THE HATCHING CHARACTERISTICS OF DIFFERENT STRAINS OF GRAND PARENT CHICKENS

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ABSTRACT

Fertility and hatchability rates were studied in two breeds - A and B - of the domestic fowl, composed of sire (A_S and B_S) and dam (A_d and B_d) grandparent strains respectively. The dam strain (A_d) of A had the highest percent hatchability of 73.18%. The sire strain (B_S) of B had the highest proportion of eggs with dead germ followed by both the B_d and A_S lines whose values were significantly the same. Chick embryo mortality was most critical between the 18th and 21st day of incubation in all strains. The results further show that the A breed had higher rates of fertility and hatchability than the B breed, and that the dam and sire strains of both breeds perfomed differently with regards to the traits examined.

INTRODUCTION

It has been established that hatchability and shell quality decline with age in chickens and turkeys. Several investigators have attempted to determine the regulatory factors of, and the cause and effect relationship between egg fertility, shell quality and hatchability. For example, Sainsbury (1980)., Say (1987); and Agbakoba and Omeje (1989a) have shown that age, light, nutrition, management, mating ratio and semen quality factors influence egg fertility in chicken; while Hunton (1981), Buss (1982)) and Pots and Washburn (1983) have reported that physiology, age, egg size, nutrition and genotype cause differences in egg shell quality among chickens. It has also been observed that the hatchability of eggs set is controlled by the age and nutrition of the dam; incubation temperature; pre-incubation storage conditions; egg shell quality, egg size, and egg fertility among other factors (Card and Nesheim, 1972; Smith and Bohren, 1975, Agbakoba and Omeje, 1989b).

In the study by Payne and McDaniel (1958), it was found that turkey eggs with thin shells as determined by specific gravity, did not hatch as well as those with thick shells. Data from an earlier work by Rauch and Steinke (1953) showed that eggs with extremely thick or thin shells had increased embryonic mortality when compared with those of average thickness. The overall mortality was shown to be as high as 50% for the extremely thick shell eggs and as low as 12% for eggs with shell of average thickness.

The present study was conducted to determine the strain differences in fertility hatchability and embryonic mortality of domestic egg-type chickens.

MATERIALS AND METHODS

Four strains, two from each of two breeds of chickens, A and B, were used. Breeds A and B were of the egg-type grand-parent stock imported from the Shaver and Hubbard Companies in Britain and the United States of America respectively. A_S and A_d comprised the sire and dam parent pair strains of breed A while B_S and B_d the sire and dam strains of breed B. Mating was arranged in four replicate floor pens containing 3 cocks and 30 hens of identical strain each when the birds were aged 28 weeks. A breeder diet consisting of 17.35% crude protein, 2640.69 Kcal/kg metabolisable energy, 3.62% calcium, 0.86% available phosphorus, 0.67% lysine and 0.33% methionine was fed to the chickens from point of lay to 44 weeks of age.

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Eggs layed were collected daily. Good hatching eggs were sorted out, trayed, fumigated and set in a Western Incubator with seperate setter and hatcher units. Eggs set in the incubator were candled on the 18th day. The eggs candled out were cracked to differentiate "infertiles" from eggs containing dead embryos. A truly infertile egg refers to an egg that has never been fertilized. In this study, however, as is the practice in the Hatchery industry, the "infertile" eggs include those whose embryos have started to develop but have died at such an early age that they cannot readily be distinguishable by candling except with the aid of a microscope. Embryos considered to have died within seven days of incubation were differentiated from those between 8 and 21 days by comparison of embryo size and stages of development. The "infertiles" were distinguished as having clear egg contents on cracking, without the visible embryonic dark spot or the developing embryo itself. On the 21st day when the transferred fertile eggs hatched, hatchability of each strain was recorded. This procedure was repeated over three hatches at 7 days interval during which records of twelve observation were taken.

Data collected were subjected to the Analysis of Variance procedure by Steel and Torrie (1980).

RESULTS AND DISCUSSION

The results from Analysis of Variance of fertility, hatchability and dead germ are presented in Table 1. Fertility was not not affected significantly by breeds themselves, instead differences between strains of the breeds were significant ($P < 0.05$). Table 2 shows that the sire strain of B breed had significantly higher rate of fertility than its dam counterpart in the same breed. On the other hand, the dam strain of breed A had apparently the same rate as its sire line even though the value for the former appeared larger but not statistically so. From Table 2 also, it will be observed that the percent hatchability of 76.02 average for breed A was significantly higher than the 71.90% obtained by the B breed. It seemed that the A_S and A_D strains had a higher hatchability than the B_S and B_D grandparent strains. That hatchability was found in this study to be highly affected by breed and strains-within-breed differences confirms that the trait is mainly governed by the genetic constitution of the animal, other factors not withstanding (Landaner 1967; Card and Neshein, 1972).

Table 3 contains the detailed data on embryo mortality whose totals were earlier presented in Table 2. The Table shows that the majority of the developing embryos died between the 18th and 21st days of incubation compared with mortality during the earlier period when eggs were in the setter. It will be observed that the effects of breed and within-breed differences among the strains were not remarkable on chick embryo mortality from 0-17 days of incubation. These differences were however highly important from 18 - 21 days of embryo development to the extent that lower mortality of 12.39% occured among embryos of the A breed compared to the higher 15.44% dead germs obtained from the eggs of the B breed. Within each breed the dam strain had a lower dead germ percentage than its sire counterpart. This variation is consistent with the

Table 1. Analysis of variance for fertility, hatchability and embryonic mortality traits in two breeds and strains of chickens.

Source	Df	Fertility MS	Hatchability MS	Dead Germ MS
Between breeds	1	0.24	50.76**	45.05
Strains within breeds	2	30.04*	102.17**	85.59*
Within strains	8	2.96	2.83	9.70

*$P < 0.05$; ** $P < 0.01$

TABLE 2. STRAIN AND BREED MEANS FOR FERTILITY, HATCHABILITY AND DEAD GERM TRAITS IN TWO BREEDS OF CHICKENS.

	A		B	
	A_s	A_d	B_s	B_d
Total No. egg set	642	3603	1108	3436
Fertility, % Strain	93.41^{ab}	95.14^{b}	96.05b	91.92^{a}
Breed Av.	94.28		93.99	
Hatchability, % Strain	73.18^{a}	78.85^{b}	72.22^{a}	71.58^{a}
Breed Av.	76.02^{b}		71.90^{a}	
Dead germ, % Strain	20.15^{ab}	16.30^{a}	$23,84^{b}$	20.35^{b}
Breed Av.	18.23		22.10	

a < b (P < 0.05)

TABLE 3. PERCENT DEATH-IN-SHELL EMBRYOS AT VARIOUS STAGES OF INCUBATION

Period of Incubation	STRAINS			
	A_s	A_d	B_s	B_d
0-7 days	3.00	3.29	3.05	4.94
Breed Av.	A = 3.15		B = 4.00	
7-18 days	2.80	2.58	2.80	2.53
Breed Av.	A = 2.69		B = 2.66	
18-21 days	14.35^{b}	10.43^{a}	17.99^{c}	12.88^{ab}
Breed Av.	A = 12.39^{a}		B = 15.44^{b}	

a < b; a < b < c (P < 0.05)

report by Hurd (1956) who attributed the observed variation to genetic differences, and also to environmental factors affecting the eggs before and during incubation.

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