

## Effect of light and dark phase on dorsum colour and pattern in *Hemidactylus* sp. of Assam

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### ABSTRACT

The effects of exposure to dark and light conditions on dorsal colour and pattern were studied in five species of *Hemidactylus* from Assam. Marked changes were observed in the patterns as well as ground colour in all the species. House geckoes of the genus *Hemidactylus* inhabit outer walls of homes as well as forest fringes and as such are more likely to face anthropogenic stress. They rely on colour change as an adaptive measure. Most of them, away from light are extremely dark in their ground dorsum colouration. But, on being exposed to light their ground colour turns pale. There have been marked differences in pattern both dorsum and tail observed in light and dark condition. In the dark phase they mostly show dark pattern and markings. Such studies involving geckoes are important for identification of species as they may be misidentified otherwise.

### INTRODUCTION

Colour change in lizards is a phenomenon that has attracted attention since time immemorial, particularly in chameleons (Parker, 1937).

Most of the 1461 species of currently recognized geckos (Uetz, 2013) are nocturnal and cryptically coloured.

Although the phenomenon of colour change is very common, especially in reptiles, the adaptive significance of color change that is not directly related to reproduction has received very little attention. Conspicuous colors in juvenile tails that fade during maturation are widespread and are a clear example of ontogenetic color change among amphibians, reptiles, and fish

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(Caldwell, 1982; Cooper, 1998; Kynard *et al.*, 2002).

House geckos of the genus *Hemidactylus* are among the most successful of all gecko species judging by their establishment and naturalisation all over the world (Bauer & Baker, 2012). They are successful not only due to their ability to spread across the globe by anthropogenic dispersal (Meshaka *et al.*, 2006; Newberry & Jones, 2007; Petren, 1996; Das *et al.*, 2011) but also due to their inherent physiological mechanisms such as food dynamics, camouflage etc. that allow them to adjust to their surrounding and avoid predators (Parker, 1937).

The house lizards of the genus *Hemidactylus* can lighten or darken their skin tones depending on exposure to light (Zug *et al.*, 2007). Usually, adults when exposed to dark (dark phase) show dark colouration in dorsum as opposed to light ground colouration in light phase (Zug *et al.*, 2007).

It has been almost universally maintained by those who have worked on lizards, that reptiles such as *Phrynosoma* sp. control their colour changes through nerves as well as through hormonal control (Bagnara & Hadley, 1973; Parker, 1937; Rohrllich & Porter, 1972). Experiments suggest that temperature, either general or local, also effects the colouration in lizards. Cold has been generally reported to induce a darkening of the reptilian skin (Hogben, 1924; Parker, 1937). However, the effects of physical factors such as temperature and

biochemical ones such as hormones have not been studied extensively in *Hemidactylus* geckos.

In this paper we present a preliminary study on the dorsum pattern and colouration change in the geckos of genus *Hemidactylus* of Assam in dark and light phase condition.

## MATERIALS AND METHODS

Visual Encounter Surveys (Crump & Scott, 1994) using time-constrained randomised walks (Lambert, 1984) were performed for specimen collection. Equal effort was given to the surveys, each of which covered a distance of 1000 sq. m. A steady speed was maintained for each survey. A total of three surveys of two hours duration each were conducted in each of the areas with a total of twelve man hours spent on the entire survey.

The lizards were captured for study and kept in a terrarium of dimension 1.5 ft x 1.5ft x 1 ft (length, breadth and depth respectively). Lizards were kept one at a time for observation. The terrarium was kept covered with a black velvet cloth for a time period of 7-8 hours after which the cloth was removed and the lizards were exposed to natural daylight for 3-4 hours. In both the cases photographs were taken with Nikon DSLR 3200 to study the effect of light and dark exposure on the colouration and pattern formation on the dorsal surface of the lizards. The lizards were released after study.

In certain cases photographs were

also taken in their natural habitat at night and captured, photographed in the daytime and released thereafter.

## RESULTS AND DISCUSSION

The pattern of the dorsum in the species of the genus *Hemidactylus* acts as an important parameter for the study of morphological variation between and within species. The species of *Hemidactylus* are unique in their dorsal ground colour, markings as well as presence or absence of tubercles. The colour and pattern of markings especially plays a very important role in species identification. During this study five species of *Hemidactylus* of Assam namely: *H. frenatus* Schlegel, 1836, *H. brookii* Gray, 1845, *H. flaviviridis* Rüppell, 1835, *H. platyurus* (Schneider, 1792) and *H. aquilonius* McMahan and Zug, 2007, were subjected to light and dark exposure and the variation in their pattern and colour was observed.

The results obtained were :

### *H. frenatus* Schlegel, 1836:

**Dark phase:** The basic ground colour in this species was observed to be dark blackish brown. In the dark phase the pattern marking was very clear. The species shows an array of dorsal patterns. In some cases longitudinal dark lines, three in number on the dorsum and blotch marks on the head can be seen, some have five dark, thick, irregular, longitudinal lines running parallel to each other on the dorsum. The extreme two of these lines start from

nostril, passes the eye and extend up to groin. The mid dorsal line stops at the base of the tail.

Dark, thick transverse bands are also found on tail and limbs

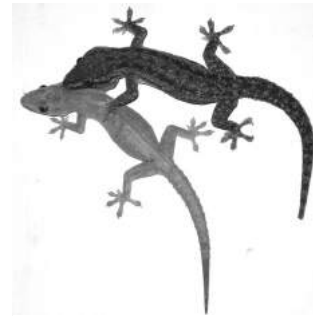


Figure 1. *H. frenatus* light and dark

alternating with cream coloured blotches while in others there are only three dark parallel lines on the dorsum.

**Light phase:** All specimens in the light phase show paleness in the ground colour. The colour turns a very pale brownish yellow. The markings and patterns are very light and in some cases disappear altogether and the specimen appears a uniform yellowish brown in colour.

### *H. brookii* Gray, 1845:

**Dark phase:** The ground colour of the specimen is dark to lighter greyish brown.

Irregular dark brown spots or bands are found all over the dorsum. Head shows variation in markings

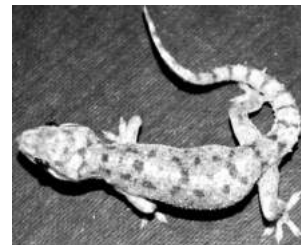


Figure 2. *H. brookii* dark

from "W" shaped markings in some specimen to blotch marks in others. Tail shows alternating transverse bands of dark and light. Mid dorsal irregular white line can also be seen in certain cases. Tubercles are of the same

ground colour.

**Light phase:** In this phase, the basic ground colour in all specimens turns to yellowish cream with tubercles turning lighter in colour. The markings on the tail disappear



Figure 3. *H. brooki* light

completely and the dorsal markings fade or almost disappear. Faint markings can be seen from the nostril to the ear opening dorsolaterally.

***H. flaviviridis* Rüppell, 1835:**

**Dark phase:** The dorsum is blackish brown in colour. The pattern on the dorsal surface contains a series of blackish brown undulating lines bordered by white. The mid-dorsal position has a series of faint whitish bands almost perpendicular to the undulating lines. The lines continue in the tail and limbs where they appear as transverse bands. The head contains mottled dark patches.

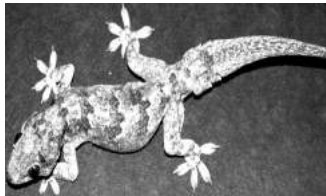


Figure 4. *H. flaviviridis* dark phase

**Light phase:** While the basic ground colour remains same, the shade becomes pale brown to almost greyish green. The



Figure 5. *H. flaviviridis* light

dark markings are not visible but their white borders can be seen. The dark bands on the limbs as well as tail is pale and the white borders are more prominent.

***H. platyurus* (Schneider, 1792):**

**Dark phase:** This species shows dark brown dorsum with underlying yellowish brown patches in the dark phase. The dorsum is covered by transverse dark brownish black bands bordered by lighter shade of yellowish brown. The pattern continues on to the tail as well as on the limbs



Figure 6. *H. platyurus* dark

and digits. Dorsolaterally a dark streak runs from the nostril, behind the eye up to the groin. The head exhibits a faint “V” mark between the eyes in some specimen.

**Light phase:** In the light phase, this species turns pinkish grey in colour. The patterns on the dorsum are very faint to nil. The “V” shaped marking on the head is visible, though faint. The bands on the limbs

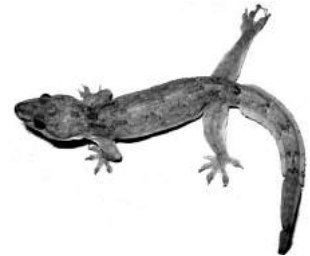


Figure 7. *H. platyurus* light

disappear almost completely and the marking on the tail remains as pale brown irregular blotches. The dorsolateral streak is also pale.

***H. aquilonius* McMahan and Zug, 2007:**

**Dark phase:** The dorsum is greyish brown in colour. In its dark phase, the lizard exhibits one pair of interrupted, brown dorsolateral stripes from the occiput to the sacrum, paralleling an irregular cream vertebral stripe. Across the mid-dorsum and extending laterally to the dorsolateral stripes are a series of 7–8 narrow, brown, posteriorly-directed chevrons. On original tails, a series of small dark brown cross markings alternate with much larger, irregularly-defined areas of cream colour. A whitish to cream stripe, often interrupted, runs from the naris, through the eye, to the insertion of the hind limb.

**Light phase:** In the light phase, the ground colour becomes pale grey to almost pinkish grey. The markings on the dorsum are lighter, and in some cases disappear completely in the anterior portion. The chevron markings on the dorsum and cross markings on the tail appear as light brown dots.



Figure 7. *H. aquilonius* dark



Figure 8. *H. aquilonius* light

turtles and snakes (Woolley, 1957; Hedges *et al.*, 1989). It usually occurs due to the rapid movement of melanosomes into (darkening) or out of (lightening) dermal melanophore processes. Morphological color change is a longer process and involves increase in melanosomes and melanophores (Bagnara & Hadley, 1973; Moll *et al.*, 1981).

Colour darkens when the melanosomes migrate up the melanophore processes and are brought closer to the epidermis while partially blocking the xanthophores and iridophores (Bagnara & Hadley, 1973). This can also be controlled by hormones as seen in *Anolis* lizards (Rohrlich & Porter, 1972). Hormonal control of melanosome dispersion in dermal melanophores has also been suggested for snakes (Rahn, 1941). Colour change in lizards is also affected by temperature although it does not have as much profound effect as illumination (Zaidan & Wiebusch, 2007).

House geckoes of the genus *Hemidactylus* are commonly found inhabiting residential houses, outer walls of home as well as forest fringe areas. These species are perhaps more prone to anthropogenic stress other than natural predators. They therefore show adaptive colour changes. They are nocturnal in behavior and thus occupy cracks and crevices and dark corners during daytime to avoid prying eyes. Therefore, away from light they are extremely dark in their ground dorsum colouration. However, on

being exposed to light their ground colour turns pale.

House geckoes play an important role in the ecosystem by preying on insects etc. and thus their conservation is important. The differences in their colouration and pattern due to exposure to darkness or light therefore act in their favour as they are able to protect themselves by sometimes blending with their surroundings. Apart from this, the colour and pattern in *Hemidactylus* are also important parameters for identification of species as they may be misidentified if their actual pattern and colour is not known in both dark and light phases.

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