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**VARIATION IN DORSAL PATTERN IN FAN-THROATED LIZARD -
SITANA PONTICERIANA CUVIER, 1829**

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ABSTRACT

Fan-Throated Lizard *Sitana ponticeriana* is a medium sized ground dwelling agamid lizard widely distributed throughout the country except for the dense forests of Western Ghats, north eastern hills and interiors of deserts. *S. ponticeriana* can easily be distinguished from rest of the Agamids by the presence of only four toes in the hind limb. A characteristic diamond shaped pattern onto its dorsum is the prominent morphological features for the identification of the species. However, when the individuals of the species were keenly observed it was found that the diamond shaped pattern tend to vary between the individuals. Analysis of the results of the present study revealed the presence of eight defined patterns within the individuals of the population sampled. The pattern analysis on a broader geographical scale could be of great significance in developing an important morphological character for establishing sub-species or geographical races or ecotypes within the species *S. ponticeriana*.

Key Words: *Sitana Ponticeriana*, Agamidae, Diamond Shaped Patch, Pattern Variation, Ecotypes

INTRODUCTION

The Fan-Throated Lizard *Sitana ponticeriana* Cuvier, 1829 (Figure 1) is a unique medium sized ground dwelling agamid lizard and is widely distributed throughout India ranging from the foot hills of Himalayas to the plains of Kanyakumari, except for the dense forests of Western Ghats, North-eastern hills and interiors of deserts (Tikader and Sharma, 1992 and Daniel, 2002). Habitat of *S. ponticeriana* consists of all the biotypes, chief amongst them are the dry deciduous forests and scrublands. The species is very agile and moves on hot surfaces with astonishing speed and ease. This species attains a maximum length of 44 mm (snout to vent length). The colouration is olive-brown above, with a series of rhomboidal patches along the middle of the back. A more or less distinct light band is seen along each side of the back. The males especially the large territorial ones extend a throat fan as courtship behaviour. The fan is the dermal appendage or gular flap found only in the males of this species and thus the name 'Fan-Throated Lizard', females shows a complete absence of this gular flap. They prefer short bushy scrubs for cover as well as use the shrub canopy for its peculiar courtship display (Shanbaug *et al.*, 2003).

During a preliminary study on the habitat utilization of *S. ponticeriana* in a scrubland in the out skirts of Vadodara city in Gujarat, one noticed remarkable variation in the dorsal pattern amongst the individuals of the population. This observation prompted one to extend an in depth study to other parts of the state of Gujarat and collect sufficient data pertaining to dorsal pattern variation in *S. ponticeriana*. Therefore, the present study was conducted with an objective to analyze and categorize these variations in dorsal pattern in *S. ponticeriana* and use the data in future for identifying various geographical races and also to understand whether the pattern play any role in mate selection.

MATERIALS AND METHODS

Study Area

The present study was initiated in a scrubland located to the west of Vadodara city that spreads over an area of 7 sq km. The area is actually a part of ravines of two perennial rivers of central Gujarat. The terrain is highly undulating with steep slopes at many locations and the scrubland supports a high density

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of *S. ponticeriana*. Study was further extended to other parts of the state of Gujarat covering all the major terrestrial biomes and the specimens recorded were critically examined for their pattern variation. A list of the surveyed regions of the state and the localities therein is presented in Table 1; also these localities are depicted on the map of Gujarat state (Figure 2).

Table 1: List of the Regions and the Sampling Localities therein

Sr. No.	Name of the Region	Localities Selected for Sampling
1.	Kutch	Scrubland of villages Bara <i>and</i> Tera; Grasslands of Kunothiya Dawn <i>and</i> Naliya; Grassland <i>and</i> Scrublands of Narayan Sarovar <i>and</i> Lakhpat
2.	North Gujarat	Jessore Sloth Bear Sanctuary; Balaram-Ambaji Wildlife Sanctuary Jambughoda Wildlife Sanctuary; Kevdi Reserved Forest in Chhota Udepur; Pavagadh Hill Reserved Forest in Halol; Ratanmahal
3.	Central Gujarat	Wildlife Sanctuary in Panchmahal; Shoolpaneshwar Wildlife Sanctuary in Rajpipla; Vadodara Rural <i>and</i> Vadodara Urban Dhrangadhra Wild Ass Sanctuary in Dhrangadhra, Surendranagar; Scrub patches around Dwarka in Jamnagar; Girnar Hill Forest in
4.	Saurashtra	Junagadh; Gir PA (only periphery) in Junagadh as well as Amreli; Velavadar National Park <i>and</i> Victoria Park in Bhavnagar.

Methodology

The method adopted in the present study was Direct Sighting or Visual Encounter method. The areas were thoroughly searched for the presence of the species, as species being much cryptic and tries to conceal itself with the environment, combing operations were carried out by disturbing the scrubs and bushes so that the movement of the individuals could enable in sighting them and could record further details on its morphology.

The study was initiated during April 2008 and was carried out till December 2008 for a period of 9 months. Surveys were done on regular basis (once in a week) during both morning and evening hours. The morning surveys were conducted from 0700 hrs to 1100 hrs and the evening surveys were done from 1600 hrs to 1830 hrs.

When any individual was sighted a close up photograph of its dorsal pattern was taken using a digital camera (Olympus C770). The variations seen in the pattern was also sketched in field notebook and later was drawn precisely by comparing with the corresponding digital image.

RESULTS AND DISCUSSIONS

Sitana ponticeriana can easily be distinguished from rest of the Agamids by the presence of only four toes in the hind limb. The rest body plan is similar to other agamids except for the character of four toes in the hind limb, a character unique to genus *Sitana* (Gunther, 1861). The name Fan-Throated Lizard is so given because the males of this species bear a large gular appendage which is a loose skin flap of the throat, that can be erected up in the form of a fan. This fan like gular appendage is roughly triangular in shape and extends from the tip of the lower jaw to a considerable length along the belly (Gunther, 1861 and Smith 1935). Females of this species do not possess any such gular appendage.

The species can also be identified by the characteristic diamond shape pattern along the mid dorsal line of the body starting from the lower nuchal portion till the base of the tail (Gunther, 1861, Smith, 1935).

Even though *S. ponticeriana* is widely distributed through the country (Tikedar and Sharma, 1992), literature mentioning any pattern variation within this species is inadequate. Sufficient literature was found to be available on the demography, interrelations and reproductive traits, seasonal variation in dietary pattern and also techniques of age determination in Fan-Throated Lizard (Shanbag *et al.*, 2003; Radder and Shanbaug, 2003; Subarao and Rajabai, 1972; Pal *et al.*, 2007 and Rath, 2007) but lead to a

lacuna when literature was searched regarding variations in the dorsal pattern in *S. ponticeriana*.



Figure 1: Fan-Throated Lizard *Sitana ponticeriana* (Male) extending its gular flap (→).

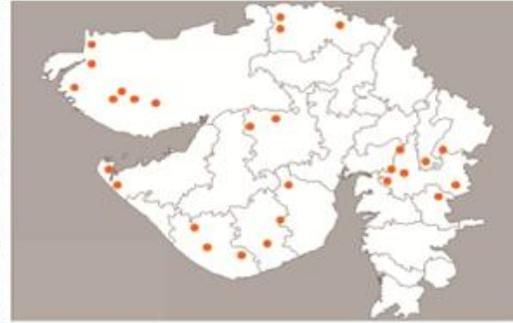


Figure 2: Map of Gujarat showing the sampling localities.



Figure 3: Uniform Paired Pattern (Male).



Figure 4: Uniform Paired Pattern with slight misalignment (←) (Male).

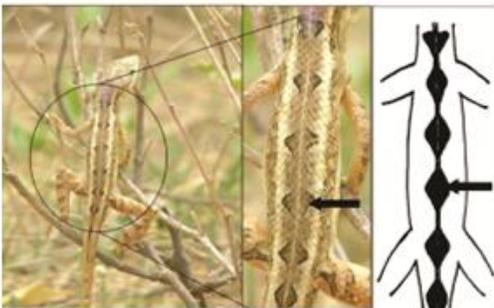


Figure 5: Uniform paired pattern with blunt tips (←) (Male).



Figure 6: Uniform paired pattern (Female).



Figure 7: Uniform paired pattern with blunt tips (←) (Female).



Figure: 8 Uniform paired pattern with a complete misalignment leading to increase in total number of diamond patches (→) (Female).

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It was indeed surprising that though being a common agamid lizard and a dominant species in the scrublands, *S. ponticeriana* escaped the attention of researchers as well as naturalists in this particular aspect of pattern variation.

Pattern Variation

While critically examining the individuals of *S. ponticeriana* we observed that the diamond pattern on the dorsum of the animal is not uniform amongst all the members. A close examination of the pattern revealed that the pattern on the dorsum is not individualistic, yet a marked difference in the pattern was evident in the population. Based upon the observations, at least eight prominent distinguishable patterns have been described within the studied population of *S. ponticeriana*. Males of this species were found to possess at least three distinct patterns whereas females showed five distinct patterns. Altogether eight distinct patterns were identified from the species occurring in the western part of the country. However, no sex specific variation was observed, and therefore pattern variation as a function for sexual dimorphism could not be ascertained. Though males by and large showed uniformity in their patterns, the females showed variation to a greater extent. As per the description given by Smith (1935), there are dark brown, black edged six diamond shape patches along the mid dorsal line of the body from the lower nuchal portion till the base of the tail and sometimes a light vertebral line dividing them. The various patterns as observed in the current study are as follows:

Pattern Variations as Observed in Males

1. Uniform Paired Pattern:

This is the most common of all the different forms wherein the diamond marks are properly arranged in pairs along the mid dorsal line of the body with no misalignment at all (Figure 3).

2. Uniform Paired Pattern with Slight Misalignment:

This pattern at first glance looks very similar to the Uniform Paired Pattern but when analyzed closely the 1st, 5th and 6th diamond patch are properly paired whereas 2nd, 3rd and 4th diamond patch are in slight misalignment (Figure 4).

3. Uniform Paired Pattern with Blunt Tips:

This pattern resembles Uniform Paired Pattern (Pattern No. 1), but the variation here is that the laterally projecting tips of the diamonds are blunt in contrast to the pointed tips as seen in case of pattern no. 1 (Figure 5).

Pattern Variations as Observed in Females

1. Uniform Paired Pattern:

This is by and large a common pattern seen both in males and females wherein the diamond marks are properly arranged in pairs along the mid dorsal line of the body with no misalignment (Figure 3).

2. Uniform Paired Pattern with Blunt Tips:

This pattern is also similar to the pattern no. 3 in case of males wherein the laterally projecting tips of the diamond patches are blunt in contrast to the pointed tips as seen in pattern no. 1 of females (Figure 7).

3. Uniform Paired Pattern with a Complete Misalignment Leading to Increase in Number of Diamond Patches:

In this particular pattern there observed a complete misalignment in the diamond patches that results in an increase in the number of diamond patch by one. The total number of diamond patches present in this case were seven of which the 1st, 2nd, 6th and 7th pair were in complete alignment whereas 3rd, 4th and 5th pair were misaligned (Figure 8).

4. Uniform Unpaired Pattern:

This particular pattern leads to an unequal numbers of diamond patches on the either side of the mid vertebral streak. It was observed that 1st, 2nd and also the last diamond patch were completely paired and aligned. However, the 3rd patch and 6th patch though paired were slightly misaligned. Moreover, the 4th and 5th pair of diamond patch was observed to be completely unequal wherein two halves of the diamond

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patches on the right side complemented with a single half patch on the left side thereby forming six triangle patches on the left side in contrast to seven patches on the right side (Figure 9).

5. Uniform Paired Pattern with Blunt Tips and Additional Small Diamonds in Between the Main Patches:
 This peculiar pattern was altogether different from rest of the patterns and was observed only in case of females. In this case six pairs of diamond patches with blunt tips were observed arranged in a uniform paired manner. However, in addition to these six pairs, additional small diamond patches in pairs along the mid dorsal axis were observed, that were placed in between the main patches numbered 2nd and 3rd, 3rd and 4th as well as 4th and 5th (Figure 10).



Figure 9: Uniform unpaired pattern (←) (Female).

Figure 10: Uniform paired pattern with blunt tips and additional small diamonds in between the main patches: 2nd & 3rd, 3rd & 4th, 4th & 5th (←) (Female).

Since the inception of the study was in a small scrubland of Vadodara district in central Gujarat, for better comprehension of the results the study was further extended to other parts of the state, notably parts of Kutch, north Gujarat and Saurashtra wherein *S. ponticeriana* is a species of common occurrence. Individuals from these areas were also documented for the variations in their dorsal pattern and it was observed that the variations in patterns could largely be assigned to one of the above mentioned patterns. In one or two cases from the regions of north Gujarat, the observed pattern in the individuals could not be defined clearly hence were considered as vagrant since it was observed only in one or two individuals. Although majority areas from the state of Gujarat have been covered, looking into this aspect of pattern variation in *S. ponticeriana*, the study needs a wider extension to other parts of the country wherein also this species is common. The current study has raised few questions regarding *S. ponticeriana* that whether this common and widespread species is a single species in its genera all throughout its distributional range or there could be different species in the same genera too? This perhaps needs further conformation through molecular analysis. . Gunther (1861) has identified and describe two species under genus *Sitana* namely, *Sitana ponticeriana* and *Sitana minor*. These species were differentiated by Gunther based upon the difference in the length of their forelimbs and hind limbs, *S. minor* having both forelimbs and hind limbs longer than *S. ponticeriana* (Gunther, 1861). However, Smith (1935), has identified and described only one species under the genus *Sitana* i.e. *Sitana ponticeriana* and completely negates the occurrence of a second species *Sitana minor* as described by Gunther. Whether or not genus *Sitana* has another species other than *S. ponticeriana*, needs further verification on a broader range but the possibility of occurrence of subspecies or geographical races over the distributional range of *S. ponticeriana* cannot be negated. A similar confusion prevailed for long in case of Dominican Anole – *Anolis oculatus*, owing to its morphological variation. This species was reported to have four subspecies described from over 500 specimens collected from thirty localities of Dominica (Lazell, 1962). Later these subspecies described in *A. oculatus* corresponded with the strikingly different ecological zones in Dominica (Lazell, 1972). Further studies on the morphology of *A. oculatus* and also molecular studies revealed no interruption to

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gene flow between the different populations, but instead was a clinal variation adaptive to local ecological factors (Malhotra and Thorpe, 1999; 2000). Therefore the basis for the use of subspecies nomenclature in case of *A. oculatus* was invalid and now the former subspecies of *A. oculatus* are now described as ecotypes based on their geographic range (Thorpe *et al.*, 2005). Hence, if ecological zones could influence morphological variations in a species thereby resulting in corresponding ecotypes, then there stands a huge possibility of occurrence of ecotypes in case of *Sitana ponticeriana* which also is a widely distributed species across a great diversity of ecological zones. Therefore, we strongly believe that the present study has to be extended to other parts of the country wherein is *S. ponticeriana* is distributed and a good number of specimens be critically examined to validate the possibility of occurrence of ecotypes or subspecies in case of *S. ponticeriana*.

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