.

### Summary

*Drosophila melanogaster* was reared in CARPENTER'S medium containing different quantity of beer yeast as nourishment, and the time schedule of daily rhythmic emergence was investigated.

If the food contains rich nourishment (standard medium) the animal emerges most actively early in the morning (3 to 6 a.m.), whereas when the food contains only poor nourishment (about 1/3 of beer yeast of the standard medium) the peak of emergence occurs 3 hours later in the morning (6 to 9 a.m.).

This result consists with the results of the former experiments, proving that the delay of the time of the maximum emergence in the course of a day that occurs in the dense population must be induced, at least partly, by the deficiency of nourishment.

### Literature cited

- MORI, S., 1954. Population effect on the daily periodic emergence of *Drosophila*. Mem. Coll. Sci. Univ. Kyoto, (B), 21: 49-54.