RESEARCH ARTICLE

The Annals of Zoology
ISSN (Print): 0003-5009
Annals of Zoology, Vol. 30; December 2014, 31-35

The Effect of Wavelength and Intensity on Gonadal Growth and Body Weight in Longer and Shorter Days in Indian Black Headed Muniya

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ABSTRACT

Environmental condition is the key factor that influences the behaviour displayed by black headed muniya. Environmental factors such as atmospheric conditions, food availability and nocturnal illumination affect the locomotors activity, reproduction in most of the subtropical birds. It is known from the past that light plays an important role in aviation growth and breeding processes. Different light condition such as photoperiod, different intensity and wavelength affect the birds in different ways. In muniya, we studied the effect of different light wave length blue (450nm) and red (650nm), intensity (blue light, .257W/m² and 1.524W/m²) and (red light, .068W/m² and .286W/m²) in gonadal growth for longer days (14L: 10D) and short days SD, (12L: 12D) as Kumar. et al, (2000) used to see the physiological responses in black headed bunting. We observed that gonadal growth under red light, .068W/m² and blue light, .257W/m² condition, blue light displayed quite larger gonadal growth but, in case of red light, .257 W/m² and blue light,1.524W/m²condition, gonadal growth was little larger for red light. Body weight analysis shows the small effect of intensity and wavelengths on its growth. This experiment shows that gonadal responses and body weight showed by muniya depend on the duration and intensity of a long day length intimated by long wavelengths.

Key words: *Day length, Seasonality, Gonadal growth, Blue light, Red light*

INTRODUCTION

Black-headed muniya (Lonchura Malacca malacca) is an estrildid finch, found in India, China, Taiwan, and Sri Lanka. This is a small gregarious bird which feeds mainly on grain and other seeds and live in wetland, grassland (Ali and Ripley, 1974).

ROLE OF LIGHT IN GONADAL GROWTH OF MUNIYA

1. PHOTOPERIOD:

Photoperiodism can be defined as the developmental responses of birds related to relative lengths of light and dark periods. The birds, from subtropical and temperate latitudes are able to assess the gradual or sudden change in day length. In long photoperiod (long day length; LD), they show gonadal recrudescence but, in short photoperiod (short day length; SD) delays the testis maturation. Pandha and Thapliyal (1969) exposed some groups of black-headed muniya to long and short days and inspected that the birds displayed gonadal growth under both conditions pursued by an accomplished elimination of regression. Gupta *et al,* (2011): studied the photo periodic responses on seasonal regulation by using bright and dim light.

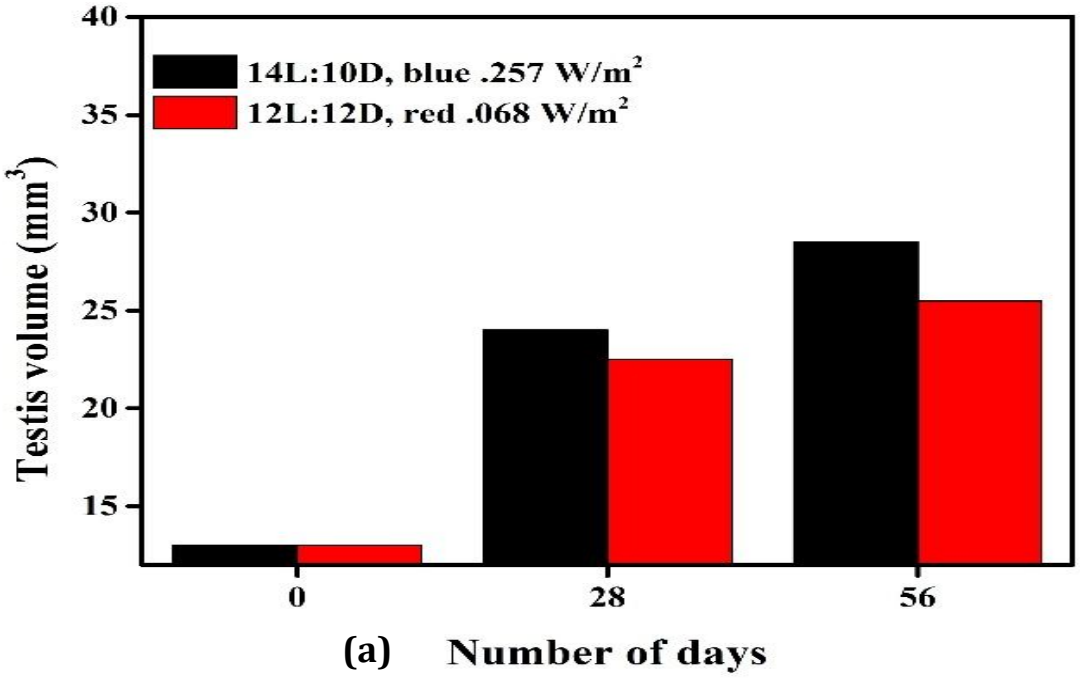
2. LIGHT INTENSITY:

Light intensity plays an effective role in impletion of the birds, mainly because birds need a certain light intensity in order to be photo stimulated. The role of white light with different intensity in gonadal response of muniya was first studied by Sikdar and Kar (1994). He used white light with different intensity and showed that higher intensity shows more gonadal development in comparison to lower intensity.

3. LIGHT WAVELENGTH:

Like human being bird is able to access narrow part of the light spectrum. Birds have got extra retinal photoreceptors (ERPRs), different from eyes, located in different portion of the brain and are responsible for transduction of photo stimulation as given by Boim (2012). The different wave length effect has been discussed previously in many birds such as in Japanese Quail by Woodard, *et al.,* (1968), Kumar and Rani (1996) in migratory bunting etc.

Fig. 1: (a). Photoperiodic gonadal response of Black headed muniya exposed by Blue light of intensity .257 W/m^2 and wavelength of 450 nm and red light of intensity .068 W/m^2 **(b).** Blue light of intensity 1.524 W/m^2 and wavelength of 650 nm and red light of intensity .286 W/m^{2}for 14L: 10D and 12L:12D combination.



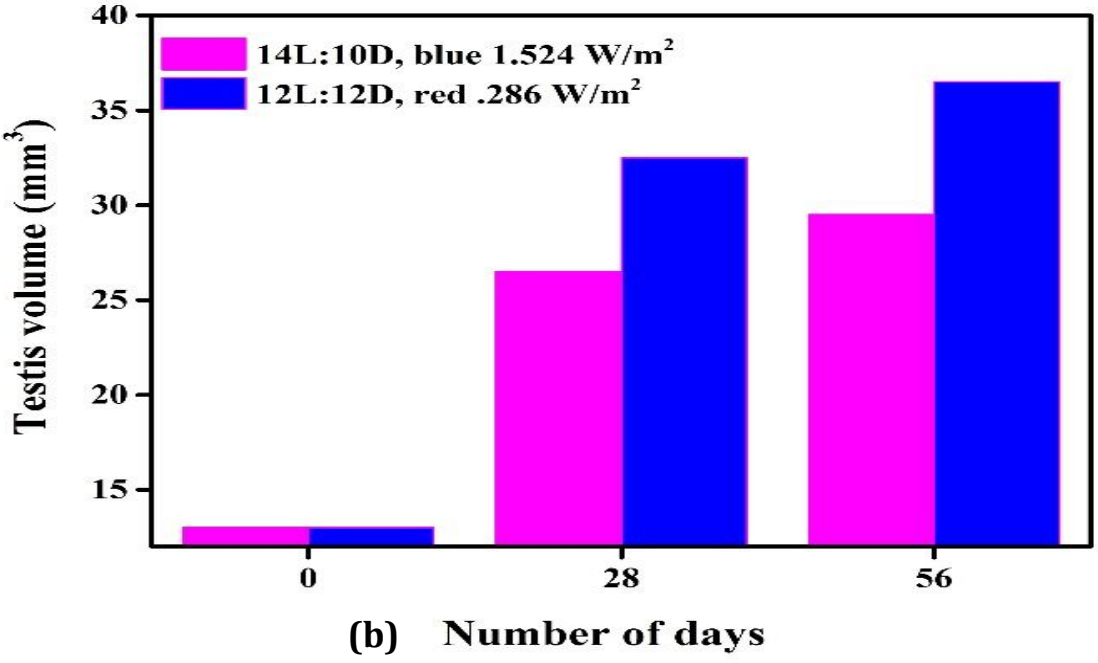
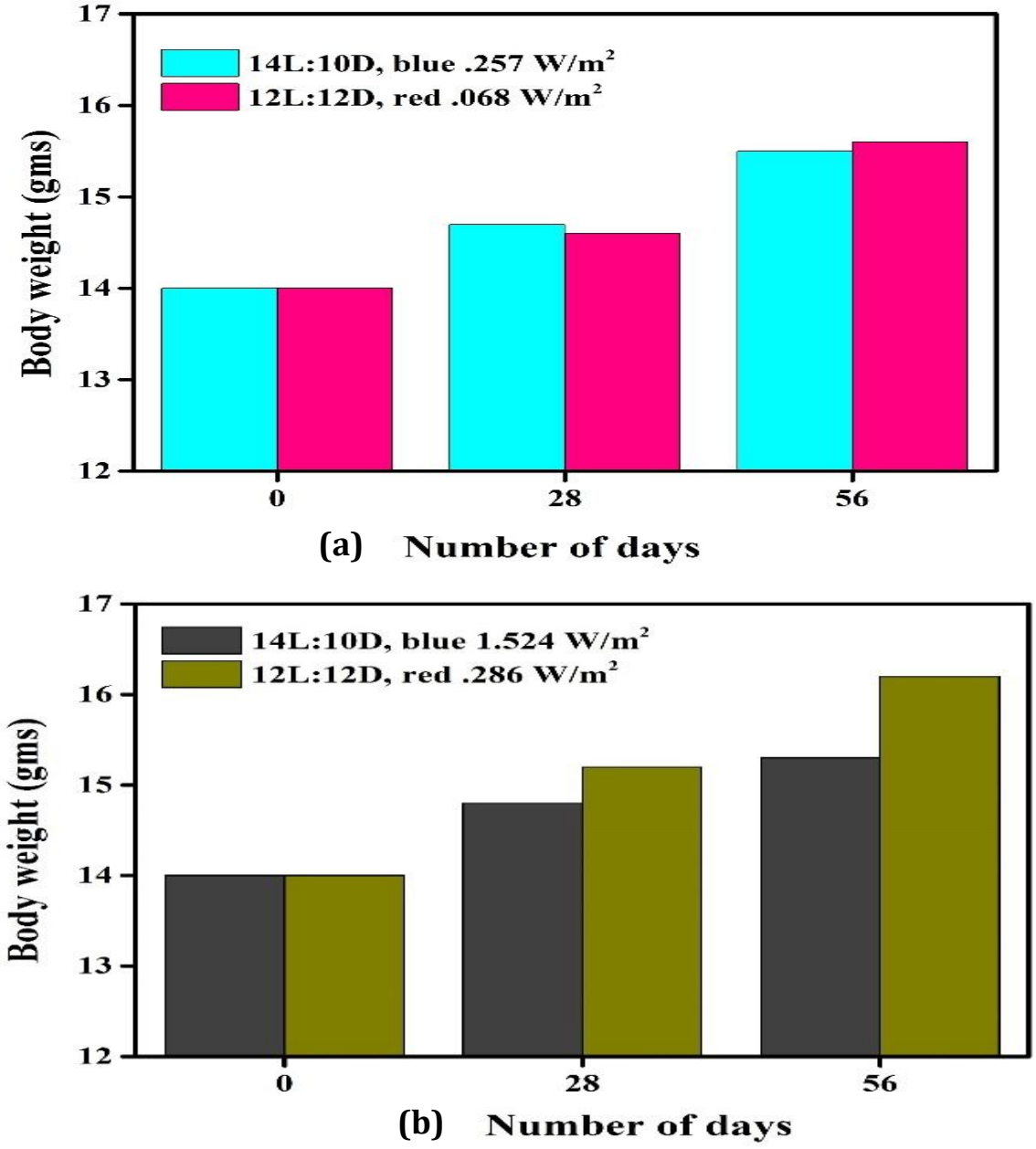


Fig. 2: (a). Body weight response of Black headed muniya exposed by Blue light of intensity .257 W/m² and wavelength of 450 nm and red light of intensity .068 W/m² **(b).** Blue light of intensity 1.524 W/m² and wavelength of 650 nm and red light of intensity .286 W/m² for 14L: 10D and 12L:12D combination.



OBSERVATION

Bentley, *et al.,* (1998) showed, in male European starlings (Sturnus vulgaris), decreasing light intensity alters the determination of day length. This means light intensity may vary the photoperiod effect i.e. photoperiod should be longer at high light intensity in compression to the low intensity regime and at the same intensity, but long wavelength (red light), stimulatory photoperiod should give rise the higher rate and more gonadal response with relative to shorter wavelength (blue light).

To see the same effect in black-headed muniya we choose adult male black-headed muniya, Lonchura Malacca Malacca. The photosensitive muniya in group of (n = 6 or 7) were kept to contrivances light: dark (L: D) cycles for eight weeks. The light of two

different wavelength, one was short (blue, 450 nm) and another one was long (red, 650 nm), were used in different conjunctions of day length i.e. long days (14L: 10 D) and short days (12L: 12D) and intensity in two different L: D cycles. In the first L: D cycle, blue light of intensity 0.257 W/m^2 for long days (14L: 10 D) and red light of 0.068 W/m^2 for short days (12L: 12D) were used to see the gonadal responses. In the second L:D cycle, high intensity in comparison to first cycle for both light, blue light of intensity 1.524 W/m^2 for long days (14L:10D) and red light of 0.286 W/m^2 for short days (12L:12D) were used. Black-headed muniya were procured by local supplier in May month and kept in an outdoor aviary. All birds were put in groups of 6 to 7 per cage (45cm×25cm×25cm). Food (kakuni, and paddy seeds) and water were supplied by ad libitum. Unilateral laparotomy was performed to distinguish male from females. Photoperiod-induced responses displayed by muniya were measured by size of the testis. Testis volume (TV) was measured at the starting, after 4 weeks and at the end of eight weeks of the photoperiod treatment of two groups on selected days were compared using Student's 't'-test. Left testis size was measured and testis volume (TV) was calculated from $4/3\pi ab^2$, where a and b denote the half of the length and width respectively. The measured testis volume in mm^3 unit was plotted as mean (±class interval) and significant was taken at $P < 0.05$ with respect to number of days in 26^{0}N region.

RESULT AND DISCUSSION

Fig. 1 (a) shows that stimulatory effects can be imitated by light of long wavelengths for the duration and intensity of a longer photoperiod of short light wavelengths. We can say that in some cases light wavelength induced photoperiodic response can compensate to the light intensity induced responses. A longer wavelength (red light) of photoperiod 10 hour account for gonadal growth alike to, or slightly quite larger than at short light wavelength (blue) for longer photo period 14 hours (shown in Fig. 2). This shows 4 hour interval between long and short period was suppressed by proper combination of wavelength and intensity of the light. The two reasons may be possible under the different irradiance condition for the similar photo periodic origination of gonadal growth and development in muniya. The light is made up by the photon with energy. The number of photons per unit time per unit differs by wavelength (inversely related) i.e. long wavelength less scattering and short wave length shows more scattering of biological tissues. Second one is CRPP in black headed muniya. It responds to light in a wavelength-dependent manner as reported by Kumar, *et al.* 2000 for black headed bunting and reported in mammals. From here, it can be attributed that at a particular light intensity, long light wavelengths in 14L:10D causes change in phase in CRPP in such a way that a major part of the Φj, toward the part of Φ_k under 12L:12D in short light wavelengths, are illuminated. Available literature says that body weight depends on many factors such as season, light illumination etc. We observed that in low intensity regime body weight increases after 2 weeks similar for high intensity regime for longer wavelength. We observed small change in body weight, shows less effect of intensity on body weight. Some changes in different intensity may be cause of environmental impact.

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