Proceedings of the Iowa Academy of Science

Volume 24 | Annual Issue Article 46

1917

The Influence of the Male on Litter Sizes

Edward N. Wentworth
Kansas Agricultural College

THE INFLUENCE OF THE MALE ON LITTER SIZES.[1]

EDWARD N. WENTWORTH.

A common belief among practical breeders is that the male in multiparous species affects the number at a birth. This belief has even permeated scientific writing; many biologists apparently taking the supposed observation at face value, while others have sought biometrical proof in the various accumulations of the data regarding fertility inheritance found in biological records. Thus Ewart reports the case of a long-haired Skye terrier bitch that was infertile to two males of her race and was the dam of one weakly pup to the service of a third, which produced four strong pups to a vigorous West Highland terrier. Harris, in some calculations made on litter frequencies reported by Wentworth and Anbel, calls attention to the fact that there is a statistically significant correlation between the size of litter in which boars are produced and the size of litters in which their daughters are produced, while he discovers the same thing in data reported on Shropshire sheep studied by Rietz and Roberts. Several other series of statistics show similar characteristics, although they are not as extensive as those discussed.

From purely logical grounds it is difficult to conceive why the male should affect the number per litter. It would seem obvious that among the millions of sperm cells in each seminal discharge of the male there would be sufficient gametes not only to fertilize the relatively few ova released by the female, but also to reach them in time to form an effective union. Theoretically there seem to be only three ways possible in which there might be differences between males. First, the male although functional to a certain degree, might produce such weak cells that their vitality would be exhausted before they could reach the ova. Second, even though they reach the ova, they might not form strongly viable zygotes, a condition which is frequently found in multiparous animals. Hammond reports that in swine there are normally several fertilized ova which atrophy during the gestation period, although he seems unable to determine the

[1]Paper No. 7 from the Laboratory of Animal Technology, Kansas State Agricultural College.

cause. There is a possibility that one cause for atrophy might be inherent in the sperm. Third, it is possible that there may be an influence of the sperm on the egg similar to that which causes duplicate twins. This is difficult to prove.

Recognizing that there are three such classes of possibilities, all of which were impossible to test with data the writer had at hand, an examination of a large amount of new material was made with the view of discovering whether such conditions existed inherently in all cases. Southdown sheep and Chester White hogs were chosen for this purpose, as well as a few records on Collie dogs.

In Southdown pedigrees begun from single births the average progenies were of course decidedly lower than in those begun from multiple births, since there were only seven possible matings on each pedigree blank (the great-grandparental generation being the last). Furthermore, in many cases the sire, grandparents, or great-grandparents, were imported, with few data obtainable as to birth rank. This gave considerable statistical weight to the mating from which the pedigree started. Hence the results from Southdown pedigrees begun with multiple births are presented separately. The data for each are presented in Tables I and II.

TABLE I.

BREEDING PERFORMANCE OF SOUTHDOWN MALES IN PEDIGREES STARTED FROM SINGLE BIRTHS.

Birth Rank of Sire	Number Cases	Birth Rank of Progeny
1	2811	1.2864±.0059
2	886	1.2776±.0103
3	18	1.3888±.0775

TABLE II.

BREEDING PERFORMANCE OF SOUTHDOWN MALES IN PEDIGREES STARTED FROM TWIN BIRTHS.

Birth Rank of Sire	Number Cases	Birth Rank of Progeny
1	4120	1.5296±.0054
2	1165	1.5682±.0072
3	26	1.6154±.0644

In Table I the differences between sires of different birth rank as far as breeding qualities are concerned, are in no case significant, if the conventional ratio of the constant being at least three times its probable error is assumed. In Table II, the difference between singles and twins, .0386 ± .0091 is possibly significant, the others are not. Since five out of six such constants are not significant, it is doubtful if the sixth one is, even though the chances of its being significant are approximately 216 to 1.

Of Chester White hogs the following statistics were collected.

TABLE III.

BREEDING PERFORMANCE OF CHESTER WHITE BOARS OF DIFFERENT BIRTH RANK.

Birth Rank of Sire	Number Cases	Birth Rank of Progeny
5	2	8.0000±.4769
6	7	7.2857±.3531
7	31	7.9644±.2061
8	65	8.3235±.1889
9	112	8.1447±.1473
10	100	7.8623±.1542
11	54	7.9466±.1894
12	30	8.1121±.2013
13	11	7.6524±.28177
14	2	9.0000±.4769
15	1	8.0000

In no case in Table III is the difference between any two types of sires statistically significant.

Table IV shows the results obtained from a few records on Collies. The figures are not comparable statistically, but since the evidence is the same as in the previous cases, the data are presented.

TABLE IV.

EFFECT OF BIRTH RANK OF SIRE IN COLLIES ON NUMBER OF PUPS PER LITTER.

Birth Rank of Sire	Number Cases	Average Number Progeny
4	3	5.3333±.1836
5	7	5.5714±.2304
6	7	5.7142±.1805
7	4	5.7500±.2500
8	2	5.0000±.4769

While these numbers are by no means large enough to be conclusive, yet in the face of the conflicting evidence from other sources it would seem that the male has no significant effect upon the litter number. Such conclusion seems just on logical grounds in spite of the possibilities suggested earlier in the paper, and until more definite evidence is adduced it seems only reasonable to conclude that the female determines the number at a birth.

KANSAS AGRICULTURAL COLLEGE.

LITERATURE CITED.

EWART, J. C., The Breeding and Origin of Domestic Animals: 27th Report Bureau of Animal Industry, pp. 125-186, 1910.

HARRIS, J. A., Variation, Correlation, and Inheritance of Fertility in the Mammals: American Naturalist, Vol. 50, pp. 626-636, 1916.

RIETZ, H. L., and ROBERTS, E., Degree of Resemblance of Parents and Offspring with Reference to Birth as Twins for Registered Shropshire Sheep: Journal of Agricultural Research, Vol. 4, pp. 479-510, 1915.

WENTWORTH, E. N., and AUBEL, C. E., Inheritance of Fertility in Swine: Journal of Agricultural Research, Vol. 5, pp. 1145-1160, 1916.