

alcohol with an increase in phenolsulphonephthalein elimination the observation was made, that if the use of alcohol was withheld from 48 to 72 hours the elimination of the dye underwent a reduction. An investigation of the liver changes which may develop in connection with the decrease in the output of this dye is now in progress.

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Evidence of Physiological Mutations in the Cladoceran, *Moina macrocopa*.

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Extensive breeding experiments with *Daphnia longispina* (Banta and Wood,¹ and unpublished data) give rather conclusive evidence that recessive mutations having physiological effects accumulate during parthenogenesis in this species. In order to learn whether recessive physiological mutations accumulate similarly in *Moina macrocopa*, 2 strains of this species were inbred (sexual reproduction). One strain, Banta's Line 1012, had a laboratory history of 1090 parthenogenetic generations before inbreeding, whereas the other line, Banta's Line 1705, had only a short history of 42 parthenogenetic generations before inbreeding. Of 151 ephippial (sexual) eggs obtained from Line 1012, 118 or 78.1% hatched. Of 321 ephippial eggs obtained from Line 1705, 282 or 87.9% hatched. Eggs in both of these groups include several series which fairly consistently showed the same differential rate of hatching as is represented by the totals given above. This is suggestive of the accumulation during long-continued parthenogenesis of semi-lethal mutations in Line 1012.

Fifty-five females which hatched from the sexual eggs obtained by inbreeding Line 1012 were compared with 55 parthenogenetically-produced females of Line 1012 as to their viability, reproductive capacity, and other characteristics.* Comparisons were made be-

¹ Banta, A. M., and Wood, T. R., *Z. ind. Abs. Vererb.*, Supplementband I, 1928, 391.

* Inasmuch as there is no reduction division in the maturation of the parthenogenetic egg of Cladocera, all parthenogenetically produced descendants of an individual should be genetically identical (except as a mutation may occur). In sexual reproduction, on the other hand, segregation and recombination of genetic factors are, naturally, to be expected.

tween the individuals of these 2 groups, on the basis of the following specific points: early mortality (died before maturity), sterility (attained maturity but died without producing young), longevity, number of broods of parthenogenetic young produced, and reproductive index (average number of young per mother per day of reproductive life). Of the sexually produced individuals 13 died early and 2 were sterile; only 1 of the parthenogenetically produced individuals died early, though 5 were sterile.

TABLE I.

	Longevity in Days																			Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
Sexually produced	1	7	5	1	1	2	2	1	1	4	1	4	2	7	3	7	4	0	2	55
Parthenogenetically produced	0	0	1	1	1	4	3	2	2	5	3	11	6	5	6	4	1	0	0	55

TABLE II.

	Number of Broods Produced										Total
	1	2	3	4	5	6	7	8	9	10	
Sexually produced	2	2	2	6	4	7	6	6	2	2	39
Parthenogenetically produced	3	2	5	7	15	9	5	2	1	0	49

TABLE III.

	Reproductive Index														
	5	6	7	8	9	10	11	12	13	14	15	16	17	Total	
Sexually produced	1	0	2	0	4	2	3	5	3	5	6	2	0	33	
Parthenogenetically produced	0	0	0	0	0	0	5	5	5	6	10	6	2	39	

Table I shows the longevity of the sexually produced and the parthenogenetically produced individuals. The longevity ranged from 1 to 19 days. The sexually produced animals died earlier. In Table II the individuals studied are classified according to the number of broods which they produced. Tables I and II show that there is a greater variability among the sexually produced individuals than among the parthenogenetically produced animals in regard to longevity and number of broods produced.

Table III shows the individuals arranged according to their reproductive indices, the range being from 5 to 17. In computing the reproductive index only such as had produced 4 broods or more were considered, inasmuch as *Moina macrocopa* individuals ordinarily live to produce 4 broods or more, and a reproductive index computed from a smaller number of broods would appear to have little significance. The reproductive indices for the sexually produced individuals spread over a rather wide range, whereas the re-

productive indices of the parthenogenetically produced individuals, on the other hand, show a tendency to group about the mean. This demonstrates the relative uniformity in reproductive capacity of the parthenogenetically produced individuals in comparison with the variation among the sexually produced individuals.

In an effort further to demonstrate the genetic nature of the variations shown by the individuals hatched from sexual eggs, a few parthenogenetically produced young of some of them were cultured simultaneously as their mothers had been. Although the study of these individuals showed that environmental factors had influenced some of the differences previously noted, these latter observations for the most part provided confirmation of the differences noted between the different hatched individuals.

As referred to above, the other line, Banta's Line 1705, with the short parthenogenetic history (42 parthenogenetic generations) was studied as Line 1012 had been. Sixty females hatched from sexual eggs produced by inbreeding Line 1705 were compared with 60 parthenogenetically produced females from the same line. Unfortunately the occurrence of adverse environmental conditions terminated the experiment.

Since it is not feasible to extend this time-consuming work at present, it seems best to report the results suggested by these experiments. As far as studied, the sexually produced individuals from the line with the short parthenogenetic history showed less diversity among themselves than did those derived by inbreeding Line 1012—the line with the very long parthenogenetic history. Further, the sexually produced individuals varied little from the parthenogenetically produced females of Strain 1705, thus indicating that in this line with a short parthenogenetic history few, if any, recessive mutations had accumulated which might show up in sexually produced offspring.

These observations suggest that recessive mutations having unfavorable physiological effects accumulate in *Moina macrocopa* (as previously shown in *Daphnia longispina*) during parthenogenesis, and that the longer the parthenogenetic history of a given line, the greater the number of physiological mutations apparently revealed by the sexually produced offspring of that line.†

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