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Study on Reproductive Parameters of Barred Plymouth Rock, White Leghorn, Rhode Island Red and White Rock Breed of Cock

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Abstract: The aim of this experiment was to compare hatchability traits of four different breeds. A total of 3087 eggs were collected in 3 batches following artificial insemination from individually caged hen. For different breeds of cock; barred plymouth rock, white leghorn, rhode island red and white rock were compared. Fertility was highest in WLH (95.08%), intermediate in WR (92.57%) and lowest and similar in BPR (88.97%) and RIR (88.16%). Breed had little effect on fertile eggs ($P > 0.05$). However, hatchability on total eggs was highest ($P < 0.05$) and similar in WLH (85.99%) and WR (85.46%), lowest in BPR (81.36%) and RIR (80.21%). Breed had no significant ($P > 0.05$) effect on dead in germ and dead in shell. Among 4 genotypes RIR (98.56%) and WLH (97.90%) were the highest ($P < 0.05$) and similar normal chicks hatched, intermediate in BPR (97.73%) and lowest in WR (96.27%). The percentage of abnormal chicks was observed highest in WR (3.73%), intermediate in BPR (2.27%) and lowest in RIR (1.44) and WLH (1.43). Breed had little effect on chick weight at hatching. Percent chick weight was found highest in BPR (67.24%), intermediate in RIR (65.96%) and lowest and similar in WR (65.47%) and WLH (65.17%). Batch had no significant effect among different hatchability traits.

Key words: Fertility, hatchability, breed, cock

Introduction

The Government of the People's Republic of Bangladesh has given priority in developing poultry sector as a means of quick return and employment generation. Recently, demand for quality chicks and egg is very high throughout the year. Therefore, the year round availability of quality chicks at a reasonable price should be encouraged in commercial hatcheries to meet up the expanding demand. There are many commercial poultry farm rear parent stock to supply hatching eggs and chicks to the consumers. They rear their birds in floor management and practice natural mating. If reared in cages and they practice artificial insemination (AI) to reduce the number of breeder cock and thereby reduce their management cost. In AI, semen collected from one cock is used to inseminate 20-30 breeder hen against 1 cock for 8-10 hen in natural mating. As a result the cost of producing baby chicks is also reduced and farmers can get quality sound chicks at a minimum cost. AI is specially needed when dwarf broiler dams are mated to normal cock. But, limited information is available on the influence of breed when cock and hen are mated artificially. The degree of multiplication of any breeding stock is essential factor to determine success of poultry operations. Fertility and hatchability are the most important determinant for producing more chicks from given number of breeding stock within a stipulated period. Fertility and hatchability performance of eggs depend on a number of factors like genetic, physiological, social and environmental (Warren, 1953; Olsen and Hyne, 1948; Hutt, 1938; Jull, 1970). Jayarajan (1992) compared fertility and hatchability using 19205 eggs of white leghorn (WL), rhode island red (RIR) and white rock (WR)) and found that fertility was highest for WL and WR during the cold season and for RIR during the summer. With this idea in view, current experiment was designed to compare hatching performance of RIR, WR, WLH and BPR using AI under Bangladesh condition. The objectives of the research work were to compare the egg fertility, hatchability and associated traits among RIR, WR, BPR and WLH.

Materials and Methods

The experiment was carried out using eggs of white leghorn (WLH), white rock (WR), rhode island red (RIR) and barred plymouth rock (BPR) at Bangladesh Livestock Research Institute (BLRI), Savar, Dhaka, Bangladesh. The experiment was conducted in summer during February to April 2001.

Cock, hen and experimental design: A total of 200 breeder hen and 40 breeder cock; 50 hen and 10 cock per breed were selected at random for this study. A total of 3087 hatching eggs comprising of 4 breeds; 798 for RIR, 748 for WR, 804 for WLH and 737 for BPR were collected for incubation in 3 batches. The birds were individually caged in an open-sided house providing a cage space of 0.2 m^2 per bird and the cockers were trained for artificial collection of semen. They received only natural day light of 13 h/day. All birds were fed ad libitum on diets containing 150g crude protein, 11.3 MJ metabolizable energy (ME) and 10g calcium per kg diet for cock. The hen was fed on a breeder hen diet containing 180g crude protein, 11.3 MJ ME and 30g calcium per kg diet. Semen from each cock was obtained twice a week in the later part of the day. Each hen was also inseminated twice a week throughout the experimental period. Semen amounting 0.05ml undiluted was used for inseminating each hen each time. Two days following first insemination, the hatching eggs were collected. Eggs were collected twice a day (8.00-11.00 and 14.00-17.00 h) and marked for individual cock and hen. After cleaning and washing, eggs of good shape and sound shell were weighed and then dipped in powerful disinfectant solution. Eggs were stored blunt end up in a cool room at 15 to 17 °C and 75 to 80% relative humidity, over a period of one week and then set for hatching. On the 10th and 18th day, the eggs were candled to identify and remove infertile eggs and eggs with dead embryos and the remaining eggs were placed in pedigree compartments in hatching trays. On the 22nd day, the number of hatched chicks and those dead in shell were recorded. Hatchery sanitation was strictly maintained during the experimental period.

Incubation of eggs: Before setting of eggs the incubator was cleaned, disinfected and fumigated properly. Eggs from a pullet were set adjacent to each other on the same tray. Number of eggs set for each individual sire-hen group of breed was recorded. The eggs were turned by automatically programmed device 12 times in 24h at 2h interval. The following temperature and humidity was maintained during incubation period:

a) Setting temperature 99.7-100 °F up to 18 days of incubation.
b) Hatching temperature 1-2 °F reduced and 98-98.7 from 18 to 21 days of incubation.
c) Setting R.H. 80-85% up to 18th day of incubation.
d) Hatching R.H. 2-5% increased and 87-90% R.H. from 18 to 21 days of incubation and particularly at 21st day R.H. increased to 92%.

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In the afternoon of the 18th day of incubation, the eggs were transferred from the setting trays to different pedigree compartment of hatching trays according to the breed and replication. The eggs were first candled on the 10th day of incubation and again 18th day of incubation with the help of an electric candler to identify the clean or infertile egg and dead embryo. At the 10th day of incubation, in each hatch, clean eggs indicated by candling were discarded and broken to confirm whether the eggs were infertile (clean). The eggs with developed blastodisc were considered as fertile eggs and identified band, ring of blood or dead embryo (dead in germ) simultaneously were discarded and these eggs were broken to confirm day on which embryo died. At the end of each hatch, the unhatched eggs and pips were counted separately as dead in shell according to breeds and replication. The unhatched eggs were broken to confirm the day on which the embryos died. On the 22nd day of incubation, the chicks hatched out of the fertile eggs were recorded as hatched chicks including the normal, weak, abnormal chicks and dead chicks after hatch. The chicks, which were undersized, poorly feathered, parrot beaked, micromelia, blind, lameness, open naveled etc. were considered as abnormal chicks. After discarding all abnormal chicks the rest of the chicks were considered as normal. The weight of all hatching eggs was taken in gram by using an electronic digital balance. Then average was calculated. Calculation were made of fertility, hatchability, embryonic mortality, dead in germ, dead in shell, abnormal chicks hatched, normal chicks hatched. The weight of day-old chicks was taken in gram by using an electronic digital balance and then average was calculated.

Statistical analysis: All the recorded and calculated data were analyzed for ANOVA using a completely randomized design (CRD) with the help of a computer package programme SPSS. Significant differences to compare mean values of all the recorded and calculated parameters among the treatments were found out using least significant differences (LSD). The following model was used during data analysis:

$$Y_{ijk} = \mu + B_i + b_j + (B \times b)_{ij} + e_{ijk}$$

Where; Y_{ijk} is the observation of the kth population of ith breed and jth batches, μ is the overall mean, B_i is the fixed effect of ith breed (I = 1,2,3,4), b_j is the fixed effect of jth batch (j = 1,2,3), e_{ijk} is the random error assumed to be distributed $(0,\sigma^2)$.

Results

Effect of cock of different breeds on hatchability traits: The different hatchability traits as influenced by cock of different breeds; barred plymouth rock (BPR), white leghorn (WLH), rhode island red (RIR) and white rock (WR) are presented in Table 1.

Fertility was highest ($P<0.01$) in WLH (95.08%), intermediate in WR (92.57%), lowest and similar in BPR (88.97%) and RIR (88.16%). Breed had little effect on fertile eggs ($P>0.05$). Apparently, the hatchability on fertile eggs was highest in WR (92.27%) followed by those of WLH (89.77%), RIR (89.14%) and BPR (88.50%). Batch had no significant effect on fertile eggs. However, hatchability on total eggs was highest ($P<0.05$) and similar in WLH (85.99%) and WR (85.46%), lowest in BPR (81.36%) and RIR (80.21%) without significant difference ($P>0.05$) among 3 batches. Among the breeds, dead in germ (DG) seems highest ($P>0.05$) in WLH (3.57%) followed by those of RIR (3.47%), WR (3.23%) and BPR (2.68%). But, neither breed nor batch nor their interaction influence DG significantly. Breed, batch and their interaction did not alter dead in shell (DS). Apparently, DS was highest in WLH (5.98%), followed by those of BPR (5.03%), RIR (4.88%) and WR (4.74%) respectively. Among 4 genotypes RIR (98.56%) and WLH (97.90%) was the highest ($P<0.05$) and similar normal chicks hatched, intermediate in BPR (97.73%) and lowest in WR (96.27%). Batch did not influence the sound normal chicks hatch. The percentage of abnormal chicks was observed highest ($P<0.01$) in WR (3.73%), intermediate in BPR (2.27%) and lowest in RIR (1.44) and WLH (1.43). Batch had no significant effect on abnormal chicks. Breed had little effect on chick weight at hatching ($P>0.05$). Among the breeds average chick weight of WLH (39.02g) was the highest followed by BPR (38.85g), RIR (38.51g) and WR (38.12g) without any significant ($P>0.05$) deference. Percent chick weight was found highest ($P<0.01$) in BPR (67.24%), intermediate in RIR (65.96%) and lowest and similar in WR (65.47%) and WLH (65.17%). Batch had no significant ($P>0.05$) influence on percent chick weight.

Discussion

Highest fertility recorded for light breed WLH than in other breeds in the current study is supported by Tam and Wong (1974) and Reddy *et al*. (1965). Tam and Wong (1974) compared fertility among cantonese, wai chow, white leghorn (WLH) and new hampshire (NS) where the fertility was 84.30, 83.62, 89.59 and 88.95% respectively. Reddy *et al*. (1965) reported fertility of WLH, RIR and WR showed 87.10, 76.30 and 69.40% respectively. Difference of fertility among batches (in different periods) agrees with Jayarajan (1992). Differences in hatchability on total eggs and lack of differences in hatchability on fertile eggs among genotypes signify that in this study hatchability on total eggs recorded was just a reflection of fertility. This finding of hatchability on fertile eggs agrees well with Chaudhry and Alvi (1967) who found no significant difference in hatchability on fertile eggs between breeds of rhode island red and new hampshire ($P>0.05$). It also agrees with Reddy *et al*. (1965) who noted highest hatchability for WLH (66.80%) than for other breeds (RIR, 59.60% and WR, 44.10%) on set eggs but differed for WR. The obtained results are supported by Luztre *et al*. (1969). Swan (1977) reported higher percentage of hatchability (both fertile and set eggs) in meat strain than that

Table 1: Hatchability traits of rhode island red (RIR), barred plymouth rock (BPR), white leghorn (WLH) and white rock (WR) of sire

	Breed				LSD (SED) and level of significance +		
Parameters	BPR	WLH	RIR	WR	B	BT	B X BT
Fertility (%)	88.97	95.08	88.16	92.57	5.130**	(1.688)^{NS}	8.886**
Hatchability on fertile eggs (%)	88.50	89.77	89.14	92.27	(2.022)^{NS}	(1.751)^{NS}	(3.502)^{NS}
Hatchability on set eggs (%)	81.36	85.99	80.21	85.46	4.823*	(2.102)^{NS}	(4.204)^{NS}
Dead in germ (%)	2.68	3.57	3.47	3.23	(1.033)^{NS}	(0.895)^{NS}	(1.790)^{NS}
Dead in shell (%)	5.03	5.98	4.88	4.74	(1.358)^{NS}	(1.176)^{NS}	(2.353)^{NS}
Normal chicks (%)	97.73	97.90	98.56	96.27	1.592*	(0.694)^{NS}	(1.387)^{NS}
Abnormal chicks (%)	2.27	1.43	1.44	3.73	1.790**	(0.589)^{NS}	(1.178)^{NS}
Average chick weight (g)	38.85	39.02	38.51	38.12	(0.361)^{NS}	(0.313)^{NS}	(0.626)^{NS}
Chick weight (%)	67.24	65.17	65.96	65.47	1.410**	(0.464)^{NS}	1.844*

NS = Non significant, *$P<0.05$; **$P<0.01$; B = Breed; BT = Batch.

in egg strains, which do not agree with the finding of present study. Lack of influence of both breed and batch in dead in germ (DG) impress that DG may be a more environment dependent trait regardless of genetic background. Present findings are also similar with the Byerly and Olsen (1934). They reported that embryonic mortality (dead in germ) was apparently highest in WLH than in RIR observed in first 3 days of incubation. No relation of dead in shell (DS) to breed found contradicts (Jull, 1951). Jull (1951) also reported genetic constitution had some effect on embryonic mortality providing good feeding management and maintaining optimum condition. Number of sound normal chicks is an indication of success of hatchability. The significant difference ($P<0.05$) among breed without significant effect of batch indicate that breeds of cock may be good determinant of chick normality giving impetus to investigate for correct genetic background to the percentage of normal chicks in hatching eggs in chicken. Moreover, the result also indicates that management and environment may have fewer roles in control of chick normality. The present study impresses significant effect of abnormal chicks hatched ($P<0.01$) may be influenced to a great extent by the breeds of cock used. Result also signifies the importance selecting cock of correct genetic make up to minimize chick abnormality. No relation with breeds of cock to chick weight impress that is rather a maternal effect with less relation with genetic make up of cock to be used. The results impress that comparatively large size eggs always did not produce heavier chicks; rather breed had an important role. Relative chick weight (chick weight as percent of egg weight) was in favour of heavier breeds along with the effect of egg weight.

From this study, considering the overall hatchability traits it is concluded that breed might have little effect on hatchability of eggs in fowl. White leghorn and white rock seems comparatively superior to RIR and BPR in hatchability under Bangladesh condition. Selection of cock of correct genetic background seems to important in getting more normal chicks in hatches. The WLH appeared to have more positive relations among hatchability parameters than in other breeds.

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