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EFFECT OF SPACING ON REPRODUCTIVE PERFORMANCE OF INDIAN PEAFOWL (*Pavo cristatus*) IN CAPTIVITY

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ABSTRACT: Effective use of available cage spaces in wild bird breeding systems in captivity is of prime economic concern. Present study was carried out at Punjab Wildlife Research Institute Faisalabad to evaluate effect of cage sizes on reproductive performance of the Indian Peafowl (*Pavo cristatus*). Three groups; A, B and C of Indian Peafowl were selected and nurtured under three different cage sizes, viz. 30, 21 and 12 square meters with an available space of 10, 7 and 4 square meters per bird, respectively. The birds were kept with a sex ratio of 1 male:2 female. Number of male mounting, egg production (average number of eggs laid per hen), average egg weight, percent egg hatchability, percent egg fertility and chicks' average weight were found significantly higher ($P<0.01$) in Indian Peafowl reared in $21m^2$ cage size, followed by cage sizes of 30, and12 m^2, respectively. This study indicated that, in case of Indian Peafowl, the breeding flock kept at intermediate cage spacing performed better than that kept at large spacing or at too narrow spacing.

Key words: Indian peafowl, *Pavo cristatus*, Egg, Reproductive traits, Fertility and Hatchability.

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INTRODUCTION

Increase in human population, habitat destruction and degradation due to human settlements, industrialization, food scarcity, hunting and trapping have caused decline in population of Indian Peafowl (*Pavo cristatus*) in its natural habitats (Anwar *et. al.*, 2015 and Jain and Rana, 2013). Captive breeding programs of Indian Peafowl are initiated by provincial wildlife departments in the country (Ali *et. al*., 2011). In Punjab province, captive breeding of Indian Peafowl is also carried out in various wildlife breeding centers and wildlife parks (Mushtaq *et. al*., 2012, 2013).

Social organization, incubation and spacing pattern during breeding is significantly associated with declined hatchability and thus causes a direct reproductive drawback and the birds living at low densities face difficulty in synchronizing reproduction between sexes. In captivity, environmental conditions such as upkeep and sheltering should be taken into deliberation to get maximum gains of genetic capabilities of birds. Cage structure, ventilation, light, warmth, moisture, stocking density are of significance for rearing fowls. Therefore, optimal stocking density for rearing different species of fowl in captivity should be determined to raise efficiency of the breeding system to reap maximum net economic benefits (Erişir and Erişir, 2002). Other variables, like stocking density, sex ratio, age of breeding flock, period and conditions of egg storage, parental live weight and ages of male and female partners in breeding flock also affect fertility and hatchability of incubated eggs.

Housing systems are mainly significant elements impacting poultry efficiency Roshdy *et al*., (2010) and may also affect the morphological, physical and chemical properties of eggs (Lewko and Gornowicz, 2011). The housing systems are crucial for the generative efficiency in an indirect way. Kucukyilmaz *et al*., (2012) detected significant affect of two dissimilar housing systems of laying hens on feed intake, feed conversion ratio (FCR), egg weight and distortion. Similarly, the housing system impacts on the results on hatchability in Japanese quails are reported by Roshdy *et al*., (2010). Keeping in view the above facts, the present study was aimed at to evaluate the effect of cage area per bird on production, fertility and hatchability of eggs in Indian Peafowl.

MATERIALS AND METHODS

This experiment was carried out at Punjab Wildlife Research Institute, Faisalabad, (31.4781° N, 73.2083° E) Pakistan, from March to August 2010 for 24 weeks. The experimental Peafowls were selected from the stock available at Wildlife Breeding Centre, Gatwala, Faisalabad with apparently no phenotypic variations on random basis and were divided in three groups (Table-1).

All randomly selected experimental birds were fed same commercial breeder feed and allowed to acclimatize to the cages for four weeks prior to data collection. The birds were watched for collection of mounting data. The eggs were collected on daily basis, cleaned, marked, weighed, fumigated with formaldehyde solution and $KMnO_4$ Vali *et. al*., (2005) and stored in room at a temperature of 15-18^{o}Cwith relative humidity (RH), 75-80 %. Locally made incubator was used having separate setter and hatcher chambers. Incubation temperature was kept at 99.7-100°F and the relative humidity was maintained at 80-85%. At termination of hatching process, unhatched eggs were broken and carefully assorted as infertile, hatched, with embryonic mortality (with dead in shell chicks) and normal chicks. One day old chicks were weighed by electronic balance to calculate average weight. Reproductive recital of each group was computed (Anandh *et. al*., 2012 and Dauda *et al*., 2014). The data was statistically analyzed with computer software MINITAB 2000. Duncan's Multiple Range (DMR) test was used to compare means.

Table 1: Cages dimension, area, stocking density and sex ratio of Indian Peafowl during experiment.

Factor	Group		
	A	B	C
Dimension of Cage (m)	7.25 x 4.15	4.57 x 4.57	4.13 x 2.90
Area of Cage (m^2)	30	21	12
Stocking Density	0.1	0.14	0.25
Available area per bird (m^2)	10	7	4
Peafowl per cage with sex ratio	1♂:2♀	1♂:2♀	1♂:2♀
Approximate age of the birds (year)	7	7	7
Repetitions	3	3	3

RESULTS AND DISCUSSION

Analysis for the effect of the cage size, number of mountings per day, number of eggs produced, average egg weight, percent hatchability, percent fertility and average weight of chick at the time of hatching is summarized in Table-1. Feed consumption in all the three groups of peafowl differed significantly, (P<0.01, F value=518.70, df = 2), maximum in group B (97.25 ± 1.00 g) followed by group A (81.69 ± 1.40 g) and group C (68.95 ± 1.87g). Egg production per peahen differed significantly in different groups (P < 0.01, F value = 81.53, df = 2). On an average, maximum eggs were produced by peahens of group B (2.09 ± 0.16 eggs) whereas there was no statistically significant difference in mean egg production by peahens of group A (0.20 ± 0.08 eggs) and group C peahens (0.73 ± 0.10 eggs).

Significant difference was recorded among the number of mounts in different groups of peafowl (P<0.01, F value = 18.32, df = 2), least mounts in group C (0.33 ± 0.13), intermediate in group A (0.71 ± 0.29) and maximum in group B (1.87 ± 0.07). Same pattern was found in fertility of eggs produced by different groups (P<0.01, F value = 96.72, df = 2), maximum in group B (80.66 ± 2.64) followed by group A (67.14 ± 2.38) and group C (32.85 ± 2.34). Similarly there was significant difference in hatchability percentage among various groups, (P<0.01, F value = 93.07, df = 2), maximum in group B (63.82 ± 1.23 %) followed by group A (44.75 ± 2.63 %) and group C (28.81 ± 2.20%). Average egg weight,71.44 ± 5.38 g, 97.79 ± 4.98 g and 52.17 ± 0.91 g, respectively among spacing groups A, B and C which differed significantly (P<0.01, F value=2.04, df=2) i.e. heavier eggs were produced by group B, followed by group A and C.

Available spacing in the cages had a significant effect on both feed consumption, egg production and other parameters of reproduction success. Birds of group B reared at intermediate spacing, consumed more feed, males mounted more often, females produced more eggs that were heavier in weight with higher fertility and hatchability and produced heavier chicks in comparison to the other two groups (Table-2). In Italian quails, feed intake and egg production were lower at lower spacing (Faitarone *et al*., 2005). A moderate density gave best higher gain per quail housed per day. In avian species, feed intake had a significant positive correlation with egg production (Zou and Wu, 2005).

Present study revealed that birds in group C, reared at higher densities were less successful with respect to breeding performance parameters. The Indian Peafowls have a very large tail with spectacular dancing and display patterns to synchronized with and lure peahens for breeding and therefore needed proper space for efficient breeding, lesser spacing likely to create hindrance and barriers in the discharge of breeding behavior and functioning. Japanese quail, gain in body weight, mortality, hen-day egg production and food conversion increased with rise in cage space per layer. In Italian quails feed intake and egg production were lower at lower spacing. Less feed intake due to several reasons resulted in decreased egg weight and egg production in avian species and increase in feed intake i.e. increase in intake of protein and other ingredients resulted in increase in egg production (Zou and Wu, 2005).

The average egg weight was higher and had better hatchability in group B than group A and group C

(Table-2). Similar effects of stocking densities were demonstrated in Italian quails on different economic traits including egg production, space per bird resulted in a linear decrease in egg weight and egg mass reported by Faitarone *et al*., (2005). The chicks hatched from eggs produced by group B females were heavier than the other two groups. Chick weight was significantly correlated to egg weight and was a significant effect on every aspect of survival and growth of chicks except for embryo mortality (Seker *et al*., 2004).

Fertility of the eggs was one of the key issues determining hatchability of a given set of eggs (Deeming and Wadland, 2001). The egg quality and fertility were vital factors to hatchability. With no management constraints during incubation and hatching, fertility affected the hatchability. Thus, hatchability was abridged with decrease in fertility (Farooq *et al*., 2001). Similar association between percentage of fertile eggs and percent hatchability was observed in the present research. There was a significant difference in number of male mountings in different study groups of birds($P<0.01$) minimum was observed in group C while maximum in group B, having maximum fertility and hatchability. There is a scope to further investigate the role of male mountings in relation to space and shape of the breeding cages on breeding behaviour under captive conditions.

Table 2: Effect of spacing on feed consumption and reproductive performance of Indian Peafowl.

Reproductive Traits	**Trial Groups**		
(Mean ± SE)	**A**	**B**	**C**
Feed Consumption (g)	81.69 ± 1.40^{b}	97.25 ± 1.00^{a}	68.95 ± 1.87^{c}
Number of mounting	0.71 ± 0.29^{b}	1.87 ± 0.07^{a}	0.33 ± 0.13^{b}
Egg production per hen	0.20 ± 0.08^{b}	2.09 ± 0.16^{a}	0.73 ± 0.10^{b}
Egg weight (g)	71.44 ± 5.38^{b}	97.79 ± 4.98^{a}	52.17 ± 5.91^{c}
Egg hatchability (%)	44.75 ± 2.63^{b}	63.82 ± 1.23^{a}	28.81 ± 2.20^{c}
Egg fertility (%)	67.14 ± 2.38^{b}	80.66 ± 2.64^{a}	32.85 ± 2.34^{c}
Chicks weight (g)	15.00 ± 1.13^{b}	20.54 ± 1.05^{a}	10.96 ± 1.24^{c}

Note: Row-wise means bearing same letter do not differ statistically significantly, $p < 0.01$

Conclusion: Indian Peafowl breeding trios in 21 m^2cages gave better results but further studies are required to be carried out for narrowing down various parameters for reducing production costs and increased net profits in breeding Indian Peafowl in captivity.

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