Zoologischer Anzeiger

herausgegeben

von Prof. **Eugen Korschelt** in Marburg.

Zugleich

Organ der Deutschen Zoologischen Gesellschaft.

Bibliographia zoologica

bearbeitet von Dr. **H. H. Field** (Concilium bibliographicum) in Zürich.

Verlag von Wilhelm Engelmann in Leipzig.

XXXV. Band. 15. Februar 1910. Nr. 14/15.

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I. Wissenschaftliche Mitteilungen.

1. A Triple-Yolked Egg[1].

By Raymond Pearl, Ph. D.

(With 2 figures.)

eingeg. 18. November 1909.

The laying of eggs with two yolks by the domestic fowl is a very common occurrence. Eggs with more than two yolks, however, occur very rarely. On this account, and because of the important bearing of these abnormal eggs on certain of the problems of the normal physiology of reproduction in birds, it appears desirable to publish a brief, but at the same time so far as possible complete description of a triple-yolked egg laid recently by a Barred Plymouth Rock pullet in the flock of the Maine Experiment Station. The occurrence of triple-yolked eggs has

[1] Papers from the Biological Laboratory of the Maine Agricultural Experiment Station. No. 15.

been noted before[2]. The rarity of such eggs, however, is indicated in the statement of Valenciennes (loc. cit.) to the effect that the marketmen handling eggs in Paris estimated that such eggs were found not more than 5 or 6 times in a year, at a time when the annual official receipts of eggs amounted to over 141 millions.

Data regarding the Bird which Laid the Triple-Yolked Egg.

The egg which forms the basis of this paper was laid September 27, 1909, by a Barred Plymouth Rock pullet bearing the leg-band number 318. This pullet was hatched March 29, 1909. Its growth and physiological development were normal. During the spring and summer this chick was kept with others in a large field of grass, where it was under free range conditions. On September 1, 1909, this pullet, along

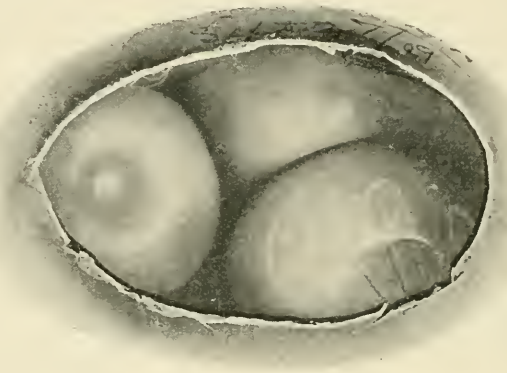

Fig. 1. Photograph (approximately natural size) of the triple-yolked egg described in the text.

with others, was put into the poultry-house which provides permanent winter quarters. She began laying about three weeks after this removal to the house. Her complete laying record to the date of writing is as follows: An egg was laid by bird No. 318 on:

September 21, 24, 25, 26, 27, 30
October 2, 3, 4, 5, 8, 12, 13, 16, 17, 19.

So far as is known the first three eggs laid by this bird were entirely normal. That laid on September 26, was " softshelled" i. e., bore only the shell membranes as an outside covering, with only a slight deposit of lime in the form of a true shell. This was followed on the 27th by the triple-yolked egg. Since that date the eggs from this bird have

[2] Cf. Valenciennes, Notes sur des œufs à plusiers jaunes contenus dans la même coque. C. R. Ac. Sci. Paris. T. 42. p. 3—6. 1856. — Akers, L. C., A Three Yolked Egg. Farm Poultry, Vol. 16. p. 358. 1895. — "Triple eggs" consisting of three eggs fused together in various ways are described by Landois, H., Mißbildungen bei Hühnereiern, Zool. Garten, Bd. 19. No. 1. p. 17—24. 1878. He makes no mention, however, of ever having observed triple yolked eggs.

been normal. The laying of the "soft-shelled" egg and the triple-yolked egg on successive days indicates that the whole reproductive mechanism was not functioning in a normal, orderly and regular manner at that time. The egg record at the time of laying of the triple-yolked egg indicates the reason of its formation. From the 24th to the 27th inclusive the bird laid an egg each day. The egg of the 27th had three yolks. On the 28th and 29th no eggs were laid, but one was on the 30th. There would appear to be little doubt that one of the extra yolks in the triple yolked egg should normally have been laid in an egg of the 28th, and the other in an egg of the 29th. Instead of this, however, the three yolks which normally should have been laid on the 27th, 28th, and 29th were all discharged from the ovary at so nearly the same time as

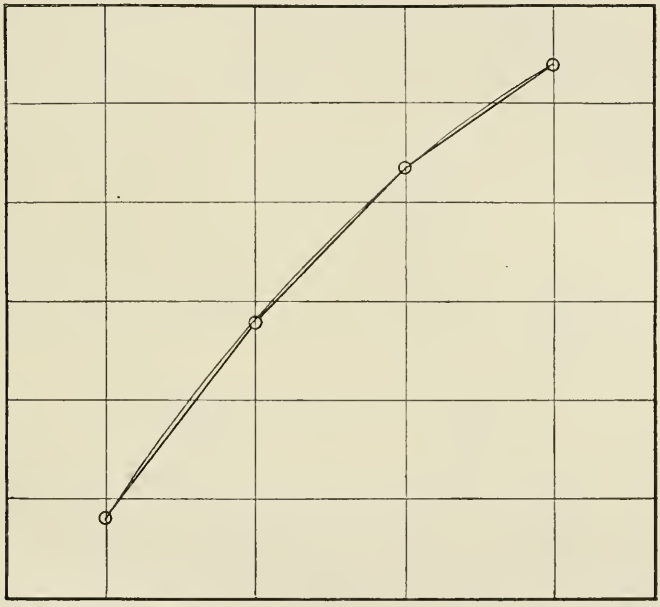

Fig. 2. Diagram showing the increase in the total weight of the egg, associated with an increase in the number of yolks contained. The zigzag line gives the observations and the smooth curve a parabola fitted to the data by the method of least squares.

in pass down the oviduct in one group. The case simply indicates that perfect regularity in rate of ovulation had not become firmly established at this time.

Bird No. 318 belongs to a family of relatively high fecundity. Her mother laid 177 eggs between November 16 and July 31 inclusive, of her pullet year. This is a record well above the average for the general flock of that year (1908–09). The records show no abnormal egg as having been produced by either the mother or the grandmother or sisters of bird No. 318, except for an occasional "soft-shelled" specimen. There

is thus no evidence of an inheritance of the tendancy to lay multiple yolked eggs in the family as in the case noted by Panum[3]. He describes an instance where four daughters of an old hen known to lay double-yolked eggs, themselves produced such eggs. Such a case does not, of course, prove an inheritance of this tendency. Experience in this laboratory where detailed records of large numbers of birds are kept shows that any individual is liable to produce at sometime in her laying career an abnormal egg. If mother and daughter both chance to do this in one or two isolated instances, it is no proof of inheritance.

External Characteristics and Size of the Egg.

The triple-yolked egg though large in size was of normal shape, being more pointed at one end than the other. This is clearly shown in Fig. 1. Its shell was firm and hard. It had the surface texture and smoothness which is normal. The shell was of the delicate brown color which is normal for the egg of the Barred Plymouth Rock. The dimensions of the egg were as follows:

Length 70,7 mm
Breadth 64,2 -
Weight 87,10 g[4].

For the normal Barred Plymouth Rock egg with a single yolk the average dimensions, obtained from the unpublished data collected in this laboratory, are as follows:

Mean length (normal egg) = 56,32 mm
- breadth - - = 41,92 -
- weight - - = 55,26 g.

From these figures it is apparant that the egg with three yolks is much larger than the normal single yolked egg. In this respect the present specimen differs from those described by Valenciennes. He says with regard to this point in his cases (loc. cit. p. 3): "Leur grosseur était celle des œufs ordinaires". It is a well known fact that double yolked eggs may be little or no larger than normal single yolked eggs[5]. Yet common observation indicates clearly enough that the great majority of such eggs are larger than the normal. It seems remarkable that

[3] Panum, P. L., Untersuchungen über Entstehung der Mißbildungen. Berlin 1860.

[4] This weight is calculated, as unfortunately the egg was not weighed. The value given was determined by first calculating the volume of the egg on the assumption that it was an oblate spheroid, and then multiplying the volume so obtained by the mean specific gravity. This method has been proved, in unpublished investigations carried out in this laboratory, to give very accurate results.

[5] Immermann, F., Über Doppeleier beim Huhn. Inaug.-Diss. Basel. 1899. S. 8 u. 9.

Valenciennes's three specimens should have all been of normal size. There probably was some abnormal factor which brought about this result and was not at all taken account of. He says nothing whatever regarding the breed of the birds which produced these eggs. It is possible that they were from bantams, in which case they might well have been of the size normal for larger breeds. The measurements given by Akers (loc. cit.) show his specimen to have been, like the present, of abnormally large size. Unfortunately he gives peripheral rather than diametral figures, stating that this specimen was "$6^1/_2$" around" one way and $8^1/_2$" the other. Its weight was $4^1/_2$ oz. Transferring to metric figures and where possible to a diameter we get:

Akers' specimen: Breadth = 52,6 mm
- - Weight = 127,6 g.

These values show that Akers' egg was distinctly larger than the present specimen.

A question of some interest is as to how this triple-yolked egg compares in size with double-yolked Plymouth Rock eggs. The following data are averages obtained from the measurement of 18 double-yolked eggs in the collection belonging to this laboratory.

Double yolked eggs: Mean length = 68,6 mm
- - - - breadth = 46,8 -
- - - - weight = 86,26 g.

It is evident from these figures that the triple-yolked egg is of approximately the same size as the average double-yolked egg from Barred Plymouth Rock hens. The size of eggs is evidently not simply proportional to the number of yolks which they contain.

The question of what is the exact relation existing between the bulk or weight of eggs and the number of yolks which they contain is of sufficient interest to warrant special consideration. The following classes of hen's eggs are known to occur: a) yolkless eggs. These are the small so-called "cock-eggs" or "witch-eggs" (Hexeneier, Windeier)[6], which everyone who has kept poultry is familiar with. They never contain a normal yolk. Occasionally they contain a small amount of fluid yolk without any distinct yolk membrane. More usually these eggs are without any trace of yolk, consisting merely of albumen, shell membranes and shell, with a minute particle (hardened albumen, blood clot, etc.) in the center, which serves as the nucleus around which the albumen

[6] The folk-lore of these eggs forms an extremely interesting subject in itself. The writer hopes to be able at some future time to put together for publication his notes on the subject.

is deposited. b) Normal eggs with one yolk. c) Double-yolked eggs. d) Triple-yolked eggs.

The average weights of these different classes of eggs for Plymouth Rock hens are given in Table I, and are shown graphically in Fig. 2. The second column in the table and the zigzag line of the diagram give the observed weights. The third column and the smooth curve are the parabola,

$$W = 16{,}242 + 43{,}762\ Y - 4{,}450\ Y^2$$

where W denotes the mean weigth of the egg and Y denotes the number of yolks contained.

Table I.

Weight of Hens' Eggs and Number of Contained Yolks.

Number of yolks.	Observed weight in grams of whole egg.	Theoretical weight (from parabola)
0	16,34[7]	16,24
1	55,26	55,55
2	86.26	85,97
3	107,38[8]	107,48

It is clear from both diagram and table that the parabola gives an extremely close fit to the observations.

The facts just noted indicate that there probably exists a definite relation between the amount of albumen secreted by the oviduct in any given case and the amount of yolk present in the oviduct at the time. Such a relation would be expected in view of the fact that the immediate stimulus to secretory activity of certain (and probably of all) parts of the oviduct is primarily mechanical in character[9]. What the precise quantitative character of this relation between amount of yolk and amount of albumen is must be determined by further study.

Internal Characteristics of the Egg.

The disposition of the three yolks in this egg is clearly shown in Fig. 1. Each yolk was enclosed in a separate yolk membrane. While the three yolks were in contact with each other, they were in no way fastened together. All of the yolks were of normal size, and of approximately the same size. Unfortunately no measurements of the yolks are available. Each yolk possessed a germ disc. These were normal so far

[7] This is the mean of these dwarf eggs which have been studied in this laboratory. The complete data regarding them will be published later.

[8] This is the mean of Aker's case and the egg described in the present paper.

[9] Cf. Pearl, R. and F. M. Surface, The Nature of the Stimulus which causes a Shell to be Formed on a Birds Egg. Science, N. S. Vol. 29. p. 428 and 429. 1909.

as macroscopic appearance indicated. The germ disc on the yolk nearest the pointed end of the egg shows very clearly in Fig. 1.

The two kinds of albumen (of thick and thin consistency) which are normal were present in this egg. There was no trace of a chalaza in connection with any yolk or at either pole of the egg.

The shell membranes were entirely normal.

Summary.

1) The purpose of this paper is to describe an egg containing three normal yolks, which was laid by a young pullet of the Barred Plymouth Rock breed.

2) It is shown that, in so far as the four different classes of eggs in respect to the number of contained yolks which are known to occur, the relation of the observed size of the entire egg (measured here by the weight) to the number of yolks, is very accurately described by a parabola.

Biological Laboratory, Maine Experiment Station, Orono, Maine, U.S.A., 3 November, 1909.

2. Copepoden aus den phlegräischen Feldern.

II. Teil.

Von Dr. V. Brehm. Elbogen in Böhmen.

eingeg. 21. Dezember 1909.

Am 15. Juni 1909 publizierte ich in dieser Zeitschrift neue Harpacticiden, die ich in dem mir von Prof. R. Woltereck gütigst zur Verfügung gestellten Material auffand und kündigte die Beschreibung weiterer Copepoden aus diesem Gebiete an.

Durch die Bemühungen meines Freundes Dr. Ferd. Urban-Plan, bekam ich Untersuchungsmaterial aus dem Averner See, in dem ich zwei der Harpacticiden wiederfand, die schon in den Proben Prof. Wolterecks vorhanden waren. Überdies enthielt der eine Fang, den mir Dr. Urban übermittelte, auch reichliches Plankton, in dem das häufige Vorkommen der *Poppella guernei* Rich. als bemerkenswerteste Erscheinung hier mitgeteilt sei.

Die eine der neuen Formen, die ich auf Grund meines früheren Materiales als *Laophonte hecate* beschreiben wollte, ist nach den mir nunmehr zur Verfügung stehenden Proben im Averner See recht häufig. Da ich auf die Fauna dieses Sees ohnehin im nächsten Heft des Archivs für Hydrobiologie ausfürlicher zurückzukommen gedenke und dort auch Abbildungen der neuen Art mitteilen werde, sei in dieser kurzen Mitteilung nur die Diagnose dieses Harpacticiden veröffentlicht.