

Non-hereditary Crooked Beaks in Poultry

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(Text-fig. 1-3)

Unlike the hereditary deformed beaks described by MERCIER and POISSON (1925)¹⁾, MERCIER (1926)²⁾ and LANDAUER (1938)³⁾, there is according to HUTT (1949)⁴⁾ and PFLUGFELDER (1961)⁵⁾ a non-genetic condition associated with unilateral microphthalmia or anophthalmia in the chick embryo.

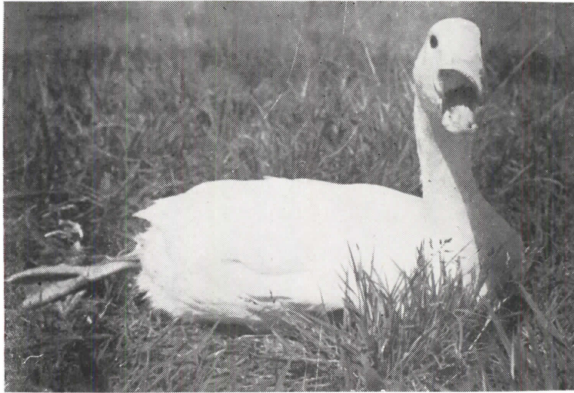
The author also discovered three examples suggestive of the nongenetic deformed beak reported earlier by HUTT and PFLUGFELDER. One was observed in a male Osaka duck which was hatched in April, 1961 and two were noted in the chicken embryos which were being incubated in November, 1964 and in March, 1965. The observed findings of these three examples will be described in detail.

MATERIALS AND OBSERVATION

1. Osaka duck :

This male duck was hatched on the 28th day from an egg whose incubation was suspended for about three hours on the 25th day of incubation by interruption of electric current. The duckling was raised for one year and observed for the developmental condition of its deformed beak and its semen was examined. When the duckling hatched, the beak did not differ much from that of normal duck, but after twenty days following hatching the abnormality of the beak became so severe that on about 40th day the duck required much more time to ingest food than that of the other normal ducks. Furthermore, after two months following hatching, the duck had to be fed by hand. The condition at the time is as shown in Text-fig. 1. This troublesome job was continue for ten months until the duck died in April, 1962. When the duck was about ten months old, the collection of semen was started and continued until a week before its death. The general properties of the semen obtained were as follows.

The volume of semen collected by the massage method was 0.22ml on the average ranging from 0.15 to 0.40ml. The semen was milky white in color. The average number of spermatozoa per ml was 1.84×10^8 . The pH value of the semen was 7.0 on the average, ranging from 6.8 to 7.2. The motility of the spermatozoa was very active and the index number of survival ranged from 70 to 92.5. The percentage of deformed sperms was 16.1 on the average and no special deformity of the sperms could not found when compared with that of other normal sperms.



Text-fig. 1. Upper crooked beak in a young drake.

2. Chicken embryos

The abnormality of the beak was found in the chicken embryo whose incubation was suspended for about four hours on the 9th day of incubation due to interruption of electric current and whose shell was cracked on the 15th day of incubation. When the shell was cracked the embryo was moving actively, but it died during the course of investigation in physiological saline solution. It was found by minute observation that the embryo possessed an abnormal beak accompanied by unilateral anophthalmia. The results of this observation are as follows.

When the shell was cracked, the length of the upper beak was found to be very short in comparison with that of the lower beak and was barely visible. The abnormality of the beak was definitely accompanied by unilateral anophthalmia as shown in Text-fig. 2.



Text-fig. 2. White Leghorn chick embryo (left) showing abnormal upper beak associated with unilateral microphthalmia on the 15th day of incubation; normal embryo of the same incubation period (right).

It is assumed that the beak abnormality would become more conspicuous with time as in the case of the foregoing Osaka duck. The author regrets that the obser-

vation had to be suspended with the death of embryo. The author recently discovered an example suggestive of a non-genetic condition associated with unilateral microphthalmia in a chicken embryo removed from the shell on the 10th day of incubation as shown in Text-fig. 3.



Text-fig. 3. New Hampshire chick embryo (right) showing abnormal upper beak associated with unilateral anophthalmia on the 10th day of incubation; normal embryo of the same incubation period (left).

In this case the incubation temperature was lowered for ten minutes six times a day for a period of three days before the shell was cracked. The results of detailed observation on this chicken embryo will be presented.

RESULTS AND DISCUSSION

As shown in Text-fig. 1, 2 and 3, the author discovered three examples suggestive of non-hereditary deformed beak. One was found in an Osaka duck and the other two were noted in the embryos which were removed from the shell on the 15th day and 10th day of incubation.

Heretofore, several investigators have reported on hereditary crooked beaks. MERCIER and POISSON (1925)¹⁾ suggested that in their stock the character was even manifested by heterozygotes. According to LANDAUER (1938)³⁾ the crooked beak is a hereditary condition in which the beaks are crossed at hatching but some become normal later. This phenomenon in the process of embryonal development greatly

differs from what the author observed in the present experiment.

On the contrary, it was recently reported by HUTT (1949)⁴ and PFLUGFELDER (1961)⁵ that there are non-hereditary deformed beaks associated with unilateral microphthalmia or anophthalmia in chick embryo. According to HUTT (1949)⁴ the most common of various abnormalities of the beaks is probably the non-genetic condition associated with unilateral microphthalmia or anophthalmia in chick embryo, but the majority of these are never seen because they die during the later stages of incubation and therefore a few hatch. This abnormality probably results, as do other teratological condition, from an accident in development, sometimes induced by an unfavorable environment. Thus, the most common kind of crooked beak in older chicken is probably that which develops between 3 and 8 weeks of age in chicks which were normal at hatching. As stated above, the tendency in the process of embryonal development bears a close resemblance to that of the present experiments. On the other hand, PFLUGFELDER (1961)⁵ carried out matings between 12 affected hens and 5 affected cocks in order to determine whether or not the type of deformed-beak that is accompanied by unilateral microphthalmia or anophthalmia is hereditary. All of the hens and cocks used in his experiment had to be fed by hand. As all the offspring obtained from the result of his experiment were normal, he concluded that this type of cross-beak was not of genetic origin. Further he stated that some cross-beak embryos were obtained as a result of raising the incubation temperature to 41°C for a short time, but all died before hatching. In the case of the present experiment, both of the two examples were obtained by lowering the incubation temperature to 18°~21°C by interrupting the electric current for about three or four hours. In the latter case the incubation temperature was lowered six times a day for ten minutes for three days before cracking the shell. In the experiment of Pflugfelder, no evidence of a causal relationship between the eye and beak defects was found. In the present experiment on the chick embryonal development, the author has discovered a deformed beak that was accompanied by unilateral anophthalmia (Text-fig. 1) and microphthalmia (Text-fig. 2). These two non-genetic conditions associated with unilateral anophthalmia and microphthalmia in chick embryos bear a striking resemblance to that described by HUTT (1949)⁴. It is suspected that the relationship between the eye and beak defect is probably induced by the same unfavourable environmental factor (e.g. temperature shock) as mentioned by PFLUGFELDER (1961)⁵, but the factors and mechanisms immediately involved in the non-hereditary abnormality could not be elucidated.

SUMMARY

Three examples suggestive of non-genetic deformed beaks were found in the present experiments. One was found in an Osaka duck and two were found in chicken embryos.

The duck was hatched on the 28th day from an egg whose incubation was suspended for about three hours on the 25th day of incubation by interruption of elec-

tric current. The duckling was raised for one year and the developmental condition of its deformed beak was observed. Its semen was also examined. The degree of the crooked beak became marked with time, but no abnormality was found in the general properties of the semen.

The other two were found in chick embryos. One was obtained from an egg whose incubation was suspended for about four hours on the 9th day of incubation by interruption of electric current. The shell was cracked on the 15th day of incubation. The other was obtained from an egg whose incubation temperature was lowered six times a day for ten minutes for three days before the shell was cracked on the 10th day of incubation. The former showed the upper beak to be deformed and accompanied by unilateral anophthalmia, and the latter showed the upper beak to be deformed and accompanied by unilateral microphthalmia.

It is assumed that the deformity of the eye and beak may be induced by the same unfavourable environmental factor, but the factors and mechanism immediately involved in the non-hereditary abnormality are not known.

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摘 要

本実験においては非遺伝的畸形嘴と思われる三例に遭遇した。その一つは大阪アヒルにおいて認められ、他の二つはニワトリの embryo において認められた。

大阪アヒルは孵卵開始後25日目に約3時間の停電に遭遇した卵から28日目に孵化したもので、約1年間育成しその畸形嘴の発育状態および精液の一般性状について観察された。畸形嘴の度合は日数の経過と共に著明となったが、精液の性状については何等異常は認められなかった。

ニワトリにおける畸形嘴の一例は孵卵開始後9日目に約4時間の停電に遭遇した卵を孵卵15日目に破殻した embryo において認められたものであり、他の一例は破殻3日前から1日6回、約10分間孵卵温度を低下した卵を孵卵10日目に破殻した embryo において認められたものである。前者は一方の無眼球症を伴った上嘴畸形を示し、後者は一方の小眼球症を伴った上嘴畸形を示した。

これらの眼球および嘴の畸形は共に好ましからざる環境要因によって誘起されるものと思われるが、直接この非遺伝的畸形に包含されている因子ならびにその機構についてはよくわからない。