# A STUDY ON THE INCUBATION OF INDIGENOUS (DESI), KHAKI CAMPBELL AND CROSSBRED (INDIAN RUNNER × KHAKI CAMPBELL, $F_1$) DUCK EGGS UNDER TWO PRE-INCUBATION HOLDING PERIODS

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## Summary

Duck eggs from Indigenous (desi), Khaki Campbell and Crossbred (Indian Runner × Khaki Campbell, $F_1$) were incubated to investigate fertility, hatchability and other related traits. The fertility was highest in crossbred followed by Khaki Campbell and Indigenous ducks respectively. The embryonic mortality was highest in Khaki Campbell followed by Indigenous and crossbred respectively. The embryonic mortality was higher in eggs of 7 days pre-incubation holding period and lower in eggs of 3 days pre-incubation holding period. A significant positive correlation was found between temperature and embryonic mortality as well as relative humidity and embryonic mortality. The hatchability on fertile eggs was highest in crossbred ducks and almost similar in both Khaki Campbell and Indigenous ducks. The hatchability was higher in eggs stored for 3 days in comparison with that of 7 days pre-incubation holding period. A negative correlation was found between temperature and hatchability as well as humidity and hatchability. The normal ducklings hatched out from the eggs of Khaki Campbell ducks was highest followed by Indigenous and crossbred respectively. There was a negative correlation between temperature and normal ducklings hatched as well as relative humidity and normal ducklings hatched. The preincubation holding temperature and relative humidity had positive correlation with dead-in-shell.

(**Key Words**: Fertility, Hatchability, Embryonic Mortality, Pre-incubation Holding Period, Temperature, Humidity)

## Introduction

The hatching of an egg is a complex biological process. A number of factors influences the hatchability of eggs of which genetic constitution of birds is one of them. Both the fertility and embryonic mortality are affected by genetic make up of the breeding stock and therefore have considerable influence on the hatchability of eggs (Jull, 1951). Crossbreeding improves fertility and hatchability whereas inbreeding decreases these two traits (Knox, 1946; Marais, 1965). Since hatchability is inherited, the hatchery men should select strain or breed of duck which have high fertility and hatchability. Kaufman (1939) found an increasing trend of embryonic mortality with increasing trend of pre-incubation holding period. Hatchability of eggs may be reduced or destroyed by prolong pre-incubation holding time and improper holding temperature and relative humidity. Byng and Nash (1962) found that the hatchability was decreased as the pre-incubation holding period increased. The dead-in-shell and abnormal chicken were increased as the pre-incubation holding period was increased. Hamid and Salauddin (1986) found positive correlation of temperature and relative humidity with embryonic mortality. Arora and Arnija (1972) observed that the embryonic development in the eggs held for 3 days was better than the eggs not subjected to any pre-incubation holding time. The dead-in-shell, abnormal ducklings and the quality ducklings hatched are generally increased or decreased with the increase or decrease of pre-incubation holding period.

Indian Runner and Khaki Campbell ducks are available in Bangladesh. They are used for egg production and also utilized for crossbred production particultarly for incorporating superior genes into Indigenous ducks commonly known as *desi* ducks. A recent study showed that eggs laid by Indian Runner and Khaki Campbell were

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superior in respect of fertility and hatchability than those of Indigenous ducks (Hamid et al., 1988). In commercial hatcheries, egg coolers are often used to store eggs for the production of large number of quality ducklings throughout the year. Small producers of hatching eggs as well as small hatcheries of mixed farming pattern can not afford cooling machines for storing eggs because of their limited resources. For them, proper storage of eggs under natural environmental temperature and relative humidity is important in order to obtain good hatchability. The present research work was therefore undertaken to study the effect of genetic constitution and preincubation holding period on fertility, hatchability and other related traits of Indigenous (*desi*), Khaki Campbell and Crossbred (Indian Runner × Khaki Campbell, $F_1$) duck eggs.

## Materials and Methods

Eggs from three genotypes (Indigenous, Khaki Campbell and $F_1$ crossbred of Indian Runner × Khaki Campbell) were collected from breeding duck flocks of approximately similar age. Natural breeding was allowed by maintaining a male-female ratio of 1:6 (1 male for 6 females) for each breeding flock for obtaining the fertilized eggs. The eggs were selected for hatching purpose on the basis of their physical characteristics. The selected hatching eggs were stored in such a way that one group reached 3 days and the other group 7 days from the date of storing until they were ready for setting. The ambient temperature and relative humidity of egg storage room were noted three times a day, 8 AM in the morning, 12 noon and 5 PM in the afternoon. At the end of two required holding periods, the experimental eggs were set in trays of a cabinet type forced-draft automatically controlled incubator (Jamesway Mfg. Co. Model 252 Single-stage Incubator) according to genotype and two pre-incubation holding periods. Before setting eggs the incubator was properly cleaned, disinfected and fumigated thoroughly by using potassium permanganate and formalin as per recommendation of the incubator manufacturers. The optimum incubation requirements were maintained by following the instructions of the manufacturers. During the first 24 days, a temperature of 99.5°F and 60 to 65 per cent relative humidity were provided. An automatic egg turning device fitted at the top of the incubator automatically turned (rotated) the eggs 12 times a day at an interval of 2 hours. The eggs were candled by an electric candler on the 7th and 21st days of incubation to check fertility and embryonic mortality and the discarded eggs were broken out to examine macroscopically for the confirmation of the candling results. The hatching eggs were transferred from the setting trays to hatching trays in the morning of 25th days of incubation maintaining pedigree records. From 25th days onwards (until hatching) the hatching temperature was 98.5°F and the relative humidity was 70 to 75 per cent. On completion of the hatch, the unhatched eggs and pips from all groups were also broken to determine the dead-in-shell. All defective ducklings hatched out from eggs were considered abnormal ducklings. The per cent fertility, embryonic mortality, dead-in-shell, hatchability and normal ducklings hatched were determined by calculations. Data on different variables were subjected to analysis of variance using appropriate procedures. The relationships of temperature and humidity with different variables were determined by correlation analysis. The intensity of association between storage temperature & embryonic mortality, storage temperature & hatchability, storage temperature & normal ducklings hatched and storage temperature & dead-in-shell were measured. Similarly, relationship between humidity & embryonic mortality, humidity & hatchability, humidity & normal ducklings hatched and humidity & dead-in-shell were also determined. There were 4 sets of data obtained from 4 sets of eggs considered for 7 days pre-incubation holding period for the determination of each coefficient of correlation value (r). The formula was:

$$r = \frac{\sum XY - \frac{\sum X \sum Y}{n}}{\sqrt{\left[\left\{\sum X^2 - \frac{(\sum X)^2}{n}\right\}\left\{\sum Y^2 - \frac{(\sum Y)^2}{n}\right\}\right]}}$$

where r = coefficient of correlation between x and y

n = number of observations

All statistical procedures were in accordance with Steel and Torrie (1980).

## Results and Discussion

The genetic make up and pre-incubation holding period had no significant effect on fertility, embryonic mortality, hatchability and normal ducklings hatched. Table 1 shows the effects of genotypes on fertility, hatchability and other traits. The fertility was highest in cross-bred ducks (84.5%) and both Indian Runner and Khaki Campbell showed similar results (79%). A recent study conducted by Hamid et al. (1988) showed that fertility in Indigenous and Khaki Campbell laying ducks was 78.8 and 82.5% respectively. These data are very close to the results obtained from Indigenous and Khaki Campbell in the present study. The improvement in fertility as obtained in case of cross-bred ducks was in consistent with the view previously expressed by Knox (1946) and Marais (1965). The embryonic mortality was found to be highest in eggs of Khaki Campbell ducks followed by those of Indigenous and cross-bred ducks respectively. The results on fertility and embryonic mortality clearly indicate the contribution of genetic make up as reported by Jull (1951). When the effect of pre-incubation period was considered, it was found that the embryonic mortality was higher in eggs of 7 days holding periods in comparison with that of 3 days holding period (table 2). This result followed a pattern previously reported by Kaufman (1939).

The relationships of temperature and humidity with different traits considered in this study are shown in table 3. A significant positive correlation ($p < 0.05$) was observed between temperature and embryonic mortality as well as between relative humidity and embryonic mortality. This indicated that the embryonic mortality was increased as the pre-incubation holding temperature and relative humidity was increased. The result agreed well with the findings of Hamid and Sala uddin (1986).

The hatchability on all eggs set of Indigenous and Khaki Campbell was almost similar (67 and 68% respectively) whereas that for cross-bred was 58% (table 1). The results on Indigenous and Khaki Campbell followed very closely to a recent report (Hamid et al., 1988) where 65.5 and 66.6% hatchability were noted for these two groups. From table 2 it is clear that eggs stored

TABLE 1. FERTILITY, HATCHABILITY AND OTHER TRAITS OF DUCKS OF THREE GENOTYPES (%)

| Traits | Indigenous (Desi) | Khaki Campbell | Cross-bred (Indian Runner × Khaki Campbell) $F_1$ |
|---|---|---|---|
| Fertility | 78.8 | 79.1 | 84.5 |
| Embryonic mortality | 19.5 | 21.9 | 16.3 |
| Hatchability on all eggs set | 66.6 | 67.9 | 57.8 |
| Hatchability on fertile eggs | 76.6 | 77.9 | 81.8 |
| Normal ducklings hatched | 91.1 | 96.1 | 87.4 |

Each value is the mean of 4 sets (replicates) each of 150 eggs.
All traits showed non-significant differences.

TABLE 2. INFLUENCE OF PRE INCUBATION HOLDING PERIOD ON EMBRYONIC MORTALITY, HATCHABILITY AND NORMAL DUCKLINGS HATCHED

| Pre incubation holding period (days) | Embryonic mortality (%) | Hatchability on all eggs (%) | Normal ducklings hatched (%) |
|---|---|---|---|
| 3 | 16.9 | 67.0 | 91.6 |
| 7 | 21.5 | 61.2 | 91.5 |

Each value is the mean of 4 sets (replicates) each of 150 eggs.
All traits showed non-significant differences.

TABLE 3. COEFFICIENT OF CORRELATION (r) OF TEMPERATURE AND RELATIVE HUMIDITY WITH SOME TRAITS

| | Embryonic mortality | hatchability | Normal ducklings hatched | Dead-in-shell |
|---|---|---|---|---|
| Temperature | 0.91* | −0.90* | $-0.72^{NS}$ | 0.99** |
| Humidity | 0.90* | $-0.81^{NS}$ | −0.92* | $0.87^{NS}$ |

$^{NS}$ non-significant; * significant at 5% level; ** significant at 1% level.

for 3 days had higher hatchability as compared to those stored for 7 days. In consistent with the findings of Byng and Nash (1962), the present study has made it clear that the hatchability of eggs is influenced by pre-incubation holding period. The present study was carried out during summer months (between 27 April and 23rd July). The results indicate that storing eggs for 3 days during summer time is better since this reduces embryonic mortality and increases hatchability. There was a significant negative correlation ($p < 0.05$) between storing temperature and hatchability but the negative correlation between relative humidity and hatchability was not significant. It indicates that the hatchability decreases with the increase of pre-incubation holding temperature and humidity. The result agrees well with the findings of Reddy et al. (1972) who also reported similar result. It appears from table 1 that the per cent normal ducklings hatched was highest in Khaki Campbell, lowest in cross-breds and intermediate in Indigenous ducks. The results from all groups seemed to be satisfactory. There is reason to believe that the genotype had some effect on the per cent normal ducklings hatched whereas pre-incubation holding period had practically no effect on this variable. There was a negative correlation between temperature and normal ducklings hatched as well as between relative humidity and normal ducklings hatched. When the effect of pre-incubation holding temperature and relative humidity on dead-in-shell was considered, it was found that they had positive correlation with the dead-in-shell. This indicates that the dead-in-shell was greater in number with the increasing rate of pre-incubation holding temperature and humidity.

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