Short Paper

Effects of mating sex ratios in Indian peafowl (*Pavo cristatus*) on production performance at Wildlife Research Institute, Faisalabad (Pakistan)

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Summary

Effects of mating sex ratios on production performance in Indian peafowl were investigated at Punjab Wildlife Research Institute, Gatwala Faisalabad. Research was conducted from May through August 2007 to explore the most productive mating sex ratio. The sex ratios have a significant effect on egg production. Maximum mean eggs (1.63) were produced by the sex ratio 1:2 while maximum egg fertility (79.63%) and hatchability (61.59%) was noted in the sex ratio 1:3. Sex ratios had a significant effect on egg weight. Sex ratios have shown no effect (except number of mountings) on courtship behavior of peafowl. Statistically less feed was consumed by sex ratio 1:3 and better feed conversion was shown by sex ratio 1:1.

Key words: Mating sex ratios, Indian peafowl, Egg production, Fertility and hatchability

Introduction

Indian peafowl breeds from April through October. Peafowl is polygynous and generally has two to three breeding peahens in its harem (Roberts, 1992). A recent study of a feral population suggests that peafowl does not defend its harem due to small breeding territory (Rands *et al*., 1984). Clutch size is usually 4 to 9 eggs in natural habitat but in captivity the hen lays 8-20 eggs and the incubation period is about 28-30 days (Anon., 2002). Hunting of Indian peafowl is prohibited under the Punjab Wildlife (Protection, Preservation, Conservation and Management) Act-1974. The captive breeding program of peacock was started by the Punjab Wildlife Department a few decades ago. The main purpose of this program was to increase the number of threatened or endangered species in captivity and reintroduce them into their original habitats. It also provided a research platform for researchers to boost understanding of the biology of this species. These activities may provide important information for conservation efforts.

There is very little published work on the relationship between the mating sex ratios and fertility in peafowls. Therefore, a study was carried out to find the effects of mating sex ratios on egg production, fertility and hatchability of eggs in Indian peafowl to investigate the most productive mating sex ratio in Indian peafowl.

Materials and Methods

This study was carried out at Punjab Wildlife Research Institute, Faisalabad from May through August, 2007. Nine pens (each having a dimension of $10^{/}$X $10^{/}$ X $7.5^{/}$) were

used to keep the peafowls. A total of 27 birds (9♂ & 18♀) were selected. Age of peafowls was 6 years, approximate weight of peacock was 4.6-5.1 kg and of peahen was 3.4-3.9 kg. Peafowls were kept in three experimental groups (Nickolova, 2004). Sex ratios were 1♂: 1♀ (group A), 1♂: 2♀ (group B) and 1♂: 3♀ (group C). Every group served as treatment and each treatment had three replicates.

Peafowls were given an adaptation period of one week and were fed on breeder hen diet containing 180 g crude proteins, 11.3 millijoules metabolizable energy and 30 g calcium per kg diet (Islam *et al*., 2002). Feed was offered to peafowls daily at 09:00, whereas water for drinking was given at 09:00 and 17:00 daily. Cages were cleaned every day to save the peafowls from any disease. Medication/vaccination of peafowls was done at the start and middle of the trial. Water soluble premixes were added for 4 days in drinking. This process was repeated after every two weeks.

Weighed quantity of breeder ration @200g/peafowl was offered to each replicate as per ration schedule of Punjab Wildlife Department. Unconsumed feed was weighed and removed from each feeding pot to record feed intake by each replicate (Khan *et al*., 2006). Feeding pots were again filled with fresh feed daily. Total and average feed intake per peafowl was calculated on a weekly basis.

Egg production was recorded daily from the onset of egg laying. Eggs of each group were marked following Khan *et al*. (2006). Per peafowl weekly egg production for each group was also calculated. Egg weight (g) was recorded on a weekly basis by using all eggs collected during the week (Zou and Wu, 2005). This gave the total mass of eggs produced by different groups in a week which was later used for calculation of feed conversion ratio (FCR).

FCR = Feed consumed/Kg egg production (Khan, 2001)

Eggs were stored in a store room at 15°C to 18°C having relative humidity 75-80% till setting in an incubator. At the end of the incubation period (waiting for five days from the appearance of first hatched egg) non-hatched eggs were separated and cracked to see late embryonic mortality (chicks' dead in shell) and were subjected to fertility control. Data of each group were used to calculate the fertility (%) of incubated eggs (Seker *et al*., 2004).

Fertility (%) = (number of fertilized eggs/total numbers eggs placed into incubator) × 100

Data on courtship behavior were collected for every sex ratio from 8 to 18 5 times daily. Data for display numbers, display duration, number of mountings and total time taken for mating were recorded for every sex ratio.

Completely randomized design (CRD) was used to analyse the data (Minitab, 2000) and Duncan's multiple range (DMR) test was used to compare means of all parameters (Snedecor and Cochran, 1980).

Results

All three sex ratios had a significant effect on mean feed consumption ($P<0.05$). Minimum mean feed was consumed by group C (56.06 ± 1.93) and maximum by group B (67.77 ± 1.67). The feed consumption in group A was 61.69 ± 1.66 (Table 1).

Sex ratios showed significantly different effect on mean egg production and egg weight per peahen ($P<0.05$). Maximum mean egg per peahen was produced by group B (1.64 ± 0.15) whereas group A and C produced statistically similar mean eggs (0.71 ± 0.13 and 0.68 ± 0.06, respectively. Mean egg weight was statistically similar in group B and C (92.46 ± 5.42 and 85.84 ± 4.99, respectively) and different with group A ($P<0.05$) (49.87 ± 8.60).

Minimum mean FCR was in group A and maximum in group C. The values of FCR in group A, B and C were 1.70 ± 0.33, 3.06 ± 0.38 and 5.48 ± 0.54, respectively. Sex ratios showed significant effect on mean FCR values ($P<0.05$).

Statistically mean minimum fertilized eggs (%) were produced by group A and maximum by group C. Egg fertility (%) was 33.65 ± 1.49 in group A, 65.05 ± 3.95 in group B and 79.63 ± 4.27 in group C. Minimum mean hatch-able eggs (%) were in group A and maximum in group C. The hatchability in group A was 24.76 ± 5.39, in

Table 1: Influence of male: female ratios on reproduction (Mean ± SE) of Indian peafowl (*Pavo cristatus*) at Wildlife Research Institute Faisalabad during 2007 (Row-wise similar alphabets show statistically non-significant differences between the mean at 0.05)

Parameters	Sex ratio groups		
	A (1:1)	B (1:2)	C (1:3)
Feed consumption (g)	61.69 ± 1.66^{b}	67.77 ± 1.67^{a}	56.06 ± 1.93^{c}
Egg production (No.)	0.71 ± 0.13^{b}	1.63 ± 0.15^{a}	0.68 ± 0.06^{c}
Egg weight (g)	49.87 ± 8.6^{b}	92.46 ± 5.42^{a}	85.84 ± 4.99^{a}
Feed conversion ratio	1.70 ± 0.33^{c}	3.06 ± 0.38^{b}	5.48 ± 0.54^{a}
Egg fertility (%)	33.65 ± 1.49^{c}	65.05 ± 3.95^{b}	79.63 ± 4.27^{a}
Egg hatchability (%)	24.76 ± 5.39^{c}	40.39 ± 3.90^{b}	61.59 ± 1.55^{a}
Display			
i. duration (in minutes)	7.84 ± 0.68	7.86 ± 0.89	7.50 ± 0.33
ii. number	10.10 ± 0.81	10.33 ± 0.59	12.33 ± 0.87
mounting			
i. number	0.13 ± 0.07^{c}	0.53 ± 0.07^{b}	1.33 ± 0.18^{a}
ii. time taken (in minutes)	7.13 ± 1.47	12.30 ± 2.66	13.98 ± 1.36

group B was 40.39 ± 3.90 and in group C was 61.59 ± 1.55. Sex ratios showed significant effect on mean egg fertility and hatchability ($P<0.05$).

Duration of display (minutes) and display number were not affected by sex ratios ($P>0.05$). Duration of display was 7.84 ± 0.68, 7.86 ± 0.89, and 7.50 ± 0.33 in groups A, B and C, respectively. Number of display was 10.10 ± 0.81 in group A, 10.33 ± 0.59 in group B and 12.33 ± 0.87 in group C.

Sex ratios showed statistically significant effect on mean number of mountings ($P<0.05$). Mean minimum mountings were noted in group A (0.13 ± 0.07) and maximum in group C (1.33 ± 0.18). Number of mountings in group B was 0.53 ± 0.07. Mean total time taken for mating in all the three ratios was not significantly different ($P>0.05$). Mean total time taken for mounting ranged from 7.13 ± 1.47 (group A) to 13.98 ± 1.36 (group C). Mean total time taken in group B was 12.30 ± 2.66.

Discussion

There was significant effect of sex ratios on mean egg production ($P<0.05$) in peafowls. Mean number of eggs per peahen laid were 0.71 ± 0.13, 1.63 ± 0.15 and 0.68 ± 0.06, respectively, for 1:1, 1:2 and 1:3 sex ratios. These results closely resembled those of Deeming and Wadland (2002) who observed the influence of mating sex ratios in commercial pheasant flocks and reported that egg production was significantly higher for the 8:1 mating ratio than that of 12:1.

There was significant difference of egg weight among the sex ratios. Egg weight for sex ratio 1:1, 1:2 and 1:3 was 49.87, 92.46 and 85.84 g, respectively. Present results in Table 1 have also shown that sex ratios significantly affected percent of egg hatchability in peafowls ($P<0.05$). Hatchability in sex ratio 1:1, 1:2 and 1:3 was 24.76, 40.39 and 61.59%. Sachdev *et al*. (1985) found a higher fertility and hatchability in fertile eggs of Japanese quail (*Coturnix japonica*) in heavy eggs (10.1-11.00 g) than light eggs (7.01-8.90 g). Similarly, Sarica and Soley (1995) observed the highest fertility and hatchability rate in incubated eggs in Japanese quail having egg weight 11.6 g and over. They determined the lowest level of fertility and hatchability rate in eggs that had a weight of 9.5 g and lower. Seker *et al*. (2004) reported an increase in hatchability rate with increase in egg weight in Japanese quail.

Sex ratio 1:3 showed higher egg fertility (%) as compared to other ratios. Fertility of the eggs is one of the major factors determining hatchability of all egg set (Deeming and Wadland, 2002). Jayarajan (1992) is of the opinion that environment and management often influence the effect of breed on egg fertility and hatchability. Fertility and egg quality are two important factors which affect hatchability if management is not a limiting factor. Fertility can affect hatchability during the process of incubation and hatching. Hatchability is reduced with reduction in fertility (Farooq *et al*., 2001). Hatchability is higher on the basis

of fertile eggs than that on the basis of total eggs set (Murad *et al*., 2001). In this study a similar relationship between percent of fertile eggs and percent of hatchability was recorded i.e. the higher the percent of fertile eggs the higher is the percent of hatchability.

Sex ratios have a non-significant effect on display duration, display number and total time taken for mating, however, sex ratios have a significantly higher effect on mounting numbers (mating) in different groups. Mounting numbers were higher in 1:3 ratio (1.33 ± 0.18). There is a scope for investigation of breeding behavior of peafowls under captive conditions to assess their effects on egg production (Mateos, 1998). Different ecological and social factors affect hatchability of eggs in different bird species. Significant relations among these factors and hatchability of eggs were obtained by Koenig (1982). Nwagu (1997) highlighted that optimum incubation conditions like the right temperature, humidity and ventilation during the setting and hatching stages are vital for best results.

It is concluded that the 1:2 sex ratio showed better results in terms of egg production and egg weight, whereas the 1:3 ratio showed better results in terms of less feed consumption, more egg fertility (%), egg hatchability (%) and number of mountings. The lowest feed conversion ratio was noted in sex ratio 1:1. Since the aim of this study was the conservation of peafowl (*Pavo cristatus*) with reference to the wildlife point of view, it is proposed that 1:3 ratio be used for the breeding of this wild bird under captive conditions.

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