

# Description of a novel species of *Mesalina* Gray, 1838 (Reptilia: Sauria: Lacertidae) from Rajasthan, India

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## Abstract

We describe a new species of the genus *Mesalina* from Rajasthan, India. The new species is genetically distinct and belongs to the *M. watsonana* species complex, and differs from all other congeners in a combination of morphological characters, such as 10 upper labials; eight lower labials; two large transparent shields of lower eyelid accompanied with three smaller shields; scales on tibia keeled; ventral plates in eight straight longitudinal series and 30 transverse rows; 34 dorsal granular scales across middle of back; nine collars; five submaxillaries; 24 gulars; four supraoculars; six or seven supraciliaries; one very large preanal shield surrounded above and at the sides by two rows of smaller scales; 14 femoral pores on each side of the thigh, narrowly separated by two scales; 21 lamellae under fourth toe.

**Keywords:** Desert lizard, morphology, phylogeny, taxonomy, Thar desert

## Introduction

*Mesalina* Gray, 1838 is a diverse genus within the family Lacertidae Oppel, 1811, currently comprising 27 described species (Uetz *et al.*, 2026), divided into seven species complexes: *M. adramitana* (Boulenger, 1917), *M. brevisrostris* Blanford, 1874, *M. guttulata* (Lichtenstein, 1823), *M. martini* (Boulenger, 1897), *M. olivieri* (Audouin, 1829), *M. rubropunctata* (Lichtenstein, 1823), and *M. watsonana* (Stoliczka, 1872) (Simó-Riudalbas *et al.*, 2019). Members of this genus are small, fast-moving, diurnal lizards well adapted to arid and semi-arid habitats, and they occur broadly from the Atlantic Sahara across North Africa to Southwest and South Asia (Sindaco *et al.*, 2008; Simó-Riudalbas *et al.*, 2019; Boroumand *et al.*, 2024a).

Members of the *M. watsonana* species complex have been reported from Iran, parts of Turkmenistan, Afghanistan, and Pakistan, with an additional historical mention from India (Smith, 1935; Anderson, 1999; Khan, 2006; Yousefkhani *et al.*, 2013; Kapli *et al.*, 2015; Ahmadzadeh *et al.*, 2017;

Boroumand *et al.*, 2024a, 2024b; Uetz *et al.*, 2026). The Indian record of the genus *Mesalina*, however, is based solely on Smith (1935), with a solitary locality record of *M. watsonana* from Jaisalmer in the state of Rajasthan.

During a recent field survey, we collected a specimen of *Mesalina* from near Gajner, Bikaner District, Rajasthan, India. This constituted the first verified record of the genus from India and confirmed its occurrence within the country. The specimen is morphologically distinct and phylogenetically divergent from other congeners, and it belongs to the *M. watsonana* species complex. In this paper, we formally describe this distinct lineage as a new species.

## Materials and methods

### Sampling

The lizard was hand-collected from outside a protected area in Bikaner District, Rajasthan, India, and euthanised using halothane in accordance with established ethical guidelines for animal euthanasia (Leary *et al.*, 2013). Liver

tissues from the specimen were preserved in molecular-grade ethanol and stored at  $-20^{\circ}\text{C}$  for subsequent molecular analyses. The specimen was deposited in the Reptilia section of the Zoological Survey of India, Kolkata (ZSI-R).

### Morphological Data

A total of 25 morphological characters, including 10 metric and 15 meristic, were examined following Boroumand *et al.* (2024a) and Ray & Mohapatra (2025). Comparative data on the members of the *M. watsonana* species complex were taken from museum specimens listed in the material examined section (Appendix 1) as well as from earlier literature (Boroumand *et al.*, 2024a). Scale counting was done using a Tomlov digital microscope. Metric characters included: head width measured immediately anterior to the ear opening (hw); head length measured ventrally from the snout tip to the posterior margin of the collar (hl); total forelimb length from the limb base to the tip of the longest toe (ffl); trunk length measured from the groin to the axilla (trl); snout-vent length from the snout tip to the cloaca (svl); total hindlimb length from the limb base to the tip of the fourth toe (hfl); pileus length measured dorsally from the snout tip to the posterior margins of the parietal and occipital scales (pl); head height near the occipital plate (hh); mouth opening measured laterally from the snout tip to the corner of the mouth (mo); and tail length from the cloaca to the tail tip (tl). Meristic characters included: number of ventral scales in transverse rows (vstn); number of ventral scales along the midline (vsn); collar scales (csn); gular scales (gsn), counted from the angle between the maxillary scales to the collar; submaxillary scales (smsn); femoral pores (fpn); upper labial scales (ulsn); lower labial scales (llsn); supraocular scales (sosn); supraciliary scales (scsn); dorsal granular scales counted across the mid-dorsum (dgsn); transparent shields on the lower eyelid (tslen); lamellae under the fourth toe (lft); scales between femoral pores on each side (sbf); and semicircular rows of scales bordering the preanal scale (rspn).

### Molecular Data

Genomic DNA was extracted from ethanol-preserved liver tissue using the DNeasy Blood and Tissue Kit (Qiagen, Hilden, Germany). The 16S ribosomal RNA (16S) gene was amplified using primers 16sar-L and 16sbr-H (Palumbi *et al.*, 1991), while L15783 and H16064 primers were used for amplifying cytochrome *b* (Cyt

*b*) (Kocher *et al.*, 1989), following the PCR protocol of Boroumand *et al.* (2024b). Sequencing was outsourced at the DNA Laboratory of the Mammal & Osteology Section, Zoological Survey of India (ZSI), Kolkata. The newly generated sequence was incorporated into the aligned dataset of the *M. watsonana* group from Boroumand *et al.* (2024b) (Table 1) with *Mesalina brevirostris* Blanford, 1874 as outgroup. The quality of sequences was checked, and contigs were assembled in the Geneious Prime program 2021.1.1.0 (Biomatters Ltd, <http://www.geneious.com/>) and aligned with ClustalW (Thompson *et al.*, 1994) under default settings in MEGA v12 (Kumar *et al.*, 2024). Uncorrected pairwise sequence divergences (*p*-distances) were calculated, and an ML tree was generated using codon-partitioned data with 1000 bootstrap replicates to assess node support.

## Results

Phylogenetic analyses recovered that the newly identified lineage falls within the *M. watsonana* group (Fig. 1). Genetic analysis based on uncorrected pairwise sequence divergence (*p*-distances) in 16S indicates that the new lineage differs from its sister taxon, *M. sp.* (Afghanistan), by 4%, 4.2–4.8% from *M. watsonana*, 4.5–4.7% from *M. khuzestanensis* and from other congeners by more than 5.3% (Table 2). In *Cytb*, based on uncorrected *p*-distances, the new lineage differs from its sister taxon, *M. watsonana*, by 9.3–9.9%, 10.2–10.4% from *M. khuzestanensis*, and from other congeners by more than 10.7% (Table 3). Given its substantial genetic divergence, we herein describe this lineage as a new species.

## Taxonomic Account

### *Mesalina bishnoi* sp. nov.

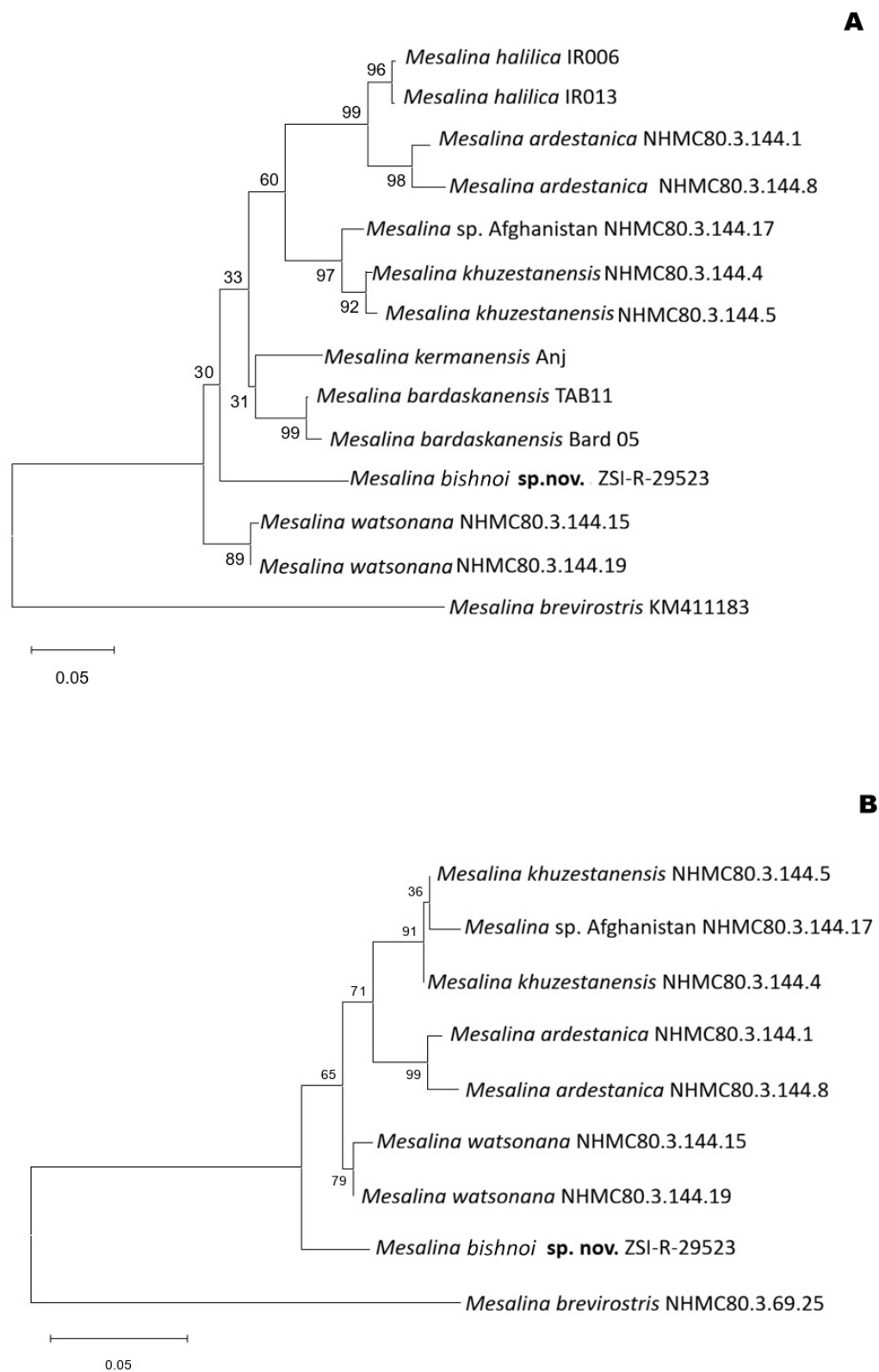
**Zoobank Registration:** urn:lsid:zoobank.org:pub:C5C17F18-0C39-4FAD-971C-06E8F33AA9E6

(Figs. 2, 3)

### Holotype

ZSI-R-29523, from near Gajner, Bikaner district, Rajasthan, India (27.940725°N, 73.006918°E), collected by D. Khandal and V. Sharma, on 6 August 2025.

**Etymology:** The specific epithet *bishnoi* (noun in apposition) honours the Bishnoi community of Rajasthan,



**Fig. 1.** Maximum-likelihood consensus tree based on (A) *Cytb* and (B) 16S gene. Numbers by the nodes indicate ML bootstrap support values.



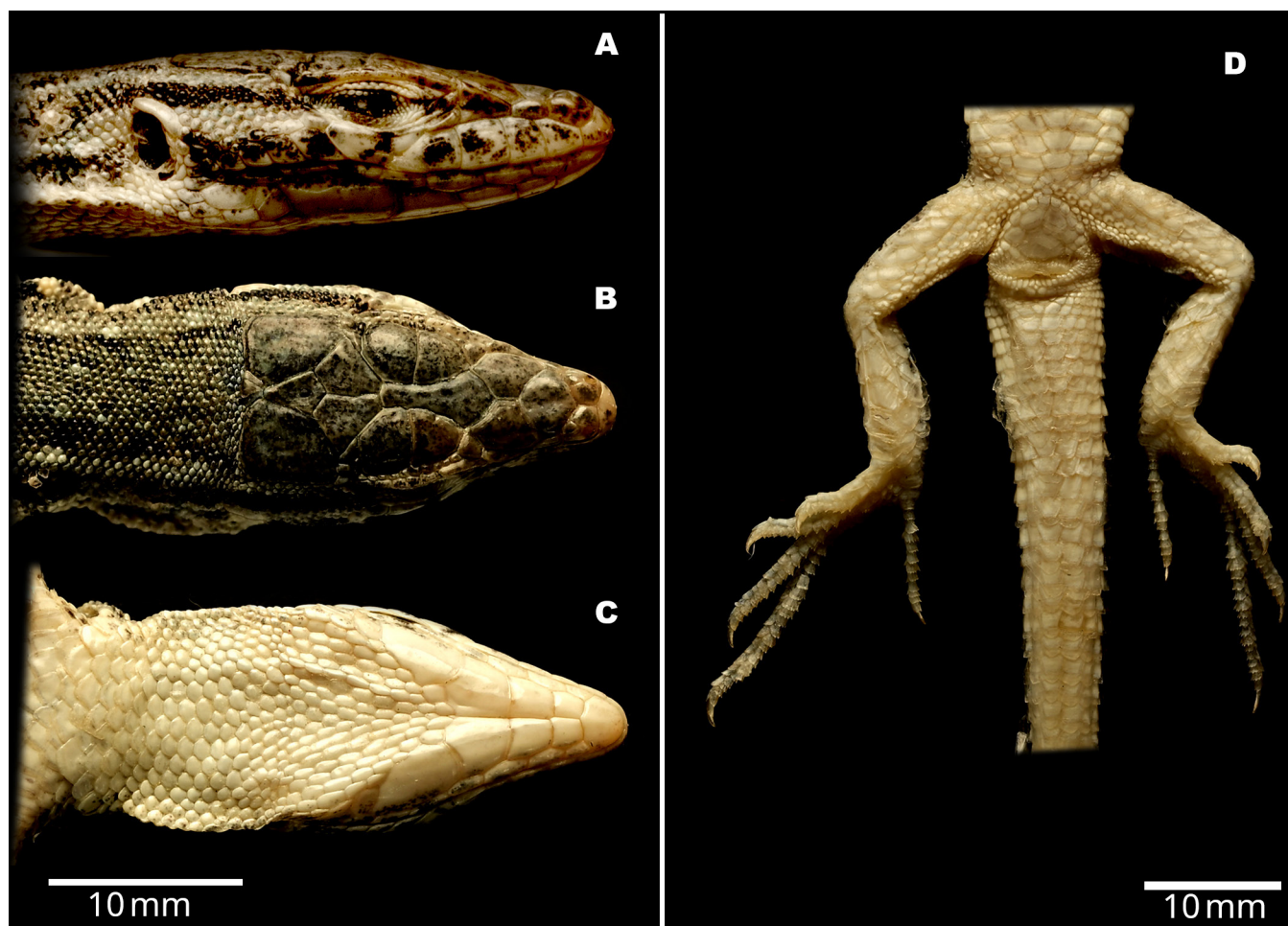
**Fig. 2.** *Mesalina bishnoi* sp. nov. (holotype, ZSI-R-29523) (A) dorsal view of body, (B) ventral view of body.

India, an indigenous socio-ecological group renowned for their long-standing traditions of biodiversity conservation and sustainable coexistence with wildlife. Bishnoi cultural tenets, grounded in a deep reverence for nature, have contributed to the protection of numerous desert species and ecosystems in the Thar Desert since the 15th century. By naming this species *Mesalina bishnoi*, we recognise and celebrate the enduring environmental stewardship of the Bishnoi people and their contribution to the preservation of arid-zone herpetofauna.

**Diagnosis:** A member of the *M. watsonana* complex with three nasals, lower in contact with rostral and first upper labial; 10 upper labials (the fifth upper labial being largest and under the orbit); eight lower labials; shields of head often smooth; occipital present; a long, narrow shield at the upper anterior edge of the tympanic hole; two large transparent shields of lower eyelid accompanied with three smaller shields; scales on tibia keeled; ventral plates

in eight straight longitudinal series and 30 transverse rows; 34 dorsal granular scales across middle of back; collar complete, curved and serrated, nine collars; five submaxillaries; 24 gulars; four supraoculars, the first and fourth supraoculars smaller than the others; six or seven supraciliaries; a row of granules separating supraoculars and supraciliaries incomplete; one very large preanal shield surrounded above and at the sides by two rows of smaller scales; 14 femoral pores on each side of the thigh, narrowly separated by two scales; 21 lamellae under fourth toe. Morphometric and meristic data of the holotype of *M. bishnoi* sp. nov., along with examined specimens of *M. watsonana*, have been provided in Table 4.

**Description of the Holotype:** An adult female; width of the head before the tympanic hole (hw) 6.3 mm; head length, from the tip of the snout to the posterior margin of the collar (hl) 14.5 mm; total forelimb length, from the base to the tip of the 4th toe (ffl) 13.6 mm; trunk length, from



**Fig. 3.** *Mesalina bishnoi* sp. nov. (holotype, ZSI-R-29523) (A) lateral view of head, (B) dorsal view of head, (C) ventral view of head, (D) view of cloacal region.

the groin to the armpit (trl) 18.0 mm; length of the body from the tip of snout to the cloaca (svl) 39.2 mm; total hind limb length, from the base to the tip of the 4th toe (hfl) 25.1 mm; pileus length, dorsally from the tip of the snout to posterior margin of parietal and occipital scales (pl) 9.6 mm; head height near the occipital plate (hh) 4.0 mm; mouth opening, from the tip of the snout to the end of the mouth (mo) 8.0 mm; ventral plates in eight straight longitudinal series; 30 ventral scales in transverse rows; nine collars; 24 gulars; five submaxillaries; 14 femoral pores (on each side); the upper labial has ten scales; the lower labial has eight scales; the supraocular has four scales; seven supraciliaries on left side and six on the right; 34 dorsal scales; five large scales on the lower eyelid and there are 21 lamellae under 4th toe.

**Colouration** (Fig. 4 a-c): In life, the dorsal ground colour is predominantly greyish to olive-brown; a pair of dorso-

lateral stripes from nape towards tail, which becomes discontinuous towards the distal end; head with distinctly black post-ocular stripe and orbit with a crescent-shaped black marking below; supralabials with light brown spots. The back is variably suffused with darker brown to blackish irregular blotches with white spots, and the mid-dorsal region is devoid of any markings; the darker markings are uneven in shape and spacing, producing a mottled appearance. The flanks are with a darker stripe outlined by the dorsolateral stripes above and a faint brown stripe below with diffused mottling. Limbs are patterned similarly to the body, showing irregular dark spots and faint banding. The tail is generally concolorous with the dorsum but exhibits a weaker pattern, restricted to the anterior part and more uniform distally. Ventral side markedly paler, ranging from off-white to light grey, largely lacking pattern except for faint speckling along



**Fig. 4.** *Mesalina bishnoi* sp. nov. (A–C) holotype (ZSI-R-29523) (in life), (D) habitat in the type locality.

the lateral margins. In spirit, the major patterns are unchanged but became darker.

**Comparison:** As *M. bishnoi* sp. nov. is phylogenetically clustered with the *M. watsonana* species complex, we restrict comparisons to members of this complex. The new species can be distinguished from all the members of this complex based on the following combination of morphological characters: vstn eight (versus 10 in all the other members of this complex); csn nine (versus 12 in *M. khuzestanensis*, 12 or 13 in *M. halilica* and *M. ardestanica*, 11–14 in *M. bardaskanensis*, 11–15 in *M. watsonana*); gsn 24 (versus 22 in *M. khuzestanensis*, 20–23 in *M. esfarayensis*); smsn five (versus six in *M. ardestanica*); fpn 14 (versus 10–12 in *M. khuzestanensis* and *M. watsonana*, 12 or 13 in *M. halilica*, 10–13 in *M. kermanensis* and *M. esfarayensis*); ulsn 10 (versus eight in *M. khuzestanensis* and *M. ardestanica*, nine in *M. halilica*, eight or nine in *M. bardaskanensis* and *M. esfarayensis*);

llsn eight (versus seven in *M. khuzestanensis*); sosn four (versus three in *M. khuzestanensis*); scsn six or seven (versus five in *M. khuzestanensis*); dgsn 34 (versus 46–47 in *M. khuzestanensis*, 45 in *M. halilica*, 40–45 in *M. kermanensis*, 48–52 in *M. ardestanica*, 42–46 in *M. bardaskanensis*, 43 in *M. esfarayensis*, 36–47 in *M. watsonana*); lft 21 (versus 22 in *M. khuzestanensis*, 24–26 in *M. halilica*, 22–24 in *M. kermanensis*, 25 in *M. ardestanica*, 22–31 in *M. watsonana*); sbfp two (versus three in *M. ardestanica*); rspn two (versus more than two in *M. khuzestanensis*, one in *M. esfarayensis* and *M. watsonana*); and tibia scales keeled (versus smooth or feebly keeled in *M. watsonana*, smooth in all the other members of this complex). A detailed comparison of diagnostic characters among these species is provided in Table 5.

**Distribution and Natural History:** *M. bishnoi* sp. nov. is currently endemic to the Thar biogeographic province



**Fig. 5.** Distribution map of the members of the *Mesalina watsonana* species complex including *Mesalina bishnoi* sp. nov. (white reverse triangle: *M. ardestanica*; black triangle: *M. khuzestanensis*; black circle: *M. halilica*; black rhomboids: *M. bardaskanensis*; black transparent rhomboids: *M. kermanensis*; black square: *M. esfarayensis*; white circle: *M. watsonana*; white triangle: *M. sp.* Afghanistan; red star: *M. bishnoi* sp. nov.)

(3A) of the Desert biogeographic zone (Rodgers *et al.*, 2000) and recorded only from the type locality in Bikaner District of Rajasthan, India (Fig. 5). Although morphologically similar lacertid lizards have been observed in the Barmer District, we refrain from assigning this population to the new species pending further taxonomic investigation, which will be addressed in forthcoming studies.

The new species inhabits an open arid semi-desert landscape characterised by hard soil containing rocks with sparse xerophytic scrub and low, scattered shrubs (Fig. 4d). In the type locality, the new species was found along with other sympatric reptile species such as *Hemidactylus sahgalii* Mirza *et al.*, 2018 of family Gekkonidae, *Platyceps ventromaculatus* (Gray, 1834) of family Colubridae and *Echis carinatus* (Schneider, 1801) of family Viperidae.

## Discussion

As there are no confirmed records of the genus *Mesalina* from India supported by voucher specimens, its occurrence in the country has long remained uncertain. The present study highlights the need for intensive taxonomic surveys in relatively understudied regions, particularly the arid western parts of India. The record of *M. watsonana* from Jaisalmer District reported by Smith (1935) warrants reassessment, as no voucher specimens were provided to substantiate this occurrence. Subsequent studies have either reiterated the presence of the species in India based on Smith's account (Sharma, 2005; Aengals *et al.*, 2018; Mohapatra *et al.*, 2025) or regarded the record as doubtful owing to the lack of specimen-based evidence (Biswas &

Sanyal, 1977; Venugopal, 2010; Mohapatra *et al.*, 2024). In the absence of verifiable material, the identity of the Jaisalmer population cannot be conclusively assigned to either *M. watsonana* or *M. bishnoi* sp. nov.

It is plausible that the Indus River functions as a major biogeographic barrier separating typical *M. watsonana* populations from *M. bishnoi* sp. nov., as nearly all confirmed localities of *M. watsonana* in Pakistan are situated west of the river. Only a single locality from the eastern bank, *i.e.*, Hyderabad, has been reported by Boulenger (1921). However, although Hyderabad lies on the eastern bank of the Indus River, the specimens referred to by Boulenger (most possibly NHMUK 1887.9.22.32–33) may have been collected from the broader vicinity

of the city, which encompasses areas on both sides of the river.

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## Appendix 1.

**Material examined: *Mesalina watsonana* (Stoliczka, 1872):** ZSI-R-4929, from Karachi, Pakistan, exchanged

with Karachi Museum; ZSI-R-5050 (lectotype), from the right bank of the Indus between Karachi and Sukkur, collected by Dr. Stoliczka; ZSI-R-5223-5225, from West of Sind, collector data unavailable.

**Table 1.** Sequences of the *Cytb* and 16S gene used in this study

S. No.	Species	Tissue voucher	locality	16S	<i>Cytb</i>	Source
1	<i>Mesalina bishnoi</i> sp. nov.	ZSI-R-29523	India	PZ437259	PZ452671	This study
3	<i>Mesalina khuzestanensis</i>	NHMC80.3.144.4	Iran	KM410978	KM411126	Kapli et al., 2015
4	<i>Mesalina khuzestanensis</i>	NHMC80.3.144.5	Iran	KM410979	KM411127	Kapli et al., 2015
5	<i>Mesalina halilica</i>	IR006	Iran	*	MK551696	Simó-Riudalbas et al., 2019
6	<i>Mesalina halilica</i>	IR013	Iran	*	MK551697	Simó-Riudalbas et al., 2019
7	<i>Mesalina kermanensis</i>	Anj	Iran	*	JN828647	Šmíd & Frynta, 2012
9	<i>Mesalina ardestanica</i>	NHMC80.3.144.1	Iran	KM411066	KM411217	Kapli et al., 2015
10	<i>Mesalina ardestanica</i>	NHMC80.3.144.8	Iran	KM411004	KM411155	Kapli et al., 2015
11	<i>Mesalina bardaskanensis</i>	TAB11	Iran	*	MK551698	Simó-Riudalbas et al., 2019
12	<i>Mesalina bardaskanensis</i>	Bard 05	Iran	*	JN828634	Šmíd & Frynta, 2012
15	<i>Mesalina watsonana</i>	NHMC80.3.144.15	Iran	KM411002	KM411153	Kapli et al., 2015
16	<i>Mesalina watsonana</i>	NHMC80.3.144.19	Pakistan	KM411069	KM411220	Kapli et al., 2015
17	<i>Mesalina watsonana</i>	NHMC80.3.144.17	Afghanistan	KM411068	KM411219	Kapli et al., 2015
18	<i>Mesalina brevirostris</i>	NHMC80.3.69.25	Kuwait	KM411031	KM411183	Kapli et al., 2015

**Table 2.** Pairwise uncorrected 16S sequence divergence (p-distances) in percentage, among the *M. watsonana* complex and the outgroup.

S. No.	Name of the species	1	2	3	4	5	6
1	<i>M. bishnoi</i> sp. nov.	0					
2	<i>M. sp. Afghanistan</i>	4	0				
3	<i>M. watsonana</i>	4.2–4.8	3.7–4.3	0.8			
4	<i>M. khuzestanensis</i>	4.5–4.7	1.3–1.5	3.4–4.3	0.2		
5	<i>M. ardestanica</i>	5.3–6.5	4.4–4.8	4.0–5.0	3.6–4.3	1.7	
6	<i>M. brevirostris</i>	11.7	12.8	12.5–12.6	11.8	13.1–14.3	0

**Table 3.** Pairwise uncorrected *Cytb* sequence divergence (p-distances) in percentage, among the *M. watsonana* complex and the outgroup.

S. No.	Name of the species	1	2	3	4	5	6	7	8	9
1	<i>M. bishnoi</i> sp. nov.	0								
2	<i>M. watsonana</i>	9.3–9.9	0.6							
3	<i>M. khuzestanensis</i>	10.2–10.4	10.9–12.5	1						
4	<i>M. halilica</i>	10.7	11.0–11.4	8.0–9.2	0.5					
5	<i>M. ardestanica</i>	10.7–10.9	11.4–12.5	9.2–10.6	5.2–6.1	3.2				
6	<i>M. sp. Afghanistan</i>	10.8	10.0–10.5	3.5–3.9	8.9	9.6–10.6	0			
7	<i>M. bardaskanensis</i>	11.7–12.7	7.5–9.4	8.9–10.7	10.4–10.8	10.7–12.1	8.9–9.7	1.6		
8	<i>M. kermanensis</i>	13.2	9.5–9.7	10.3	11.7–12.1	11.5–12.5	10.6	10.4–10.5	0	
9	<i>M. brevirostris</i>	16.3	14.9–15.8	15.9–16.0	16.9–17.4	17.0–17.4	16.1	17.3–17.9	16.1	0

**Table 4.** Morphological and meristic data for the specimens of *Mesalina* spp. in Reptilia section, ZSI, Kolkata, including the new species. \* denotes damaged body parts

Voucher No./ characters	ZSI-R-29523 <i>M. bishnoi</i> sp. nov. (holotype)	ZSI-R-5050 <i>M. watsonana</i> (lectotype)	ZSI-R-4929 <i>M. watsonana</i>	ZSI-R-5223 <i>M. watsonana</i>	ZSI-R-5224 <i>M. watsonana</i>	ZSI-R-5225 <i>M. watsonana</i>
hw	6.3	8.5	7.8	8.5	6.8	8.5
hl	14.5	20.0	14.7	17.6	14.5	18.6
ffl	13.6	16.9	13.9	14.8	15.0	14.6
trl	18.0	23.0	30.1	22.9	26.3	22.1
svl	39.2	51.7	53.2	49.4	48.5	52.2
hfl	25.1	31.5	25.9	29.0	26.1	29.2
pl	9.6	13.0	10.7	11.7	10.2	11.9
hh	4.0	6.0	5.6	5.0	4.7	5.3
mo	8.0	7.3	7.0	8.7	6.2	7.7
tl	79.1	*	*	*	*	113.9
vstn	8	10	10	10	10	10
vsn	30	29	37	29	32	29
csn	9	11	10	10	9	8
gsn	24	23	25	28	23	27
smsn	5	5	5	5	5	5
fpn (l/r)	14/14	13/13	12/13	16/16	10/10	13/13
ulsn	10/10	9/9	9/9	9/9	8/8	8/8
llsn	8/8	7/7	8/8	7/7	7/7	7/7
sosn	4	4	4	4	4	4
scsn	7/6	6	6	6	6	6
dgsn	34	40	34	43	37	38
tslen	5	2	2	2	2	2
lft (l/r)	21	22	21	22	20	22
sbfps	2	2	1	2	2	2
Rspn	2	1	1	2	2	2

**Table 5.** Comparative key morphological characters of *M. watsonana* species complex

Name of the species	vstn	vsn	csn	gsn	smsn	fpn	ulsn	llsn	sosn	scsn	dgsn	tslen	lft	sbfp	rspn	tibia scales
<i>Mesalina bishmoi</i> sp. nov.	8	30	9	24	5	14	10	8	4	6-7	34	5	21	2	2	keeled
<i>Mesalina khuzestanensis</i>	10	27-32	12	22	5	10-12	8	7	3	5	46-47	2	22	2-3	>2	smooth
<i>Mesalina halilica</i>	10	30	12-13	24-25	5	12-13	9	8	4	6	45	2	24-26	2	2	smooth
<i>Mesalina kermanensis</i>	10	28-31	9-12	22-28	5	10-13	8-10	7-8	3-4	5-7	40-45	2	22-24	2-3	2	smooth
<i>Mesalina ardestanica</i>	10	27-31	12-13	24-28	6	12-14	8	8	4	6-7	48-52	2	25	3	2	smooth
<i>Mesalina bardaskanensis</i>	10	28-31	11-14	22-27	5-6	11-14	8-9	7-8	4	6-8	42-46	2	20-25	1-3	2	smooth
<i>Mesalina esfarayensis</i>	10	28-33	9-11	20-23	4-5	10-13	8-9	6-8	4	6-7	43	2	20-24	1-3	1	smooth
<i>Mesalina watsonana</i>	10	26-32	11-15	21-27	5	10-12	8-10	6-8	3-4	6-7	36-47	2	22-31	2-3	1	smooth or feebly keeled