

## XII. EXPERIMENTS ON EGG PRODUCTION IN BRUCHUS

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The following observations of *Bruchus quadramaculatus* were made at the University of Oklahoma between June 1 and August 1, 1922. The work was preliminary to a study of the embryology of the weevil and was primarily concerned in determining the optimum temperature at which the weevils deposit their eggs. The humidity in each experiment was kept at as near a point of saturation as it was possible to do so. The weevils used were from the stock of Dr. J. K. Breitenbecher.

In the first test twelve females were mated and placed into test tubes with cowpeas. They were kept at a temperature of 37° C. saturated humidity. This test lasted over a period of five days. The number of eggs laid by the weevils ranged from 0 to 87. Thirty-eight was the average. Twenty-nine was the largest number of eggs produced by a female in a twenty-four hour period. This occurred twice by the female which laid the 87 eggs. On the fourth day of the test five of the females had died. On the following day all of the remainder were dead.

The day after this experiment was started, eight other pairs were mated in the same way. Here the average number of eggs laid was 39, although three pairs failed to produce any eggs. Ninety-seven was the largest number laid by a female.

An observation was made at this time on the distribution of the eggs over the peas in the bottle. In most cases there was but one egg on a pea. This also is true of the first lot. Only in two or three cases were there more than two eggs on a pea, while most frequently where less than twenty eggs were laid in one day they were distributed so that there was seldom more than one egg on a pea.

On June 19 twenty-five matings were made and run at the same temperature. This was stock that had been in-bred for several generations. Here the largest number produced by any female for the entire time was 22. Seven had laid only one egg during the entire period. These were active vigorous weevils. Part of them

were virgin and emerged females while the other part were virgins which had been removed from the pea. Whenever this was done care was taken to secure only those which were active and ready to emerge.

Later two other attempts were made with the same stock and gave similar results at 33° C. The results of this experiment would indicate that in-breeding tends to produce sterility or at least greatly reduced fertility.

Twenty-two pair were mated and run at 27° C. This temperature was maintained by submerging them in a fruit jar under running water. At this temperature the average length of life was 10 days. The mean number of eggs was 49. The average number produced by all females was 41. The largest number produced by any female was 83. Only one female failed to lay.

The next matings were at 34° C. Seven days was the average length of life. All had died by the eighth day. The largest number of eggs produced by a female was 98 while a second gave 91. Four pair out of 22 failed to yield any eggs. The average number was 56. Forty-three was the largest number in one day laid by a female. This female produced 43 the first day, 21 the second, 10 the third, 4 the fourth, and six the fifth, a total of 73. On the sixth day she had none, and on the following day was dead. A second female gave 39 eggs in a single day.

Simultaneously with these another lot was run at a temperature of 38° C. This was also virgin hybrid stock obtained from the same lot of the previous experiment. The mean production was 57. Fifty-three was the average number. In this lot egg production was more uniform than in any preceding lot. No pair failed to produce. The smallest number produced by any was seven, the largest 76. Eight pair produced from 50 to 60. The average length of life at this temperature was two days shorter than at 34° C. Four pair had died by the fifth day, and eight pair lived one day longer, leaving only one pair to survive seven days. Only three pair produced eggs after the fifth day. The average number of this lot was therefore 2 5-7 more than that at 34° C. At this temperature the weevils are very active and show fight. Metabolism seems to be hastened in every way.

Nineteen pair were run at 44° C, which is near their thermal death point. Length of life was from 1 to 2 days. The largest number produced was 4 by one female. One had 3, and 4 had 2. The remainder had none. This was the highest temperature at which the experiment was conducted.

The final experiment was run at a temperature of 15° C.

Eight females were taken from peas and mated. These showed widely varying results. One produced 3 eggs, one 14 eggs, one 22 eggs, one 16 eggs, one 44 eggs, and one 66. The average was 20 eggs per female. Death took place between the twentieth and thirtieth day. Average was 26.

In order to get vigorous active females eleven pair of emerged weevils were mated and run at 15° C. Results were as follows: Mean number, 43. Average 37. Length of life 26 days.

A number of virgin females were also put into tubes and their egg laying watched. In one female at 15° C. 1 egg was obtained. In another 44 eggs were laid. Probably however this female had emerged and been fertilized and had gone back into a hole. None of the other seven females produced eggs at this temperature. At other temperatures isolated females likewise failed to lay eggs except at 34° C. where one female produced 1 egg.

Largest number of eggs was obtained at 37° C. at this temperature the weevils appear most active. The length of life is seven days. Very few eggs are produced if the temperature goes above 40° C., and life is short. The presence of a male is a stimulus to egg laying. Few eggs are laid in the absence of a male. Although there is a fairly good distribution of eggs when sufficient peas are present, this is not always the case. Some females regularly deposited the largest number of their eggs on the side of the tube. It seems to depend mostly on the activity of the female during the laying period.

At each temperature a number of isolated virgin females were run with uniform results namely, no production with the two exceptions already given. Fertilized isolated females produced as many eggs as those that were paired. This was also observed in those tubes in which the male died shortly after being put into the tube. This indicates that a single fertilization is all that is necessary to start the egg laying.

At the lowest temperature the weevils in general were quite inactive. In some instances when the tubes were turned in counting, the weevils would drop from the peas. Closer examination would reveal however that they were not dead. The egg production at this temperature however does not show so great a falling off. Fourteen was the largest number produced in one day, and this was done only on one occasion. The egg production is spread out over the entire period and the final number of eggs is not far short of numbers produced at the temperature at which the weevils show greater activity.

Pair	34° C.								Total
	Days								
	1	2	3	4	5	6	7	8	
1	5	30	21	12	5	2	0	d	75
2	23	3	18	0	0	0	d		44
3	0	0	0	0	0	0	0d		0
4	13	13	17	10	5	0	0d		58
5	9	25	21	18	6	0	0d		78
6	0	3	0	0	1	0	0d		4
7	2	20	22	10	2	0	0d		56
8	3	39	18	13	3	1	0d		77
9	0	30	12	12	3	0	0d		57
10	17	19	12	13	4	0	0d		65
11	11	16	10	9	4	1	0	3d	54
12	43	21	10	4	6	0	0d		84
13	20	32	28	13	4	1	0	d	98
14	0	0	0	0d					0
15	22	30	18	7	2	0			79
16	0	0d							0
17	0	0	0	19	6	8	0	0d	33
18	33	24	1	1	0d				60
19	24	22	15	13	0	0	0	0d	74
20	0	0	0	0	0	0	0d		0
21	0	19	14	4	0	0	0	0d	37
22	0	0	0	0	0	0	0d		0
23	0	19	14	4	0	0	0	0d	
24	1	1	1	2	4	4	0	0d	13
25	35	30	14	11	1	0	0d		91
<b>Mean 56</b>					<b>Av. 57</b>				

Pair	38° C.							Total
	Days							
	1	2	3	4	5	6	7	
1	1	20	23	16	0	0	0d	59
2	9	25	19	6	0	0d		59
3	30	19	7	2	0d			58
4	1	12	26	0	2	0	0d	41
5	0	16	19	10	1	2d		48
6	0	14	27	21	3	4	0	59
7	0	20	20	12	0	0d		52
8	19	25	14	7	0	0d		65

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9	0	0	5	2	0d						7
10	6	22	21	8	0d						57
11	48	22	5	0	1	d					76
12	9	25	13	2	0	1	0d				50
13	19	21	12	5	0d						56
14	0	20	22	16	1	0d					57
<b>Mean 57</b>					<b>Av. 53</b>						

27° C.

Pair	Days											Total
	1	2	3	4	5	6	7	8	9	10	11	
1	0	0	0	0	0	4	0	0	0	d		4
2	0	0	0	18	8	11	1	3	2	d		43
3	3	18	15	16	6	8	2	2	0	1	d	71
4	0	6	16	12	12	7	1	3	0	0	d	57
5	0	0	0	0	4	2	1	1	4	0	d	12
6	16	10	9	14	13	5	4	0	d			71
7	1	0	3	5	1	0	5	5	0	0		20
8	0	0	4	0	8	7	10	1	2	0	d	32
9	0	1	6	6	11	7	4	4	8	2d		49
10	0	4	16	13	17	3	2	5	0	0d		60
11	0	12	10	8	18	4	3	5	0d			63
12	0	4	7	11	15	7	2	4	0	0d		50
13	0	0	14	1	3	0	0	0	0	0	1d	19
14	0	1	2	9	2	6	2	0	4	2	0d	28
15	17	14	14	1	6	2	0	0d				54
16	11	6	6	5	13	3	0	0d				44
17	18	12	8	5	13	0	0	0d				56
18	2	0	0	0	0	0	d					2
19	13	9	26	8	13	2	5	1	0d			83
20	2	0	0	1	1	d						4
21	0	2	2	1	0d							5
22	0	17	9	6	8	1	0	0	0d			41
<b>Mean 49</b>												<b>Av. 41</b>

37° C.

Pair	Days					Total
	1	2	3	4	5	
1	0	0	14	14	0d	28
2	9	13	15	5	2d	44
3	15	18	18	0d		51
4	6	10	12	0	1	29

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5	1	1	1	0d		3
6	1	1	1	0	0d	3
7	0	0	0	0	d	0
8	12	14	14	0	d	40
9	19	19	24	0d		62
10	21	29	29	2	6	87
11	22	25	26	0d		73
12	0	4	0	d		4
<b>Mean</b>	<b>40</b>					
				<b>Av.</b>	<b>38</b>	