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RESEARCH PAPER

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Effect of Constant Illumination and Constant Darkness on the Body Weight and Testis of Rain Quail "*Coturnix coromandelica*"

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ABSTRACT

Groups of photosensitive male Rain quails were exposed to continuous light (LL) for 180 days and continuous darkness (DD) for 365 days. Periodic laparotomies during the treatments indicated that the testes were stimulated in the birds exposed to continuous light and continuous darkens and the body weight also increases in both the schedule. This implies that photoperiod is not a necessity for gonadal growth.

Keywords: Rain Quail, Illumination, Darkness, Reproductive Cycle and Photoperiodic Stimulation.

INTRODUCTION

The seasonal reproductive cycle in the vast majority of temperate zone birds is under the control of the seasonal changes in day length (Farner 1975). There is very little information available on the photoperiodic stimulation on wild non-passerine locally migratory birds (Saxena and Saxena 1978, 1984, Saxena et al. 1983, Saxena 1979, Saxena 1983, Saxena et al. (1987), Singh 1992, Bhatt 1992 Singh et. al. 1996 over no one has ever tried before to study the effect on gonads when birds were places in complete darkness. It was therefore decided to study the role of darkness on the gonad development of Rain quail.

As only few finches and migratory birds like Red headed bunting and starling have been investigated under continuous illumination yielding more interesting information, it was decide to examine the response of locally migratory Rain quail *Coturnix coromandelica* in such experimental condition.

MATERIAL AND METHODS

Adult Rain quail were bought from a local fowler in Kanpur. They were acclimatized to the laboratory condition for one week and kept under short day conditions (3L: 21 D) for one month, so that they would become photosensitive. They were divided in three groups, each group consisting of three birds only. The cage number one was kept in Light proof boxes containing these birds. These were not cages were illuminated with 40 walt fluorescent tubes providing light at an intensity of about 400 Lux at the perch level. The cage number two was kept in total darkness and the cage number three was kept in natural day length as control birds. The experimental group (DD) was measured only twice once at the start of the experiment and the other after the termination of the experiment. Food and water given adlibitum. Prior to the beginning of the experiment, the birds were taken on a physical balance later they were weighed and the size of the left testis were measure in situ, following unilateral laparotomy. The experimental birds were laparotomized regularly and weighed individually every month and the gonad sizes were measured in situ. The data were statistically analysed by students 't' test.

RESULT

It was noted that there was a significant rise in body weight of the birds under constant illumination (LL) from October to February with the difference at ($P<0.025$), Later it was observed that throughout the period of observation, the rise and fall in the body weight of the birds was intermittent and fluctuated. There was increase in body weight of birds during March and April, when compared with that of control birds. The difference in weight was significant at ($P < 0.005$) and ($P < 0.01$) (Table 1).

Table 1. Effect of Constant Illumination on the Body Weight and Testis Volume of Rain Quail.

WEIGHT AND TESTIS VOLUME		**3L:21D**	**(LL) CONSTANT ILLUMINATION ON THE BODY**				
MONTH	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.
Body Weight M ± Se (gm)	62.00 ± 3.68	67.8 ± 2.31	75.56** ± 2.12	76.13 ± 1.73	79.13 ± 2.37	77.33*** ± 2.17	72.66** ± 2.32
Testis Volume mm M±SE	73.50*** ± 0.60	102.57*** ± 1.78	101.66*** ± 2.53	84.85*** ± 0.00	104.76*** ± 0.00	146.66*** ± 6.68	137.5*** ± 5.35

Tests of Significance * $P < 0.025$, ** $P < 0.01$, *** $P < 0.005$ compared with control birds.
Number of birds = 3.
Effect of Constant darkness on the Body weight and testis volume of Rain Quail.

The testis volume of constant illumination (LL) birds atarled to increase from October to December with the difference at (P < 0.005). It decreased in month of January (P < 0.005) when compared with that of the control birds. Maximum testis volume was observed in March.

The body weight and testis volume of birds exposed to continuous darkness increased significantly in the month of September.

The body weight of control receiving birds increased from October to June and was significant during February and June (Table 2). In August the body weight further increased and remained the same till September.

The testis volume of control receiving birds decreased from November to July. It was significant during June and further significantly increased during August and September.

Table 2.

Month	Body weight (gm)	Testis volume (mm3) M ± SE	Body weight M ± SE	Testis volume (mm3 M ± SE)
Oct.	59.00 ± 0.40	74.34 ± 1.32	56.20 ± 6.15	61.87±1.44
Nov.			69.00±2.12*	9.77±0.28
Dec.			67.12±2.57*	8.03 ± 0.28
Jan.			61.85±4.32	15.27 ± 0.87
Feb.			84.58±4.11	18.07 ± 0.64
Mar.			62.46±5.00	21.83±0.50
Apr.			65.60±4.45	24.98±0.77
May			66.72.57*	31.2±4.62
Jun.			76.0±2.59***	27.4±7.31***
Jul.			53.54±1.19	23.00±0.00
Aug.			67.82±2.12*	46.29±4.59
Sep.	69.33±7.02	174.00±5.81	64.13±1.67	53.92±2.40***

Testis of significance = P < 0.025, *** P < 0.005 Compared with control birds.
Number of birds = 3.

DISCUSSION

Light induced gonadotrophin serrection results in gonand maturation and the physiological potential for reproduction (Farner and Follett 1966, Davies and Follett 1974 a, b, 1975 a, b, Lofts and Murton 1973, Murton and Westwood 1977).

Moreover the long days are stimulatory and short days are inhibitory or non stimulatory (Saxena and Saxena 1978, 1979, 1984, Saxena et al. 1983, Singh et al. 1991, Bhatt et al. 1991, Saxena and Thapliyal 1978, Sinha and Saxena 1979, Singh and Chandola 1991 a). In European starlings Sturnus vulgaris (Schwab 1971) House finches, Carpodacus mexicanus (Hammer 1968) and House sparrow, Passer domesticus the continuous light causes gonadal growth followed by regression and development of photorefractoriness. Gwinner 1973, 1975 has also reported the starlings respond to LL but it depends upon the time of the year. The house sparrows under LL, maintained active gonads till day 224 although a reduction in testicular weights was observed while birds under NDL showed only a slight elevation in testicular weights on day 45 and thereafter regression occurred (Prasad and Tewary 1981).

Findings on the testicular responses of European starlings under constant darkness (Rutledge and Schwab 1974) had support that circadian ascillations are involved the control

of main reproductive responses, albeit in a form slightly modified from that of Hamner (1968). Photo refractory male stgarlings were placed in light-tight chambers and held without daily photo stimulation (DD) for 448 days. Testicular growth has been reported in the absence of photo stimulation in House sparrow, *Passer domesticus* (Vaugien and Vaugien 1961, 1966). Spotted Munia, *Lonchura punctulata* (Rutledge and Schwab 1974), Zebra Finch, Poephila guttata (marshall and Servently 1958) and in temperate zone population of *Passer domesticus* (Farner et al. 1977). The effect of the DD on testis could depend on the state of testicular development at the time of transfer to continuous darkness (Farner et al. 1977). In European starling the testicular growth was reported may be due to endogenous circannual rhythm (Aschoff 1955) or because of the emergence of free running circadian rhythm (Rutledge and Schwab 1974) which resulted in the absence of daily photoperiod.

Aschaff (1960) demonstrated how under conditions of constant light (LL) or darkness (DD) various animals exhibited rhythms of activity and rest having a period of about 24 h, the fact that the period length was not exactly 24 h can be taken as good evidence that such rhythms must be endogenous. In constant light the circadian frequency increases with increased intensity of illumination in diurnal and decreases in nocturnal species. The total circadian period can be divided into one phase of activity and one of rest and it was early discovered that under conditions of high light intensity the amount and duration of activity was increased. Hamner (1968) has demonstrated the regression and refractoriness in the presence of continuous illumination in House finch.

In same birds (Chandola et al. 1975) constant light (LL) itself does not show stimulatory role although gonad is inactive phase as in spotted munia *Lonchura punctulata*. The active gonad maintained on 3 L: 21 D when shifted to constant light registered a fall. The birds when shifted to 3 L: 21 D from LL redeveloped the gonad to peak and when they were again transferred to LL gonads refressed again.

It appears that the response of Rain quail under continuous photoperiod is different than that of the spotted munia and the gonad and body weight both increase in bothy continuous light (LL) and continuous darkness (DD). In temperate zone LL does not6 make the birds rhythmic as reported by (Macmiltan et al 1975) and (Binkley 1977). The effects of constant light on rhythms have also been reported in rats (Klotchkov and Belyaev (1978) starling Gwinner, E. (1975).

The maintenance of body weight almost too normal indicates that birds were healthy during the course of study although there was mortality which might be due to frequent laparotomies. A heavy mortality has also been reported in temperate zone populations of House sparrows in continuous light Farner et al. (1973).

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