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## RESEARCH ARTICLE

## New Species of Genus *Sitana* (Sauria: Agamidae) from Kalesar National Park and Wildlife Sanctuary, Haryana, North Western India

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### Abstract

During extensive surveys at various localities of Kalesar National Park and Wildlife Sanctuary (District: Yamuna Nagar, Haryana) and other districts of Haryana, India, 11 specimens of the agamid lizard of Genus *Sitana* were collected. The collected specimens were examined based on morphometric and pholidosis characters as well as color pattern. Out of 11 specimens examined, nine were males and two were females and had characters different from those of other described allied species of the genus *Sitana*. Based on type locality, the species is thus named *Sitana kalesari* sp. nov. The species described belongs to the *Sitana sivalensis* complex, the small fanned sitana, which hitherto are known only from Nepal. *Sitana kalesari* sp. nov. can be distinguished from known congeners by SVL 22-23 mm, TL 41-45 mm, HL/HW 1.16, SVL/HL 3.1-3.28, FOL 7 mm in male (n=9); SVL 31-32 mm, TL 62 mm, HL/HW 1.28, SVL/HL 3.4-3.5 mm, FOT 16 mm in female; pholidosis supralabials 10/9 (left/right), infralabials 9/9 (left/right), number of large scales between tympanum and orbit 6/6 (left/right), mid dorsal longitudinal rows 10 in male, 9 in female with triangle lozenge pattern

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## INTRODUCTION

The genus *Sitana* Cuvier 1829, one of the most easily distinguished genera among agamids, which is very easily identified by absence of 5th toe and presence of special markings on dorsal surface (Günther 1861). The dorsum bears a typical dark lozenge pattern. Males have a small or large gular fan, which turns partially blue in the excited animal. Another peculiarity of this genus is the presence of a single enlarged scale on the posterior region of the thigh, halfway between hip and the knee i.e. inguinal scale. Its keel is strongly projecting or may even grow into a high process, which is white. This structure of unknown function occurs in both sexes (Kastle, 1998; Schleich and Kastle, 1998 a, b). The species of this genus are known only from India, Sri Lanka, Pakistan and Nepal. In India *Sitana ponticeriana* Cuvier is known to be present throughout India except east of Ganga in eastern India (Sharma, 2002; Daniel 2002). *Sitana sivalensis* Schleich, Kastle & Shah was also reported by Vasudevan and Sondhi in 2010 but this report needs further exploration of the localities in Uttarakhand, India as the specimen was not registered.

## Materials and Methods

Five extensive surveys (7 days each) and one day tour in a month were done for three years to Kalesar National Park and Wildlife Sanctuary (District: Yamuna Nagar, Haryana) under General Faunistic Survey to Kalesar National Park and Wildlife Sanctuary and 15 days extensive surveys were done to districts Gurgaon and Fatehabad, Haryana, India under General Faunistic Survey to Haryana (approved projects by the Director, Zoological Survey of India) by team from the Northern Regional Centre, Zoological Survey of India (ZSI). During

surveys nine males and two females *Sitana* were collected from various localities of Kalesar National Park and Wildlife Sanctuary (district: Yamuna Nagar, Haryana, and other districts of Haryana).

Measurements were taken for Snout vent length SVL, Tail length TL; Relative tail length/SVL Head length HL, Head width HW, Relative head length/width, Relative SVL/HW, Forelimb length FL, Hind limb length HL, Relative Hind limb length / forelimb length, Foot length FoT, Heel to second largest toe HeL. Features of dorsal chevron pattern and pholidosis were also noted. Stereo zoom microscope Nikon SMZ 1500 and Cannon 60D, macro lens 18-135 was used for taking photomicrographs of gular region, inguinal scale, inguinal marks and dorsal lozenge pattern. Published literature was used for comparative studies of *Sitana kalesari* sp.nov. with allied species. T test was applied for comparison between *Sitana kalesari* sp.nov

*Sitana ponticeriana* Cuvier (SPSS ver.22)

## Results and Discussion

### Holotype

Northern Regional Centre /Zoological Survey of India /151, an adult male (SVL: 22 mm; Tail length 41 mm) collected by S.J.S. Hattar and Archana Bahuguna on 3<sup>rd</sup> August 2008

from Paddal line (N 30°23'12.2"; E 077°01'44.5"; Alt 387.6 m), Kalesar National Park, Wildlife Sanctuary (District: Yamuna Nagar), Haryana, India (specimen no I, Fig.1, Table 1).

*Paratypes*: Reg no. NRC,ZSI 165, 128, 160a,b,c; 153,170, 124 eight adult males; X and XI (Reg.no. 126a,b) : two adult females collected by team of scientists and staff of NRC, ZSI Dehra Dun, Uttarakhand, India from type locality and other localities of Haryana, India. Details of which are given below (with numbering as given in Table 1):

Paratype Reg. no. NRC, ZSI, 165:Aamwali khol and around Kalesar National Park and Wildlife Sanctuary (district: Yamuna Nagar, Haryana), 1 specimen, male, 28.11.08, collectors S.J.S. Hattar and party.

Paratype Reg. no. NRC, ZSI, 128. Kali mandirkhol, Kalesar National Park and Wildlife Sanctuary (district: Yamuna Nagar, Haryana), one specimen, male, 10.x.07, collectors P.C. Tak and party,

Paratype Reg. no. NRC, ZSI, 160 a,b,c Guga fire line, Kalesar National Park and Wildlife Sanctuary (district: Yamuna Nagar, Haryana), three specimens, males, 9.ix.06, collectors S.J.S. Hattar and party .

Paratype Reg. no. NRC, ZSI, 153 Sona, near Ansal Farm House (district: Gurgaon, Haryana), one specimen, male, 12.ii.09, collectors Archana Bahuguna and party, Reg. no. NRC, ZSI, 153.

Paratype Reg. no. NRC, ZSI, 170 Bhodiya Khera, Fatehbad (Haryana), one specimen, male, 16.xii.09, collectors A.N. Rizvi and party .

Paratype Reg no. NRC, ZSI, 124 Khillonwals, (Haryana), one specimen, male, 22.xi.08, collectors P.C. Tak and party .

Paratype Reg. no. NRC, ZSI, 126 a,b. Guga fire line, Kalesar National Park and Wildlife Sanctuary (district: Yamuna Nagar, Haryana), two specimens, females, 22.v..08. collectors S.J.S. Hattar and party.

After collection, the specimens were killed and immediately fixed in 4% formalin for one day then transferred in 70% alcohol.

### Description of holotype

An adult male with Snout-vent length (SVL) 22.0 mm, tail length 41mm, relative tail length/SVL 1.86, head length (HL) 7mm, head width 6mm, relative head length/HW 1.16, relative snout vent length/head length 3.14, hindlimb length HLL 19mm, forelimb length 12, foot length 7mm, relative snout vent length/head 3.6, relative hindlimb length/forelimb length 1.58, heel to second largest toe HeL 4mm (Table 1). Number of scale types examined supralabials left to right 10/9, infralabials left/right 9/9, scale row between supralabial & orbit (left/right)3/3, large scales between tympanum and orbit (left/right) 6/6, contact between nasal & supralabial full contact & dorsal longitudinal rows 10 (Table 1).

### Description of paratypes

*Paratype* NRC,ZSI 165: an adult male with Snout Vent Length 23mm, with tail length 45mm, relative tail length/Snout Vent Length 1.95, head length 7mm, head width 6mm, relative head length/head width 1.16, relative snout vent length/head length 3.28, hindlimb length HLL 19mm, forelimb length 12mm,foot length 7mm,relative snout vent length/head width 3.8, relative hindlimb length/forelimb length1.58,heel to second largest toe Hel 4mm. Pholidosis features are similar to that of holotype.

*Paratype* NRC,ZSI 128 an adult male with snout vent length 22mm, tail length 41mm, relative tail length/SVL 1.86, head length 7mm, head width 6mm, relative head length/head width 1.16, relative snout vent length/head length 3.14, hindlimb length 19mm, forelimb length 12mm, foot length 7mm, relative Snout Vent

Length/head width 3.6, relative hindlimb length /forelimb length 1.58, heel length HeL 4mm. Pholidosis characters are similar to that of holotype.

*Paratype* NRC,ZSI 160a an adult male with snout vent length 22mm, tail length 41mm, relative tail length/snout vent length 1.86, head length 7mm, head width 6mm, relative head length/head width 1.16, relative snout vent length/head length 3.14, hindlimb length 19mm, forelimb length 12mm, footlength 7mm, relative snout vent length/head width 3.6, hindlimb length/forelimb length 1.58, heel to second largest toe 4mm.

Pholidosis characters are similar to that of holotype.

*Paratype* NRC,ZSI 160 b an adult male with snout vent length 22mm, tail length 41mm, relative tail length/snout vent length 1.86, head length 7mm, head width 6mm, relative head length/head width 1.16, relative snout vent length/head length 3.14, hindlimb length 19mm, forelimb length 12mm, footlength 7mm, relative snout vent length/head width 3.6, hindlimb length/forelimb length 1.58, heel to second largest toe 4mm.

Pholidosis characters are similar to that of holotype.

*Paratype* NRC,ZSI 160 c an adult male with snout vent length 23mm, tail length 42mm, relative tail length/snout vent length 1.83, head length 7mm, head width 6mm, relative head length/head width 1.16, relative snout vent length/head length 3.28, hindlimb length 19, forelimb length 12mm, foot length 7mm, relative snout vent length/head width 3.8, relative hindlimb length/foot length 1.58, heel to second largest toe 4mm. Pholidosis characters are similar to that of holotype

characters are similar to that of holotype

*Paratype* NRC,ZSI 153 an adult male with snout vent length 22mm, tail length 41mm, relative tail length/snout vent length 1.86, head length 7mm, head width 6mm, relative head length/head width 1.16, relative snout vent length/head length 3.14, hindlimb length 19mm, forelimb length 12mm, foot length 7mm, relative snout vent length/head width 3.6, relative hindlimb length/forelimb length 1.58, heel to second largest toe 4mm.

Pholidosis characters are similar to that of holotype

*Paratype* NRC,ZSI 170 an adult male with snout vent length 22mm, tail length 41mm, relative tail length/snout vent length 1.86, head length 7mm, head width 6mm, relative head length/ head width 1.16, relative snout vent length/head length 3.14, hindlimb length 19mm, forelimb length 12mm, foot length 7mm, relative snout vent length/head width 3.6mm, relative hindlimb length/forelimb length 1.58, heel to second

largest toe 4mm. Pholidosis characters are similar to that of holotype

*Paratype* NRC,ZSI 124 an adult male with snout vent length 23mm, tail length 43mm, relative tail length /snout vent length 1.87, head length 7mm, head width 6mm, relative head length/head width 1.16, relative snout vent length/head length 3.38, hindlimb length 22mm, forelimb length 18mm, foot length 7mm, relative snout vent length/head width 3.8, relative hindlimb length/ forelimb length 1.22, heel to second largest toe 4mm.

Pholidosis characters are similar to that of holotype

*Paratype* NRC,ZSI 126a adult female, with snout vent length 31mm, tail length 62mm, relative tail length/snout vent length 2.0mm, head length 9mm, head width 7 mm, relative head length/head width 1.28, relative snout vent length/head length 3.4, hindlimb length 3.9 mm, forelimb length 21mm, foot length 16 mm, relative snout vent length/head width 4.4, relative hindlimb length/forelimb length 1.86, heel to second largest

toe 4mm. Pholidosis characters are similar to that of holotype

*Paratype* NRC,ZSI 126 b an adult female with snout vent length 32mm, tail length 62mm, relative tail length/snout vent length 1.9, head length 9mm, head width 7mm, relative head length/ head width 1.28, relative snout vent length/head length 3.5, hind limb length 39, forelimb length 21mm, foot length 16mm, relative snout vent length/head width 4.5, relative hindlimb length/forelimb length 1.86, heel to second largest toe 4mm.

Pholidosis characters are similar to that of holotype

#### *Diagnosis*

*Sitana kalesari* sp.nov. can be distinguished from known congeners by the following combination of characters, snout vent length: 22-23 mm ( $22.3 \pm 0.5$ ), tail length 41-45 mm ( $41.72 \pm 1.3$ ) (N=9) in male; snout vent length 31-32 mm ; tail length 62 mm in female; TL/SVL is 1.83-1.95 ( $1.86 \pm 0.0$ ) in male, 1.9-2.00 mm in female; relative head length to head width HL/HW 1.16 in male ( $1.16 \pm 0.0$ ) and 1.28 in female; relative snout vent length to head length SVL/HL 3.14-3.28 ( $3.18 \pm 0.0$ ) in male, 3.4-3.5 mm in female, hind limb length 19-22 mm ( $19.3 \pm 1.0$ ) in male, 22 mm in female; forelimb length 12- 18.0 mm ( $12.6 \pm 2.0$ ) in male, 18 mm in female; foot length 7 mm in male, 16 mm in female; hand length 4 mm in male, 7 mm in female; SVL/HL 3.14-3.28 ( $3.6 \pm 0.1$ ) in male, 3.4 - 3.5 in female, Heel to second largest toe 4 mm in male, 7mm in female; SVL/HW 3.6-3.8 mm in male, 1.86 in female. Digital formula: fingers formula V < I < II = III < IV; toes formula: I > II = III < IV (Table 1). Supralabials in all specimens examined are 10/9 (left/ right) and infralabials are 9/9 (left/right). Number of scale rows between supralabial and orbit are 3 (left/right); numbers of large scales between tympanum and orbit are 6/6 (left/right); contact between nasal and supralabial noted to be full. Dorsal

longitudinal rows counted at mid trunk are ten in male (N=9); nine in female (N=2) (Table 3). The ventral scales are triangular without keels. Dorsal pattern with five dark rhombi (one each at the limb insertions and three between them), which are more or less divided lengthwise by a narrow light vertebral line except the last one on tail (Fig. 5). Eyelids are light brown in both male and female. Group of scales around tympanum are also light brown. Dorsal rhombi dark brown without any margins. A light brown vertebral line divides the rhombi into two isosceles triangles. Inguinal mark is white with cream colored marks (Figs. 5,6). Gular region has brown blotch which is demarcated by light brown margins (Fig. 3). Venter is uniformly white with smooth scales.

#### *Coloration and Sexual Dimorphism*

Males are light brown however, the head has dark brown markings (Figs 1, 2, 3), lozenge pattern is of dark brown color, gular region with thin fold or streak (white in color). In female the color appears grey with dark grey pattern on head, tail and arms. Lozenge pattern is same as in male except the color is dark grey. Male mean SVL 22.3 mm, mean TL 41.7 mm, Female mean SVL 32.5 mm, mean TL 75.5 mm. Inguinal scale is white with cream colored markings.

#### *Etymology*

*Sitana kalesari* sp.nov. is named after the type locality Kalesar National Park and Wildlife Sanctuary, District Yamuna Nagar, Haryana, India.

#### *Comparisons with other allied species of Sitana*

Two species *Sitana ponticeriana* Cuvier and *Sitana minor* (Jerdon) are known from India. *Sitana ponticeriana* Cuvier is known to be distributed in Northern part of India.

Holotype of *Sitana ponticeriana* Cuvier, 1829, male (Registration no. 5051) examined from collection of Zoological Survey of India, has a large gular fan with snout vent length 36.8 mm, unlike that of *Sitana kalesari* sp.nov. Other morphometry characters also differ from that of *Sitana kalesari* sp.nov. as given in Tables 2, 6. *Sitana ponticeriana* Cuvier has mean SVL 33.15 mm and tail length 50.3 mm unlike *S. kalesari* sp. nov. (SVL 22.3 mm, TL 41.7mm), mean relative head length/width 1.56, mean relative SVL/HL 2.72. Mean forelimb length 18.30mm, hindlimb length 36.88 mm, relative hind limb length/forelimb length 2.01 and foot length 11.36 mm, relative foot length/length of second largest toe 2.9. *Sitana kalesari* sp. nov. has relative tail length/SVL 1.52, relative head length/width 1.56, relative SVL/HL 2.72, relative hind limb length/forelimb length 2.01, relative foot length/ length of second largest toe 2.9 (Table 3) According to Günther the characteristic features of *Sitana ponticeriana* Cuvier are forelimb does not extend on the vent, if laid backwards; the hind limb reaches to the orbit, if laid forward; the lower thigh is rather shorter than the foot (measured from the heel to the tip of the longest toe), the length of which is only three fourth of the distance between shoulder and hip joints. The species is known to attain to a length of 8 inches, of which tail takes 5 inches. The characteristic features of *Sitana minor* (Jerdon) as described by Jerdon are : 'the forelimb extends beyond vent, if laid backwards; the hind limb to or beyond the extremity of the snout, if laid forwards; the lower thigh is considerably shorter than the foot, the length of which is more than the distance between the shoulder and hip joints. Both the species are brown in colour with a series of rhomboidal dark spots along the back, the spot on the neck being the darkest with a white line along each side of the back. Gular appendages are known to be tricoloured with blue, black and red colours. *Sitana minor* (Jerdon) is closely allied to other, but readily distinguished by its proportionally much longer limbs, the body of which measures two inches in length, being almost as long as that of *Sitana ponticeriana* Cuvier, the body of which is three inches long, the fully grown specimen reported to measure seven inches, of which the tail takes five inches. The gular appendages are equally well developed in both the species. Supralabials are nine in all specimens examined and infralabials are ten".

Smith (1934) noted that there are two size variants with intermediates. Larger form (SNV=70-80mm, tail one and a half to twice the length of the head and body; hind limb not reaching to the snout; lateral scales not intermixed with larger ones; no enlarged scales on the occiput. This form appears to be confined to the district around Mumbai (Maharashtra). According to Smith this may possibly represent Jerdon's *deccanensis*. A smaller form with snout to vent 40-50mm, tail two to three times the length of the head and body; hind limb reaching to beyond the tip of snout; lateral and occipital scales intermixed with larger ones. This form ranges over the rest of India and Ceylon. The typical form is from Pondichery and Gunther's *minor*, from Chennai, is therefore, a synonym of it (Smith 1934). Thus *S. minor* is not considered for comparison with *S. kalesari* sp.nov.

Statistical analysis (t test) further revealed the significant difference in morphometry between *S. kalesari* sp.nov and *Sitana ponticeriana* Cuvier (Table ). The SVL, TL, TL/SVL, HL, HW, HL/HW, SVL/HL, HLL, FL,



FeL,SVL/HW, HLL/FL and HeL all parameters , thus analysed (t test) depicted highly significant differences (p value< 0.001) between the two species (Table 6 )

Thus other allied species *Sitana fusca* Schleich and Kastle, *Sitana schleichi* Anders and Kastle, *Sitana sivalensis* Schleich, Kastle and Shah with thin gular region and smaller size reported from Nepal are thus considered for comparison.

Comparisons are done in a pair-wise manner by using morphometric data

provided by Schleich, Kastle and Shah 1998, Schleich & Kastle 1998b, Anders & Kastle 2002. *Satan fusca* Schleich and Kastle has snout vent length 39.0 mm in male and 42.2 mm in female, tail length 86.2 mm in male and 83.0 mm in female (Table 2), whereas *Sitana kalesari* sp.nov. has mean SVL 22.3 mm, mean TL 41.7 mm in male and mean SVL 32.5 mm, mean TL 62.0 mm in female. Other measurements of body are also noted to differ from that of *Satan kalesari* sp.nov. (Table 3). In *Sitana fusca* supralabial scales are 8/9 (left/right) (Table 5) in male and 9/9 in female with some variations and infralabials are 9/8 (left/right) in male and 7/8 to 9/9 in female whereas in *Sitana kalesari* sp. nov. supralabials are 10/9 (left/right) and infralabials are 9/9 (left/right) both in male and female. Number of scales from supralabial to orbit are 2/2.5\*(\* two broad and one narrow), unlike 3/3 in *Sitana kalesari* sp. nov. Tympanum to orbit, the number of scale rows is 6/6 as in case of *Sitana kalesari* sp. nov (Table 5). Dorsal longitudinal rows are 8 in male and 10 in female in *S.fusca* whereas in *Satan kalesari* sp. nov. these rows are 10 in male and 9 in female. A gradual change is noted from enlarged mid gular fan scales to small size ventrals in *S. fusca*. In *Sitana kalesari* sp. nov mid gular fan scales are triangular and smaller in size than of ventrals. Due to irregularities in scale size, shape and arrangement, the dorsal scale keel rows are frequently interrupted with small scales, however this feature is not present in *Sitana kalesari* sp. nov. (Fig.5). General pattern in *S.fusca* are identical with those of *S. sivalensis* , except blue stripe on the nuchal roach and blue spot on the upper eyelid, which are also noted to be absent in *S.sivalensis* sp. nov. Orange dorsolateral patches are recorded to be present, which are very resistant to darkening and never disappear entirely. The inguinal mark is noted to be of constant light orange which is of white colour in *Sitana kalesari* sp.nov. (Fig.6).Sexual dimorphism is noted in *S.fusca* species. Males have an enlarged tail size and a gular fan has rows of enlarged scales. Dorsal rhombiis composed of two isosceles triangles as in *S. sivalensis*, but their shape is composed of bell shaped and U shaped spots unlike *Sitana kalesari* sp.nov. *S.fusca* has gular pattern with a deep blue streak which is followed by a grayish brown blotch, unlike *Sitana kalesari* sp.nov. It is white with brown spots and brown lines with brown blotch in *Sitana kalesari* sp.nov (Fig. 3).Ventral is white, but it is reported to be always marked with brown in *S. fusca*, unlike *Sitana kalesari* sp. nov., where it is uniformly white.

*Sitana schleichi* Anders and Kastle has male mean SVL 35.0 mm; female mean SVL 37.3 mm, mean TL 66.9 mm (Tables 2), relative head length/head width 1.5 in male, 1.33 in female, relative SVL: HL 3.47 in male, 3.59 in female, hind limb length/forelimb length 2.45 in male and 2.09 in female; relative foot length/length of second largest toe 1.25 in male and 1.3 in female. This morphometry of the species is noted to be different from that of *Sitana kalesari* sp.nov. (Table 2). The pileus scales of *Sitana schleichi* are triangular with obtusely rounded tips with one sharp and dark keel (sometimes with two), seven to eight supralabials, seven or eight infralabials in male, two larger scale rows and a narrow one between the eye and orbit (Table 4). Scales of the throat at midline at the end of the dark post mental streak are pointed. About 8 enlarged and asymmetrical scales in one row are present near the gular midline. Enlarged dorsal scales in 10 longitudinal rows at mid body with sharp keels in male and female are present in *Sitana schleichi* (Table 5). The process of enlarged thigh scale is reported to be extremely developed in case of *Sitana schleichi*, but not in *Sitana kalesari* sp.nov (Fig. 6).Ventral scales are rounded with weak keels whereas in *Sitana kalesari* sp. nov.ventral scales are triangular without keels. Tail with strongly keeled scales which are regularly arranged in oblique rows. The ventral scales at the base of the tail are not keeled. At upper side of head, there are dark, grayish brown patches and supralabials are mottled with a blackish colour. In the region anterior and posterior of the tympanum, groups of scales are diffuse white, unlike *Sitana kalesari* sp. nov.Upper side of body: 5 blackish, regular dorsal rhombi with light margins. *Sitana kalesari* sp. nov.has rhombi without light margin (Fig 6). In *Sitana schleichi* a light brown ventral line divides the rhombi into two isosceles triangles and starts on the nape between two narrow dark patches and between the rhombi, the dorsum is beige like *Sitana kalesari* sp. nov. but with a brownish - orange enlarged dorsolateral scales unlike *Sitana kalesari* sp. nov. The holotype male of *S. schleichi* has a gular fan and a dark blue gular streak, unlike *Sitana kalesari* sp.nov. Behind it towards the foreleg insertion there is a wide lighter brown blotch in gular region, across the whole ventral side of the neck like *Sitana kalesari* sp.nov. (Fig.4).

*Sitana sivalensis* Schleich, Kastle and Shah has mean snout vent length (SVL) 39.5 mm, mean tail length (TL) 80.3 mm in male; mean SVL 37.3 mm, mean TL 76.7 in female, relative head length (HL)/head width

(HW) in male 1.36 and in female 1.32; relative SVL//HL3.84 in male and 3.87 in female; HL/FL 1.93 in male and 2.29 in female; relative foot length/length of the second largest toe 1.4 for male and 1.5 for female. These measurements are noted to be different from that of *Sitana kalesari* sp.nov. In *Sitana kalesari* sp.nov.snout vent length is 22-23 mm, tail length 41-45 mm in male (N=9) whereas in female it is 31-32 mm and tail length is 62 mm. relative head length (HL)/head width HW is 1.16 in male, 1.28 female;SVL/HL 3.14-3.28 in male, 3.4 - 3.5 in female (Table 1). In holotype of *S. sivalensis*,pileus is noted to be imbricate, unequal, rounded and polygonal with one keel. Three rows of elongated scales are present between the orbit and supralabials; supralabials (left/right): 8/8, infralabials (left /right): 8/9 in male; unlike that of *Sitana kalesari* sp.nov.; six large scales counted in one row between the orbit and tympanum like that of *Sitana kalesari* sp. nov in male (Table 6) ; supralabials (left/right) max 10/9, min 8/8; infralabials 10/8 max, 8/8 min unlike that of *Sitana kalesari* sp. nov. (Table 5). Scales of gular fan are keeled but not in *Sitana kalesari* sp. nov.(Fig.4).Dorsal scale keeled, subtriangular, rounded with sharp keels, in eight-nine longitudinal rows. Scales in the two median (vertebral) rows are smaller than the lateral ones, unlike *Sitana kalesari* sp. nov.Ventral scales: regular, keeled, with indistinct transition zone laterally. The scale forms varied between triangular with straight sides, rounded tip and sub triangular with rounded sides. In case of *Sitana kalesari* sp. nov., the ventral scales are triangular without keels. Dorsal pattern with five dark rhombi (one each at the limb insertions and three between them, which are more or less divided lengthwise by a narrow light vertebral line in *S.sivalensis* is similar to *Sitana kalesari* sp. nov.The upper side of the anterior head is sepia brown with prefrontal triangle almost black unlike *Sitana kalesari* sp. nov. Eyelids are whitish grey with large diffuse spots of ultramarine blue unlike in *Sitana kalesari* sp. nov. Group of scales around tympanum are white unlike *Sitana kalesari* sp.nov. Dorsal rhombi colour is dark sepia brown with light orchre margins. A light brown vertebral line divides the rhombi into two isosceles triangles with the exception of the first one, which is divided by the ultramarine line unlike *Sitana kalesari* sp. nov.Inguinal mark is light grayish brown in *S.sivalensis* but it is white in *Sitana kalesari* sp. nov. (Fig.6).Gular sides are dotted with dark brown with dark gular streak composed of two parts i.e. the anterior dark ultramarine blue which is sharply delimited unlike that of *Sitana kalesari* sp. nov. It penetrates into a diffuse brown blotch which extends backwards between the forelegs, this brown blotch is also resent in *Sitana kalesari* sp. nov. Normally females show different hues of brown in *Sitana sivalensis* sp.nov.Venter is white but abdominal pattern consists of longitudinal streaks with mid ventral ones unlike *Sitana kalesari* sp. nov.

The comparison study in the present study through t test between *Sitana kalesari* sp. nov and other species from Nepal could not be done because of lack of accesss to specimens from Nepal, but the published work by Schleich, Kastle and Shah 1998, Schleich & Kastle 1998b, Anders & Kastle 2002 has been used for comparison indicated the clear difference between the species from Nepal and *Sitana kalesari* sp. nov and based *Sitana kalesari* sp. nov., the small fanned lizards of genus *Sitana* belongs to on this the key was prepared . *sivalensis* complex. *Sitana kalesari* sp. nov., differs from congeners in various measurements (Tables 2) and other characters like pholidosis (Table 4) and features of gular region. As far as body measurements are concerned the differences from other allied species are noted in snout vent length, tail length and relative tail length/SVL, Head length HL, Head width HW, relative head length/width, relative SVL/HW, Forelimb length FL, Hind limb length HL, realtive Hindlimb length / forelimb length , Foot length FoT, Heel to second largest toe HeL (Table 1,2,3).

Pholidosis characters vary from that of other allied species mainly in number of supralabials (left/right), infralabials (left/right) and dorsal median rows (Table 5). Gular fan, a small fan in *Sitana kalesari* sp. nov.is noted to differ in scale pattern and colour from other allied species. The lonzenge pattern is different from other allied species in shape as well as in colour. It is U shaped in *Sitana fusca* (Schleich & Kastle 1998a) but it is V shaped in *Sitana kalesari* sp. nov.like that of *Sitana schleichi* and *sivalensis*. But there is no ultramarine or blue coloration noted in the pattern as reported in *schleichi* and *sivalensis* (Kastle 2002, Schleich, Kastle & Shah1998). The inguinal mark, major character of the genus is noted to be white in the sp. nov.whereas it is reported orange, creamish brown in other allied species.

Sexual dimorphism is observed in the *S.kalesari* sp. nov with differences in morphometric and colouration, the presence of gular fan in male, but very little difference in pholidosis. Further molecular study is required to differentiate the described species of *Sitana* with that of *S.kalesari* sp.nov.

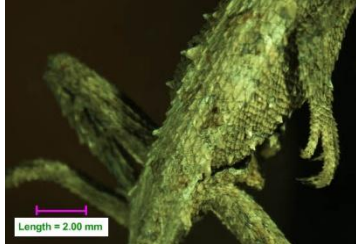
#### Key to *Sitana* species (based on males)

1. Enlarged scales of folded fan reach mid venter where they are superposed into a sack---- *Sitana ponticeriana* complex
- 1' Enlarged scales of folded fan reach only the foreleg insertion----- *Sitana sivalensis* complex ----2
- 2 lonzenge pattern V shaped-----3, 3', 4, 5.

- 2' lonzenge pattern U shaped ----- 6
3. the terminal scales of the folded fan form a flat pile of enlarged scales which covers the first regular ventral scales; brown gular patch medially light or divided. ----- *Sitana sivalensis*
- 3' The terminal scales of the folded fan gradually change into the first regular ventrals----- 4
4. In wet preserved specimens, the blue peritoneum (lining of the abdominal cavity) colour is visible through the translucent ventral skin; brown gular pouch large and mesially dark. ----- *Sitana schleichi*
5. lonzenge pattern without ultramarine or blue colouration noted in the pattern as reported in *schleichi* and *sivalensis* The inguinal mark, white. ----- *Sitana kalesari* sp.nov.
- 6 Ventral colour whitish or with brown pattern. Basic colouration in the field dark brown; blue gular streak prolonged posteriorly. lonzenge pattern U shaped Range: Eastern Nepal ----- *Sitana fusca*



**Fig 1. *Sitana kalesari* sp.nov. as sighted (NRC,ZSI 151).**



**Fig 2. Dorsal view of *Sitana kalesari* sp.nov. after preservation(NRC,ZSI 151).**



**Fig 3. Pholidosis of head of *Sitana kalesari* sp.nov(NRC,ZSI 151) .**



**Fig 4. Gular region of *Sitana kalesari* sp.nov(NRC,ZSI 151) .**



**Fig.5. Lozenge pattern on dorsal side of *Sitana kalesari* sp.nov(NRC,ZSI 151) .**



**Fig 6. Inguinal scale of *Sitana kalesari* sp.nov(NRC,ZSI 151) .**



Table 2. Morphometry of Holotype and paratypes of *Sitana ponticeriana* (with registration number, from collection of Zoological Survey of India)

Morphometric parameters	Holotype Reg no 5051	Paratype I Reg no 5052	Paratype II Reg no. 5053	Paratype III Reg no. 5054	Paratype IV Reg no. 5055	Mean $\pm$ SD
SVL	36.8	32.07	32.8	34.6	29.5	33.15 $\pm$ 2.7
TL	50.0	51.0	50.0	50.0	50.5	50.3 $\pm$ 0.4
Relative tail length/SVL	1.35	1.59	1.52	1.44	1.71	1.52 $\pm$ 0.1
HL	12.6	12.45	12.07	10.53	13.19	12.17 $\pm$ 1.0
HW	8.8	7.89	8.46	6.48	7.16	7.7 $\pm$ 0.9
Relative head length/head width	1.43	1.5	1.47	1.6	1.84	1.568 $\pm$ 0.16
Relative SVL/HW	4.18	4.06	3.8	5.3	4.12	4.292 $\pm$ 0.5
Forelimb length FL	19.0	19.42	22.3	12.9	17.9	18.304 $\pm$ 3.430172
Hindlimb length HLL	44.0	40.1	41.2	28.5	30.6	36.88 $\pm$ 6.8
Relative hind limb length/forelimb length	2.3	2.06	1.8	2.2	1.7	2.012 $\pm$ 0.2
Foot length	11.93	11.9	11.0	11.0	11.0	11.366 $\pm$ 0.5
Heel to second largest toe	4	4	4	4	4	4.0 $\pm$ 0.0
Relative foot length/length of second largest toe	2.9	2.9	2.9	2.9	2.9	2.9 $\pm$ 0.0

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