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OBSERVATIONS ON THE REPRODUCTIVE BEHAVIOR OF INDIAN PEAFOWL (*PAVO CRISTATUS LINN.*) UNDER CAPTIVITY

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ABSTRACT

Indian peafowl, *Pavo cristatus* (*P. cristatus*) is a beautiful bird but its population is declining in the wild and currently it is declared as a threatened species according to International Union for Conservation of Nature (IUCN). Therefore, captive breeding of this species is common for its conservation.The present study was designed to elucidate various parameters of sexual behavior of this bird, such as breeding season, clutch size, hatching time, age at maturity of both male and female and breeding interval under captive conditions in Punjab, Pakistan. It was observed that the mean clutch size of *P. cristatus* at one captive site, government zoological gardens, was 8.6±0.55eggs and at the other captive site (private sectors) were 7.24±0.6 eggs. Female birds spent more time in feeding and less time in standing compared to their respective males. Similarly, females spent significantly more time in walking and running but less time in sitting, preening and calling compared to their respective males. Indian peafowls breed from May to August at the two field captive sites.Time for hatching of eggs of *P. cristatus* was observed to be 27.92±0.17days and 27.96±0.12days at the government and private sites, respectively. At these sites, the bird breeds only once in a year. Age at reproductive maturity of female Indian peafowl was 2.41±0.13 years and 2.26±0.12 years and of male was 2.65±0.65 and 2.71±0.63 years, respectively at both government and private captivity sectors.The results of the present study should be helpful especially to farmers for information concerning the breeding season and behavioral activities of the bird under captivity. Furthermore, breeders will be able to timely implement proper management practices before the onset of the breeding season of this bird in order to obtainmore fruitful results in terms of their business.

Key words: Breeding Pattern, Reproductive Behavior, Captive Breeding, Indian peafowl, Pakistan.

INTRODUCTION

Indian peafowl (*Pavo cristatus Linn*.) is cosmopolitan in distribution; however, India, Sri Lanka, Pakistan, Nepal, Burma and Congo are considered to be its nativehomeland (Ansari, 1957). Arkan hills and mountains of Himalayas have prevented the migration of this bird to the east and the north, respectively (Vijayarani *et al.,* 2010). Commonly, this bird is present in dry deciduous forests rather than green lands; lands that are deprived of human populations and have plenty of water sources are the favorite habitats of this bird (Jaiswal *et al.,* 2013). Small territory and sufficient food supply are the basic requirementsof this bird. Most of the peafowls are reportedto exist in areas 900-1200 meter above sea level. This bird has the ability to adapt according to variations in weather conditions and can survive well in both hot and cold climates (Kaliner and Miringa 1972; Krautwald and Schildger 1986). Indian peafowl is thought to be one of the largest flying birds. Attractive train and plumage are the reasons behind their worldwide fame (Liu *et al.,* 2005). Their mean weight amounts to 2.7±06 kg; length varies between 0.86 meter to 2.12 meter, and the wingspan stretches from 1.4 to 1.7 meters. This bird has lengthy androbust grayish brown legs that are equipped with brush for their protection from predators (El-Shahawy, 2010). Spur of about 2.5 cm in length are fortified in both sexes; males use them to compete with other males during breeding season. Color of female bird is greyish brown to cream while the chicks are light yellow to brown in color (Rao and Acharjyo, 1979). Train of almost 1.3 m length is seen in males during June-December. They use to discard this train in January, but during breeding season this train grows more rapidly (Sahajpal and Goyal, 2008). Neck and breast are of bright blue color, golden feathers have lines on their sides and backs, while trains sparkle with multiple colors (Pabisch *et al.,* 2010). Spreading out of male's train, shine in green, gold, brown and black feathers. Around the outer edges of fan about 35-45 v-shaped ocelli are present (Hart, 2002). This intricate pattern gives advantage to the bird to disappear in foliage and is also beneficial in mating (Sahajpal and Goyal, 2008; Hart, 2002). When the breeding behavior of Indian peafowl is studied, the following parameters, such as feeding, sitting, calling, preening, display, running, etc., is of great interest (Harikrishnan *et al.,* 2010). There are three types of Indian peafowl. White feathered peafowl have white plumage throughout the body (Khan *et al.,* 2009); they should not be confused with albinos as thelatter belong to pure white breeders having brown eyes. Pied peacock is

another type with white feathers in plumage randomly (Amoudi, 1988). Incomplete dominant gene is considered to be responsible for these color variations. Black-winged peafowl is a mutated breed having dark feathers with blue-green tips (Athar *et al.,* 1996; Stewart *et al.,* 1996). A new mutation in feathers also has been observed but not reported in hybrids of *P. cristatus with P. muticus* (Green peafowl) resulting in genetic diversity among the breeds (Weiss and Kirchner, 2010).

MATERIALS AND METHODS

Observation were recorded on 25 pairs (n=25 pairs) of *P. cristatus* in captivity at five government zoological gardens from Punjab-Pakistan, focusing five pairs in each of the government zoological gardens. Similar observations were made on 25 pairs (n=25 pairs) at five private sector in Punjab-Pakistan. Specifically, reproductive behavior of the bird was studied by observing different morphological characteristics which play a great role in the breeding of Indian peafowl. Female preference is based on visual, auditory and olfactory signals from certain males. For elucidating the accurate breeding behavior, parameters, such as site and structure of the nest, clutch and incubation period, season of breeding and air temperature were monitored under captive conditions. Male courtship display was also monitored and time-span for each activity was noted. Peacock tail plays a key role to attract the female for mating; tail display behavior was monitored as described by Hollamby *et al.,* (2003). To record the breeding behavior of Indian peafowl, birds were observed for one year, with the routine time period of observations stretching from 07:00 am to 04:00 pm. Observations, such as when a female approaches a male and the male starting to display and beginning to shiver his train at the female followed by copulating behavior of both male and female were made and recoded. Post-copulation behavior of male and female of the bird was also recorded. Any aggressive contact from either side was also monitored.

Statistical Analysis: The collected data were analyzed by using Repeated Measure Design ANOVA to compare different groups. For thisanalysis, Statistical Package of Social Sciences (SPSS version 17.0) was used. A difference of $P<0.05$ level was considered significant.

RESULTS

Frequency of Mating of Female *Pavo cristatus:* Mating frequency of female *P. cristatus* is shown in Table 1. Data indicate that respectively 68% and 76% of the total females copulated at least once; 32% and 24% females copulated more than once under government zoological gardens and private sector captivity. However, no statistically significant difference ($P>0.05$) was observed between mating frequency of female *P. cristatus* at the government and private observation sites.

Number of Times of Copulation by Female *Pavo cristatus:* In the government zoological gardens, out of a total of 8 female *P. cristatus* that copulated more than once, three copulated two times, one copulated three times, two copulated four times, one copulated five times, and one copulated nine times. Similarly, at the private sector site, out of a total of 6 female *P. cristatus,* two copulated two times, two copulated three times and one copulated six times, while one copulated eight times (Table 2).

Number of Mates of Female *Pavo cristatus:* At the government zoological gardens, out of a total 8 female *P. cristatus* that copulated more than once, five copulated with two male partners, two copulated with three male partners, while only one female copulated with five male partners. Similarly, at the private sectorstudy site, out of a total 6 female *P. cristatus* that copulated more than one time, three copulated with male birds two times, two copulated three times with male partners, while only female copulated six times with male partners (Table 3).

Breeding Behavior: Proportion of time taken for some common behaviors of Indian peafowl, such as feeding, standing, walking, running, sitting, displaying, preening, and calling was calculated from scan records for a period of six weeks. It was discovered that male Indian peafowl spends more time in display and less time in other activities as compared to their females (Table 4.)

MeanNumber of Ocelli with Successful Mating: Data on mean number of ocelli with successful mating rate in Indian peafowl at both government and private sector observation sites had no significant effect as shown in Table 5. The number of eye spots is irrelevant in feathers with male's successful mating pattern.

Mean Number of Eggs Laid per Season: Mean clutch size of *P. cristatus* at the government captive area was 8.6 ± 0.55 and at the private sectorarea was 7.24 ± 0.61 (Table 5) having no statistically significant difference ($P>0.05$) between thetwo observation sites.

Mean Time Required for Egg Hatching: The mean time required for hatching of *P. cristatus* eggs at the government zoological gardens location and at the private sector site were 27.92 ± 0.17days and 27.96 ± 0.12 days respectively. There was no significance difference ($P>0.05$) between the egg hatch-time between the two field study sites (Table 5).

Breeding Interval: The observation record on mean breeding interval of *P. cristatus* at the government zoological gardens and at the private sector showed no statistically significant difference ($P > 0.05$) between the two experimental observation sites (Table 5).

Mean Age at Reproductive Maturity of Female Indian Peafowl: The mean age at reproductive maturity of female *P. cristatus* at the government zoological gardens and at the private sector site was 2.41 ± 0.13years and 2.26 ± 0.12 years, respectively, showing no statistically significant difference (P>0.05) between the female Indian Peafowl sexual maturity between the two field captive sites(Table 5).

Mean Age at Reproductive Maturity of Male Indian Peafowl: The mean age at reproductive maturity of female *P. cristatus* at the government zoological gardens and at the private sector site was 2.65± 0.65years and 2.71 ± 0.63 years, respectively (data not shown). There was no significant difference (P>0.05) between the male Indian Peafowl regarding the mean age at sexual maturity at the two study sites (Table 5).

Table 1. Frequency of Mating of Female *Pavo cristatus* at the Two Field Captive Sites

Parameters	Field Captive Sites		*P*-Value
	Government Zoological Gardens (n= 25pairs)	***Private Sectors (n= 25pairs)***	
Number of females copulated once	17 (68.00 %)	19 (76.00 %)	0.5287
Number of females copulated more than once	8 (32.00 %)	6 (24.00 %)	

Table 2. Number of Times Female *Pavo cristatus* Copulated.

Field Captive Sites	Numbers of Female	Number of CopulationTimes
Government Zoological Gardens	3	2
	1	3
	2	4
	1	5
	1	9
Private Sectors	2	2
	2	3
	1	6
	1	8

Table 3. Number of Male Mating Partners of Female *Pavo cristatus*

Field Captive Sites	Number of Female	Number of Mates
Government Zoological Gardens	5	2
	2	3
	1	5
Private Sectors	3	2
	2	3
	1	6

Table 4. Percentage of time allocated for each behavioral activity by Indian peafowl for a period of six observation weeks during a breeding season.

Behavior Category	Field Captive Observation Sites					
	Government Zoological Gardens			Private Sectors		
	Male	Female	*P*-value	Male	Female	*P*-value
Feeding	24.97	54.56	< 0.0001	25.18	54.44	< 0.0001
Standing	36.91	19.93	< 0.0001	37.03	20.21	< 0.0001
Walking	12.97	20.50	< 0.0001	13.07	20.58	< 0.0001
Running	0.20	0.75	< 0.0001	0.19	0.76	< 0.0001
Sitting	0.20	0.17	< 0.0001	0.20	0.18	< 0.0001
Display	15.76	---	---	16.02	---	---
Preen	2.05	1.79	< 0.0001	2.13	1.84	< 0.0001
Call	2.93	0.06	< 0.0001	2.97	0.08	< 0.0001

Table 5. Behavioral variations in Indian Peafowl under two different captive field sites

Parameters	Field Captive Sites		*P*-Value
	***Government Zoological Gardens* (*n= 25*pairs)**	***Private Sectors* (*n= 25*pairs)**	
Mean no. of Ocelli with Successful Mating Rate	36.33 ± 0.94	34.87 ± 0.86	0.262
Average number of Eggs Per Season	8.6 ± 0.55	7.24 ± 0.61	0.096
Mean time to Hatching	27.92 ± 0.17	27.96 ± 0.12	0.869
Mean Breeding Interval	1.08 ± 0.05	1.06 ± 0.07	0.394
Age at Reproductive Maturity of Female Indian Peafowl	2.41 ± 0.13	2.26 ± 0.12	0.425
Age at Reproductive Maturity of male Indian Peafowl	2.65± 0.65	2.71 ± 0.63	0.486

DISCUSSION

The observations recorded indicate that female birds spent more time in feeding them and less time in standing as compared to their males. Similarly, females spent significantly more time in walking and running but less time in sitting, preening and calling the male birds. These observations agree with the findings of Harikrishnan *et al.* (2010) reporting that female Indian peafowl spent more time in walking, running, feeding andless time in sitting, preening and calling. El-Shahawy (2010) performed an experimental study and observed that males with maximum number of eyespots in their trains have greater rate of mating success and if the ocelli are experimentally removed from the trains, mating success rate decreases significantly. Similar findings were observed in the present study showing that greater the number of ocelli greater will be the mating success rate. Hence, there is direct correlation between number of ocelli and mating success rate. It has been documented that males with more number of ocelli have greater energy; leading to female's first choice to copulate with them. Chicks inherit strong immune system if peahens choose peacock with most number of ocelli (Kumar *et al.,* 2013; Saini *et al.,* 2007). Grimmett (2011) documented that the mean number of eggs laid by peahen per season was 8.06 ± 0.32. Samour *et al*. (2010) observed the mean numbers of eggs per season were 6.99 ± 0.57 while investigating the hematologic and biochemical aspects of Indian peafowl and a similar outcome was reported by Rao and Acharjyo (1979): their documented mean number of eggs per season was 7.01 ± 0.69. The present study findings also correlate with the above-given data. Moreover, mean number of eggs laid by peacock significantly decrease under captivity conditions compared to their natural habitats. Barbieri *et al.*(2012) and Black *et al.*(2010) reported April-August as breeding season of *P. cristatus* mostly under captivity. It may be due to the suitable environmental temperature and level of humidity suited for egg laying during April-August. Results of the present study are in agreement with similar earlier studies as months from May to August were most suitable for the peafowl to breed in the governmental and private field sites. Ansari (1957); Athar *et al.* (1996) has documented the *P. cristatus mean* hatching time as 26.98 ± 0.85days, 27.95±0.13days, 28.11±0.12 days and 28.33±0.05 days respectively; the findings of the present study are in agreement with the reports of these authors. The main reason for the long hatching time is that the males play much less role than the females in hatching eggs. Peahens look after the eggs alone until the eggs hatch. Amoudi (1988), Partington (1836) and Zhou (2015) described the phylogenetic lineage of Indian peafowl. Further, it was reported that peahens breed only once in a year. However, they may breed more than one time if their hormonal level is disturbed or eggs previously laid were broken by other aggressive peacocks, ready to mate with peahen. Findings in the present study were similar as reported earlier, and there was no obvious significant difference regarding the breeding interval of *P. cristatus.* Peahen lays only one clutch in a breeding season, but female can lay two to three clutches in a year if they are reared in captivity or eggs are taken away fromthe females. According to Rao and Acharjyo (1979) and Stewart *et al.* (1996) maturity age of peacock is 2-3 years; females mature earlier than males. It takes almost three years for a male to have fully developed train, a main feature for the mating success and preferences for peahen. The present study also revealed that female *P. cristatus* take less time to mature than their males.

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