International Archive of Applied Sciences and Technology
Int. Arch. App. Sci. Technol; Vol 10 [2] June 2019 : 134-142
© 2019 Society of Education, India
[ISO9001: 2008 Certified Organization]
www.soeagra.com/iaast.html

IAAST
ONLINE ISSN 2277- 1565
PRINT ISSN 0976 - 4828

CODEN: IAASCA REVIEW ARTICLE

DOI: .10.15515/iaast.0976-4828.10.2.134142

Reappraisal of Seven decades of Behavioral research on the Indian Blue Peafowl (*Pavo cristatus*)

Isha Hina, Deep Singh and Reshma Bhatnagar
Department of Zoology, Faculty of Science
Dayalbagh Educational Institute (Deemed to be University), Agra-282005
1 Email id: ishashah2008.is@gmail.com
Corresponding author: mailmedeepsingh17@gmail.com, reshma.bhatnagar@gmail.com

ABSTRACT
This review article is a detailed reappraisal of seven decades of research on the Indian Blue Peafowl, Pavo cristatus, native to the Indian subcontinent. It is listed under Least Concern category by the IUCN Red Data List but currently this bird is facing a multitude of threats due to habitat destruction and consequent predation, poaching for feathers and flesh, conflict with farmers, use of chemical fertilizers and pesticides and above all, exotic consumerism. Ethological data and analysis is an indispensable tool for any conservation plans but this species has not been studied for all behavior patterns across the country, except for the courtship display. Modern innovative methods, tools and software based coding/analyses are completely lacking in publications till date. Hence there is an urgent need for intense and diversified non-invasive observational data from across the country so that precautions can be taken to ensure good population levels for management, maintenance and conservation efforts of this bird.
Keywords: Peafowl, behavior, tools, softwares, management, conservation.

Received 24.02.2019 Revised 08.04.2019 Accepted 30.05.2019

CITATION OF THIS ARTICLE
Isha Hina, Deep Singh and Reshma Bhatnagar. Reappraisal of Seven decades of Behavioral research on the Indian Blue Peafowl (*Pavo cristatus*).Int. Arch. App. Sci. Technol; Vol 10 [2] June 2019: 134-142

INTRODUCTION

The order Galliformes of family Phasianidae includes peafowls, jungle fowls, pheasants, partridges, turkeys, grouse, chickens and quails. They are commonly known as game birds[13,25]. Pheasants are native to Asian countries except the Congo peafowl which is endemic to the Democratic Republic of Congo in Central Africa. Several species of pheasants have been introduced by humans in various parts of Europe and North America. Pheasants and humans are closely associated; because of their large appearance and mainly terrestrial occurrence, they are easy to trap and shoot; their meat and eggs provide rich sources of protein. Apart from the benefits, they have been absorbed into human cultural traditions over the centuries. 51 species of pheasants are found all across the world, but in India only 17 species are found with scanty ecological information recorded about their biology, ecology and behavior[16].

Peafowls are the largest birds among pheasants. Only three species of peafowls are found worldwide which belong to the following two genera[14]:

1). ***Afropavo-*** *Afropavo congensis* is the only species which belongs to this genus. It is commonly known as African Peafowl or Congo Peafowl. It is near endemic to the Central Congo lowland forests of the Belgian Congo in Africa.

2). ***Pavo-*** It has two species, both are found in Asia. *Pavo muticus*, commonly known as Burmese Peafowl or Green Peafowl is found in Sumatra. *Pavo cristatus,* commonly known as Indian Blue Peafowl, is found in India and Srilanka.

Pavo is derived from Latin word *pawe*, which refers to the peacock, and the species *cristatus* refers to the crest[28]. Peafowl was declared the national bird of India in 1963[25,37]. IUCN Red Data Book, 2016 reported the conservation status of peafowl as Least Concern (LC) category. It is protected under Schedule-I of Indian Wildlife Protection Act, [9,18] and its subsequent amendment and Appendix-I of CITES[6,18].

Three morphs are found of peafowl: The white feather peafowl that is not an albino, it has brown eyes; another morph is pied, it has random white feathers appear in the plumage due to incomplete dominant gene; and the last morph is black-winged peafowl, it has dark feathers with blue green tips. Since last two decades, new mutation in the plumage has been introduced almost every year[22].

Geographical range

The geographical range of *P. cristatus* is the Indian subcontinent and Srilanka, Pakistan but can also be found in Nepal, Burma, Java, Malaya and rarely found in Bhutan and possibly extinct in Bangladesh. It has been introduced in the Andaman Islands, Europe, Australia, Hawaii Islands, South Africa, New Zealand, West Indies and USA[37].

Habitat

The preferred habitats are deciduous forests, semi-arid biomes and patchy lands, with adequate area for dust bathing and lekking[12,37]. Riparian regions i.e. interface areas of land and riverine water in the range of 900-1200 m above sea level are also the preferred habitat. Indian peafowls easily survive in non-forest areas near human settlements and even in urban areas[18]. They are able to adapt much colder climates than their native place. They are often kept in urban gardens and zoos.

Habit

They indulge in dust bath which helps to remove parasites from their trains but they do not get wet in rain because rain makes their feathers too heavy and weighs them down. They require a lot of water to drink. Peafowls are ground dwellers, omnivorous and opportunistic feeders[36].

Sexual dimorphism in adults

Males have blue neck, blue crested crown, train feathers are long, blue-green and have spots known as ocelli. They are more colorful and larger than females[43]. Females have grey neck with a green-blue patch around the upper neck region, brownish crested crown and have short tail without the long train feathers[20].

Juveniles

Juveniles resemble females but the size is about half of adult counterparts[25]. There are no records of any sexual dimorphism among the juveniles of this species.

Life cycle

The average life span is 20 years. They reach sexual maturity at the age of 2-3 years. They are polygamous. Females generally lay 4-7 eggs which are incubated only by them. The eggs take about 28 days to hatch. The chicks are nidifugous i.e. they leave the nest shortly after hatching[45].

ECOLOGICAL IMPORTANCE

Positive aspects

The water/ash extract of feathers of *Pavo cristatus* is high in iron, protein and steroids. It acts as an inhibitor to harmful enzymes in snake venom and has been used for traditional treatment of snake bites *viz Vipera russelii* (Russell's viper), *Naja naja* (common cobra) and *Trimeresurus malabaricus* (Malabar pit viper). In tribal regions of India, various body parts of *Pavo cristatus* are used for preparing drugs in traditional treatments[8,25]. They also kill venomous snakes and consume a large variety of insects which can reduce the need of pesticides used on crops[22,30].

Negative aspects

Some researchers consider *P. cristatus* as crop pest that may cause potential threats to disrupt the ecosystem. It predates on endangered lizards and other smaller but ecologically precious animals, which can alter the ecosystem stability. They can be a nuisance in some residential areas because of frequent vocalizations[22].

Review of literature reveals that qualitative and quantitative analyses of different behavioral pattern of peafowls have been studied by researchers:

Table: 1. Behavioral aspects of peafowls studied till date

Behavior	Researcher's Name	Year	Inferences	Qualitative analysis	Quantitative analysis
Foraging	Rajeshkumar and Balasubramanian	2012	Peafowls are omnivorous and prefer open scrub vegetation for foraging	X	√
	Deepa *et al.*	2013	They forage in early morning and late evening	√	√
	Chopra and Kumar	2015	Maximum time devoted to foraging	√	√
Locomotion	Rajeshkumar and Balasubramanian	2012	Locomotion may be due to food requirement, nesting and roosting	X	√
	Fowler	2011	They can cover only short distances at a stretch	X	X
Roosting	Subramanian and John	2001	Peafowls are both communal and solitary roosters	X	√
	Beauchamp	2013	Peafowls begin roosting on trees before sunset	√	√
	Mittal and Chaturvedi	2013	Peafowls are mostly communal roosters	X	√
	Chopra and Kumar	2015	Maximum time devoted to roosting	√	√
Vocalization	Takahashi and Hasegawa	2008	Males produce different types of calls and six alarm calls produced by males and females	√	√
	Beauchamp	2014	Peacocks normally use *eow* and sometimes *ka* call during courtship display	√	√
	Dakin and Montgomerie	2014	Copulation hoot calls attract females to peafowl lek	√	√
	Nicholas and Yorzinski	2016	Peahens are able to differentiate anti-predator calls of different individual conspecifics	√	√
Courtship	Petrie *et al.*	1991	Peahens prefer peacocks with more elaborate trains	√	√
	Petrie *et al.*	1999	Males are closely related to other males within a same lek than the males at other leks	√	√
	Loyau *et al.*	2008	For selection of their mating partner females may use eyespot density rather than the number of eyespots in train	X	X
	Takahashi *et al.*	2008	No correlation between mating success rate and peacocks with more elaborate trains	X	X
	Dakin and Montgomerie	2009	Peacocks perform courtship display towards the sun and the position of breeding females	√	√
	Harikrishnan *et al.*	2010	Some differences occur in the wild and captive populations of peafowl which may alter the intensity of display	√	√
	Beauchamp	2013	Breeding behavior of introduced population of peafowl seems to be similar to conspecifics in native place	√	√
	Gokula and Muthukrishnan	2015	Peacocks perform courtship display even in the absence of peahens while presence of peahens influences the display duration of peacock	√	√
Mating	Hassan *et al.*	2012	Significant effect of mating sex ratio on egg production while no	X	√

			significant effect of mating sex ratio on courtship behavior		
Nesting	Subramanian and John	2001	December-March is the breeding season and the nest is made up of *Prosopis* bushes	X	√
	Mittal and Chaturvedi	2013	Peahens prefer *Prosopis* bushes for nesting and the nesting period is October	√	X
Parental care	Loyau *et al.*	2007	Only maternal care	X	X
Conflict	Jackson	2006	Males defend their territories from other males during breeding season	X	X
Vigilance	Jackson	2006	Peafowls are very cautious and always alert to danger	X	X
Grooming	Harikrishnan *et al.*	010	Mostly males engage in self-grooming	√	√

(√ = conducted; X= not conducted)

Review of literature reveals that qualitative or quantitative analyses of several aspects of *P. cristatus* behavior have been conducted, though none of these studies cover all behaviors across all age groups and habitats. Moreover, the techniques used are also not standardized nor updated at par with similar studies done on other animal/bird groups. There is no standard battery of techniques or minimal sample threshold specified for their target populations. The techniques are varied and therefore no concise and comprehensive record and analyses are available that would test any hypotheses from the empirical data sets. (Table 2).

Foraging

P. cristatus is omnivorous[12,15,35,36] and feeds on terrestrial worms, termites, insects, frogs, snakes, lizards. They also feed on tree and flower buds, petals, leaves, seeds, grains, nuts, roots, tubers, grass and bamboo shoots. They ingest pebbles to facilitate their storage and grain grinding help in the gizzard[22,36]. The foraging has been generally observed in early mornings and the late evenings[12]. *P. cristatus* spent most of time in feeding rather than other activity[24].

Locomotion

P. cristatus exhibits bipedal locomotion and flapping flight to cover a short distances. Long train of male is the reason for its limited mobility[15]. The long, greyish brown legs are very strong and help in escape and perching the heavy body during roosting[15].

Roosting

Peafowls roost on high trees with medium canopy and they generally select the tallest trees for roosting in forests from where they clearly seen in all directions and protect themselves from predators such as leopards and other big cats[23,25]. Roosting sites of peafowl is negatively correlates with human disturbance and positively correlates with canopy of trees and parks[21]. Males are both communal and solitary roosters while females roost communally with juveniles and other females, as a strategy of protection from predators[1,17,41]. There are a number of tall trees in which peafowls roost at night such as *Azadirachta*, *Pyrus*, *Mangifera*, *Cocus*, *Eucalyptus*, *Syzigium*, *Acacia*, *Dalbergia* and *Ficus*. Peafowls have been observed to roost when the light intensity dropped below 8 lux[41].

Vocalization

There are many different types of calls reported so far and they are described in Table 4. Vocalizations alter due to seasonal and diurnal changes. Females can differentiate between anti-predator calls of individual conspecifics[32].

Courtship

Different researchers have reported different types of courtship displays which are depicted in Table 3. Males perform courtship displays towards the sun[10]. Typically they breed in monsoon season[11]. The display territories are established by males in mid-April and are maintained until the end of the breeding season when molting of train begins[46]. Peafowls have a lek like mating system[26]. Several males involve in lekking and females visit the lek

sites to assess and select mates. Males having longer tarsus and longer train might be more dominant males and perform high quality of display. Competing males are often closely related to each other[35].

Mating and Nesting

While several researchers have reported this species to be polygamous, some have the opinion that it is a polygynous species. The details are mentioned in Table 3.

Peafowls make nests on the ground and bushy areas with dry sticks and leaves. There seems to be a disagreement among researchers regarding the nesting period also, as shown in Table 3. Nest is protected by females, they move very short distances from the nest only for feeding and return soon[28].

Parental care

Only females are involved in the incubation of eggs and rearing of the chicks. Males do not engage in parental care, only maternal care has been reported, however unusual instance of a male incubating a clutch of eggs has been reported[39]. Chicks are mobile and fully feathered after hatching. They can fly at about one week age and depend on their mother only for 1-2 weeks[26]. Juveniles take 2-3 years to attain sexual maturity.

Conflict

During the breeding season, males defend their territory from other males. In the non-breeding season, the males are less aggressive towards other males, but if they feel any threats from other animals, they attack[22]. Females are aggressive with other females regarding potential mates and try to monopolize the selected males[34].

Vigilance

Peafowls are very cautious and always alert[22]. They spend most of their time perched on high branches of trees. Their heads and neck are always moving in vigilance.

Grooming

Most of the time, peafowls engage in self-grooming, especially those males whose mating success rate is high. It is because of the long ornamental train. This is known as 'high maintenance handicap' because only the long train and fittest males perform courtship display for long period of time to attract females for mating[19].

Table: 2. Peafowl behavior studies: Methodologies/techniques used till date

Behavior	Researcher	Year	Method/Technology	Method/Technology references
Foraging	Rajeshkumar and Balasubramanian	2012	Focal sampling Method	Altman 1974
	Chopra and Kumar	2015	Scan Sampling Method	Altman 1974
	Deepa *et al.*	2013	Direct and Indirect Method	X
Locomotion	Rajeshkumar and Balasubramanian	2012	Focal sampling Method	Altman 1974
Roosting	Subramanian and John	2001	X	X
	Chopra and Kumar	2012	X	X
	Mittal and Chaturvedi	2013	X	X
Vocalization	Beauchamp	2014	SYSTAT 10., Sonogram. and Raven Lite	X
	Dakin and Montgomerie	2014	Raven V 1.3, R 3.0.1 Generalized linear models	Bioacoustic Research programme 2008 R Development Core Team 2013
	Nicholas and Yorzinski	2016	Raven Pro v 1.4 Luscinia sound analysis SAS v.9.3	Lachlan, 2007 SAS Institute
Courtship	Petrie et al.	1999	Genomic DNA sampling Montel tests Randomized testing version 2.1 Compass method	Manly, B.F. Manly, B.F.
	Dakin and Montgomerie	2009	Parametric second-order analysis X	Zar, 1999
	Beauchamp	2013	SYSTAT 10., Sonogram. And Raven Lite	X
	Beauchamp			

	Gokula and Muthukrishnan	2014 2015	PAST Software	X Hammer *et al.*, 2001
Mating	Harikrishnan *et al.* Takahashi and Hasegawa	2010 2008	Scan sampling method SPSS V.14.0 Generalized linear mixed model, Sonogram	Altman, 1974 X
Nesting	Subramanian and John Mittal and Chaturvedi	2001 2013	X X	X X
Parental care	X	X	X	X
Conflict	X	X	X	X
Vigilance	Yorzinski and Platt	2013	Eye Tracking Software SAS v9.3	Yarbus,(Positive Science, LLC)
Grooming	X	X	X	X

(√ = present; X=absent)

Table: 3. Ambiguities regarding certain behavioral aspects of *P. cristatus*

Peafowl Aspects	Researchers	Year	Ambiguities
Train and eyespots density	Petrie *et al.*; Takahashi and Hasegawa	1991; 2008	Peacock's train is not the universal target of female choice but it is a good indicator of genes
	Loyau *et al.*	2008	Males may use eyespot density rather than the number of eyespots in train Positive
	Fowler	2011	correlation between peafowl's train and its mating success
	Kushwaha and Kumar	2016	Females mate the males who have most eyespot
Mating and Nesting	Ali and Ripley	1987	January-October
	Yasmin and Yahya	1996	Starts from October to end December when molting of train begin Monsoon is the breeding season
	Das and Sivakumar	2009	December-March
	Subramanian and John	2001	Monsoon is the breeding season April-
	Harikrishnan *et al.*	2010	September is a mating period
	Fowler	2011	Starts from late September to mid December
	Beauchamp *et al.*	2013	Starts from October and until December first week
	Gokula and Muthukrishnan	2015	
Clutch size	Subramanian and John	2001	3-6 eggs per clutch
	Hassan *et al.*	2012	4-9 eggs per clutch
	Beauchamp *et al.*	2013	5-6 eggs per clutch
	Fowler	2011	3-12 eggs per clutch

Table 4: Different vocalizations of *P. cristatus* identified till date

Call		Behavior	Reference
Vocalized by	**Acoustic**		
Males	*hoot*	Hoot-dash display in attempt to copulate	Petrie *et al.* (1991, 1992); Takahashi and Hasegawa (2008); Beauchamp, (2014); Dakin and Montgomerie (2014)
Males	*ke-ow*	Trumpet complex of mating calls	Petrie *et al.* (1991); Takahashi and Hasegawa (2008); Beauchamp, (2014)
Males	*ka*		
Males	*eow*		
Males	*eon 1*		Takahashi and Hasegawa (2008)
Males	*eon* 2		
Males	*may-awe*	During display	John and Rana (2013)
Males	*kian-kian*	Attempt to copulate	Yasmin and Yahya (1996)
Males and females	b*u*	Alarm calls	Takahashi and Hasegawa (2008); Beauchamp, (2014)
Males and females	*bu-girk*		Takahashi and Hasegawa (2008); Beauchamp, (2014); Nicholas and Yorzinski (2016)
Males and females	*pe*		Takahashi and Hasegawa (2008); Yorzinski and Platt (2013)
Males and females	*pe-girk*		Takahashi and Hasegawa (2008)
Males and females	*khok*		Takahashi and Hasegawa (2008)
Males and females	*he-on*		Rajeshkumar and Balasubramanian (2012)
Juveniles	*kokok*		Takahashi and Hasegawa (2008); Beauchamp, (2014)
Juveniles	*a*		Takahashi and Hasegawa (2008)

Pavo cristatus is one of the most beautiful and largest flying birds. It is the national bird of India; cited as a species of significant economic and ecological importance. The courtship display of this genus is the most studied and perhaps the best example in animal kingdom. However, currently this bird is facing a multitude of threats due to habitat destruction and consequent predation, poaching for feathers and flesh, conflict with farmers, use of chemical fertilizers and pesticides and above all, exotic consumerism. Tackling exotic consumerism is one of the goals of the UN Environment Program (UN Year Book, 2016). There is no concise data on the consumerism facts and trends of this bird from India and neighboring countries. Although listed under Least Concern category by the IUCN, the population trends have been labeled as declining in urban and local areas. Hence there is an urgent need for intense and diversified non-invasive observational data from across the country so that precautions can be taken to ensure good population levels. Several questions related to the accurate time periods of breeding, display, mating, nesting and clutch size, breeding success determinants, parent-offspring interactions, juvenile dimorphism, intra- and inter-specific interactions, population trends, vocalizations, conflict

and social cognition system of *Pavo cristatus* still remain unanswered. Behavior research on these aspects of peafowl involving thorough hypotheses testing with help of sophisticated and innovative tools like camera traps, radio telemetry, robotic mimicry tools and behavior coding software is the need of the hour for planning and taking informed decisions by wildlife management authorities for any maintenance and conservation efforts of this bird.

ACKNOWLEDGEMENT

We would like to thank Dayalbagh Educational Institute, Agra and Dr. Reshma Bhatnagar for guidance and support. We are also thankful to CSIR-UGC, Delhi, India for financial support for conducting the research work.

REFERENCES

1. Ali, S. & Ripley, S.D. (1978). Compact handbook of the birds of India and Pakistan Vol (1), *Oxford University Press*, New Delhi.
2. Ali, S. & Ripley, S.D. (1987). Compact handbook of the birds of India and Pakistan together with those of Bangladesh, Nepal, Bhutan and Srilanka. 2nd ed. Pp. i-xii, 1-737,52ll. Delhi*: Oxford University Press*.
3. Beauchamp, A. J., Ave, B. & Onerahi, W. (2013). Breeding and behavior records of peafowl (*Pavo cristatus*) at Mansion House Historic Reserve, Kawau Island, New Zealand, 1992-2010. *Notornis*, 60: 224-232.
4. Beauchamp, A. (2014). Calling and display by peacocks (*Pavo cristatus*) at Mansion House Historic Reserve, Kawau Island, New Zealand. *Notornis*, 61: 27-34.
5. BirdLife International. 2016. *Pavo cristatus*. The IUCN Red List of Threatened Species 2016: e.T22679435A92814454.
6. Chopra, G. & Kumar, T. (2012). Study of daily activities of Blue Peafowl, *Pavo cristatus* Linnaeus, 1758 in Kurukshetra, Haryana. *The Ecoscan*, 9(1&2): 165-168.
7. Chopra, G. & Kumar, T. (2015). Study of roosting sites of Blue Peafowl, *Pavo cristatus* Linnaeus, 1758 in district Kurukshetra, Haryana. *Nature and science*, 10(4): 49-55.
8. Dadhich, P. National Bird of India, Indian Peafowl: In Danger?. Biome Ecology
9. Dakin, R. & Montgomerie, R. (2009). Peacocks orient their courtship displays towards the sun. *Behavioral Ecology and Sociology*, 183(4): 558-564.
10. Dakin, R. & Montgomerie, R. (2014). Deceptive copulation calls attract female visitors to peacock leks. *The American Naturalist*, 183(4): 558-564.
11. Das, N. & Sivakumar, K. (2009). Population status and distribution pattern of Indian peafowl (*Pavo cristatus* Linnaeus, 1758) in Chilla range, Rajaji National Park. *Indian Forester*, 135(10): 1391.
12. Deepa, A. A., Gunasekaran, C., Mohana, P., Lena, M. & Elanchezhian, M. (2013). Survival strategy , population and habitat utilization (domesticated and captive) of Indian peafowl, (*Pavo cristatus*) in Bharathiar University Campus and V.O.C. Park (Mini Zoo) The Western Ghats, Tamil Nadu, South India. *International Journal of Recent Scientific Research*, 4(6): 787-789.
13. Delacour, J. (1977). Pheasants of the World. *Spur Publication and WPA*:395.
14. Dharmakumarsinjhi, R. S. & Lavkumar, K. S. (1981). Indian peafowl, Sixteen Indian birds. Publication division. Ministry of information and broadcasting, *Government of India*, 24-28
15. Fowler, E. (2011) "*Pavo cristatus*" (On-line). *Animal Diversity Web*., Accessed July 08, 2016.
16. Fuller, R. A. & Garson, P. J. (eds.). (2000). *Pheasants. Status Survey and Conservation action Plan 2000-2004.* WPA/BirdLife/ssc Pheasant Specialist Group. IUCN, Gland. Switzerland and Cambridge, UK and the World Pheasant Association, Reading, UK. vii + 76 pp.
17. Gadgil, M (1972). The function of communal roost relevance of mixed roosts. *Ibis*, 114: 531-533.
18. Gokula, V. and Muthukrishnan, V. (2015). Display behavior of Indian Peafowl *Pavo cristatus* (Aves: Galliformes) during the mating season in Viralimalai, Tamil Nadu, India. *Taprobanica: The Journal of Asian Biodiversity*, 7(1): 8-13.
19. Harikrishnan, S., Vasudevan, K. & Sivakumar, K. (2010). Behavior of Indian peafowl *Pavo cristatus* Linn. 1758 during the mating period in a natural population. *Open Ornithology Journal*, 3: 13-19.
20. Hillgarth, N. (1984). Social organization of wild peafowl in India. *World Pheasant Assoc. J*, 9: 47-56.
21. Hussain, M. S., Sultana, A. and Arafat, Y. (2018). Conservation and management of the national bird, Indian Peafowl *Pavo cristatus*, in urban green areas of Delhi, India. Ambient Science, 5(2): 1-7.
22. Jackson, C. (2006). *Peacock*. London: Reaktion Books LTD.
23. Johnsingh, A. J. T. & Murali, S. (1980). The ecology and behaviour of the Indian peafowl (*Pavo cristatus*) Linn. Of Injar. *Journal Bombay Natural History Society*, 75(3):1069-1079.

24. Kaur, S. & Kler, T. K. (2017). Studies on different behavioral activities of Indian peafowl (*Pavo cristatus*) in agricultural areas of Punjab. *Journal of Entomology and Zoology Studies*, 5(5): 294-300.
25. Kushwaha, S. & Kumar, A. (2016). A review on Indian Peafowl *Pavo cristatus* Linnaeus, 1758. *Journal of Wildlife Research*, 4(4): 42-59.
26. Loyau, A., Jalme, M. S., Mauget, R. & Sorci, G. (2007). Male sexual attractiveness affects the investment of maternal resources into the eggs in peafowl (*Pavo cristatus*). *Behavioral Ecology and Sociology*, 61(7): 1043-1052.
27. Loyau, A., Petrie, M., Jalme, M. S. & Sorci, G. (2008). Do peahens not prefer peacocks with more elaborate trains?. *Animal Behaviour*,76: 5-9.
28. Mittal, A. & Chaturvedi, S. (2013). Roosting and nesting habits of Indian Peafowl, *Pavo cristatus*. L. at Keoladeo National Park, Bharatpur, Rajasthan. *World Journal of Applied Sciences and Research*, 10(2): 73-84.
29. Mittal, A. & Chaturvedi, S. (2014). Population and distribution of Indian Peafowl, *Pavo cristatus*. L. at Keoladeo National Park, Bharatpur, Rajasthan. *World Journal of Applied Sciences and Research*, 4(1): 39-43.
30. Murari, S., Frey, F., Frey, B., Gowda, T. & Vishwanath, B. (2005). Use of *Pavo cristatus* feather extract for the better management of snakebites: Neutralization of inflammatory reactions. *Journal of Ethnopharmacology*, 99(2): 229-237.
31. Mushtaq-ul-Hassan, M., Ali, M., Arshad, M. I., Mahmood, S. & Mahmood-ul-Hassan, M. (2012). Effects of mating sex ratios in Indian peafowl (*Pavo cristatus*) on production performance at Wildlife Research Institute, Faislabad (Pakistan). *Iranian Journal of Veterinary Research, Shiraz University,* 13(2): 143-146.
32. Nichols, M. R. & Yorzinski, J. L. (2016). Peahens can differentiate between the anti-predator calls of individual conspecifics. *Animal Behavior*, 112: 23-27.
33. Petrie, M., Halliday, T. and Carolyn, S. (1991)Peahens prefer peacocks with elaborate trains. *Animal Behavior*, 41(2): 323-331.
34. Petrie, M., Hall, M., Halliday, T., Budgey, H. & Pierpoint, C. (1992). Multiple mating in a lekking bird: why do peahens mate with more than one male and with the same male more than once?. *Behavioral Ecology and Sociology*, 31(5): 349-358.
35. Petrie, M., Krupa, A. & Burke, T. (1999). Peacocks lek with relatives even in the absence of social and environmental cues. *Nature*, 401(6749): 155.
36. Rajeshkumar, N. & Balasubramanian, P. (2012). Habitat use and food habits of Indian peafowl (*Pavo cristatus*) in Anaikatty Hills, Western Ghats. *Indian Birds*, 7(5): 125-127.
37. Ramesh, K. & McGowan, P. (2009). On the current status of Indian peafowl *Pavo cristatus* (Aves: Galliformes: Phasianidae): keeping the common species common. *Journal of Threatened Taxa*, 1(2): 106-108.
38. Riparian areas: Functions and strategies for management. *The National Academies Press* (www.nap.edu/read/10327/chapter/3) (Date accessed- 20 September 2017).
39. Shivrajkumar, Y. S. (1951). "An incubating peacock (*Pavo cristatus* Linn.)". *Journal Bombay Natural History Society*, 54(2): 464.
40. Stephen, G. A. (2002). *Extraordinary Pheasants*. Harry N. Abrams, Inc., New York. Book ISBN 0-8109-1007-1.
41. Subramanian, K. S. & John, M. C. (2001). Roosting and nesting habits of free ranging Indian peafowl (*Pavo cristatus*) in Southern Tamil Nadu. *Zoos' Print*, 16: 537-538.
42. Takahashi, M. & Hasegawa, T. (2008). Seasonal and diurnal use of eight different call types by Indian peafowl (*Pavo cristatus*). *Journal of Ethology*, 26(3): 375-381.
43. Talha, M. M. H., Mia, M. M., Momu. J. M., Ur-Rahman, M., Ahmad, M., Adnan, M. R., Razee, A., Aktaruzzaman, M., Haque, M. N. & Paul, B. (2018). Morphometric, productive and reproductive traits of Indian peafowl (*Pavo cristatus*) in Bangladesh. *International Journal of Development Research*, 8(2): 19039-19043.
44. UNEP (2016). UNEP Frontiers 2016 Report: Emerging Issues of Environmental Concern. United Nations Environment Programme, Nairobi, 1-77. *ISBN: 978-92-807-3553-6, DEW/1973/N.*
45. Whistler, H. (1949). Popular handbook of Indian birds (4th Edn.). Gurney and Jackson. London, 401-410. *ISBN: 1-4067-4576-4586.*
46. Yasmin, S. & Yahya, H. S. A. (1996). Correlates of mating success in Indian peafowl. *Auk,*113: 490-492.
47. Yorzinski, J. L. & Anoop, K. R. (2013). Peacock copulation calls attract distant females. *Behavior*, 150(1): 61-74.
48. Yorzinski, J. L. & Platt, M. L. (2013). Selective attention in peacocks during predator detection. *Animal Cognition*, 17(3): 767-777.