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Lost before being recognized? A new species of the genus *Ophisops* (Squamata: Lacertidae) from Gujarat, India

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Abstract

A new species of the lacertid genus *Ophisops* is described based on a single female specimen from a plateau in the Dahod district, Gujarat state, western India. The new species is diagnosable by the following suite of characters: a small-sized *Ophisops* (adult, snout to vent length 40.8 mm); two frontonasals; prefrontals not in contact; enlarged tympanic scale absent; 30 scales around mid-body; 19 lamellae underneath the fourth toe; five chin shields, first two in contact medially; 15 gular scales between symphysis of chin shields and ventral plates; large mental scale, extending beyond second supralabial; females with 9 femoral pores on either side interrupted by three poreless scales. The new species, *Ophisops agarwali* sp. nov. is the fourth endemic species of reptile described in last 12 years from the state of Gujarat and highlights the rich and unique diversity of this understudied region. The single known specimen of the new species was collected nearly two decades ago and recent surveys by the authors at the type locality and surrounding areas failed to yield a surviving population which reflects the possibility that *Ophisops agarwali* sp. nov. may have been lost before any understanding could be gained about its existence or identity. The study emphasises dire need for proper taxonomic documentation of animals from poorly studied regions in India.

Key words: Endemic, plateau, Snake-eyed lizard, taxonomy, Vindhya Range.

Introduction

Ophisops Ménétries, 1832 is a member of subfamily Lacertinae in the family Lacertidae; members of this genus, commonly known as snake-eyed lizards or snake-eyes, are diurnal, terrestrial lizards found in open, grassy habitats (Agarwal *et al.* 2018). The distribution range of genus *Ophisops* ranges from the Saharo-Arabian region to south Asia, with seven recognized species in South Asia and three in Saharo-Arabia (Agarwal *et al.* 2018; Uetz *et al.* 2020). A recent molecular study by Agarwal & Ramakrishnan (2017) has shown that deep divergences within *Ophisops* separate the genus into a small-bodied clade (snout to vent length, SVL < 45 mm) and a large-bodied clade (SVL > 50 mm); with nearly 30 candidate species in India based on mitochondrial sequence divergence. The majority of this diversity in India, is within the small-

bodied clade, with 26 candidate species in three species complexes namely, *Ophisops beddomei* (Jerdon, 1870), *Ophisops jerdonii* Blyth, 1853 and *Ophisops nictans* Arnold, 1989. Indian members of the large-bodied clade include the widespread single species *Ophisops leschenaultii* (Milne-Edwards, 1829), and the *Ophisops microlepis* Blanford, 1870 complex, which includes three candidate species, of which two were described recently: *Ophisops pushkarensis* Agarwal, Khandekar, Ramakrishnan, Vyas & Giri, 2018, and *Ophisops kutchensis* Agarwal, Khandekar, Ramakrishnan, Vyas & Giri, 2018 (Agarwal *et al.* 2018).

During a herpetological survey in 2000 in Ratanmahal Wildlife Sanctuary, Dahod district in central-western Gujarat, India, a single female individual of an unknown *Ophisops* species was collected from a plateau near Bhuvero village by the second author. It differs from its congeners and detailed comparison with existing museum material and published data allows us to describe it as a new species.

Materials and methods

Material for the morphological examinations included 28 alcohol-preserved specimens, one of the new species and 27 specimens of the six geographically proximate, closely-related species; in addition to preserved specimens, we also examined high resolution images of type material of a few species, viz. *Ophisops beddomei*, *O. nictans* and *O. microlepis* (list of material examined is present in Appendix 1). Collection abbreviations are as follow: NHMUK: Natural History Museum, London; BNHS: Bombay Natural History Society, Mumbai; ZSI: Zoological Survey of India, Kolkata; HP: Harshil Patel field series; RV: Raju Vyas field series. In addition to the examined material, comparative data on described species of *Ophisops* was collected from following publications: Boulenger (1921), Smith (1935), Vyas (2003), and Agarwal *et al.* (2018). Specimen examination was made using a Leica S4E stereomicroscope to count meristic characters; mensural characters were taken on the right side using a digital calliper to the nearest 0.1 mm. We selected morphological characters based on previous taxonomic studies of lacertids (Arnold *et al.* 2007), especially of the genus *Ophisops* (Agarwal *et al.* 2018) and on personal observations. We examined 22 metric and 17 meristic characters of the newly recognized species, which are: snout-vent length (SVL) measured from tip of snout to anterior edge of cloaca; tail length (TL) measured from posterior edge of cloaca to tip of tail; trunk length (TRL) measured from posterior margin of fore limb insertion to anterior margin of hind limb insertion; head length (HL) measured from tip of snout to the posterior edge of tympanum; head height (HH) measured maximum distance between upper head and lower jaw; head width (HW) measured distance between posterior eye corners; length of forelimb (LFL) measured from top of shoulder joint to tip of 4th finger; length of hindlimb (LHL) measured from hip joint to tip of 4th toe; forearm length (FL) measured from elbow to distal end of wrist; length of femur (LFO) measured from hip joint to top of knee; length of tibia (CL) measured from top of knee to beneath wrist; eye diameter (ED), greatest horizontal diameter of eye; snout to eye distance (SE) measured from anterior margin of eye to tip of snout; nostril to eye distance (NE) measured from tip of nostril to anterior corner of eye; eye to ear distance (EE) measured from posterior edge of eye and tympanum; length of neck (NL), distance between posterior edge of tympanum and shoulder joint; tympanum diameter (TD), measured largest size; inter narial distance (IN), horizontal distance between nares; inter orbital distance (IO) taken at the posterior margin of orbit; length of cloaca crevice (LV), largest size; tail width (LBT), length of widest part of tail base; body width (BW), length of widest part of belly; supraciliary scales (SCS); supraciliary granules (SCG); supraocular scales (SOS); supralabials (SL) and infralabials (IL); loreal scales (LO); supra temporals scales (STS); chin shields (CS); dorsal scales (DS, number of scales on dorsum from behind occipital to above vent); mid body scales (RBS, scales in transverse rows at mid body); ventral scales (VS, number of enlarged scales on belly from forelimb insertion to above femoral pores); number of gular scales (GS) in a straight median series, including collar; number of collar scales (NCS) on ventral side; number of transverse series of ventral scales (NVS) counted in straight median series between collar and the row of scales separating the series of femoral pores; number of femoral pores (NFP); scale between femoral pores (SBFP); transverse subdigital lamellae, counted from the base of the digits to the claw and including the claw sheath on the finger 1 (LAM1F), finger 2 (LAM2F), finger 3 (LAM3F), finger 4 (LAM4F), finger 5 (LAM5F), toe 1 (LAM1T), toe 2 (LAM2T), toe 3 (LAM3T), toe 4 (LAM4T), toe 5 (LAM5T). These characters along with the observed values are presented in Table 1. The description style follows Agarwal *et al.* (2018) with some modifications.

TABLE 1. List of morphological characters and their abbreviations that were used in this study along with the observed values of the holotype of *Ophisops agarwali* sp. nov. (All measurements are in mm).

Characters		BNHS 2750
Snout-vent length (from tip of snout to anterior edge of cloaca)	SVL	40.8
Tail length (from posterior edge of cloaca to tip of tail)	TL	57.9
Trunk length (from posterior margin of fore limb insertion to anterior margin of hind limb insertion)	TRL	19.6
Head length (from tip of snout to the posterior edge of tympanum)	HL	11.8
Head height (maximum distance between upper head and lower jaw)	HH	4.1
Head width (distance between posterior eye corners)	HW	4.8
Length of forelimb (from top of shoulder joint to tip of 4th finger)	LFL	15.2
Length of hindlimb (from hip joint to tip of 4th toe)	LHL	23.6
Forearm length (from elbow to distal end of wrist)	FL	4.9
Length of femur (from hip joint to top of knee)	LFO	5.7
Length of tibia (from top of knee to beneath wrist)	CL	7.4
Eye Diameter (greatest horizontal diameter of eye)	ED	1.8
Snout to eye distance (from anterior margin of eye to tip of snout)	SE	5.6
Nostril to eye distance (from tip of nostril to anterior corner of eye)	NE	4.5
Eye to ear distance (from posterior edge of eye and tympanum)	EE	3.6
Length of neck (distance between posterior edge of tympanum and shoulder joint)	NL	3.7
Tympanum diameter (largest size)	TD	1.3
Inter narial distance	IN	1.3
Inter orbital distance (taken at the posterior margin of orbit)	IO	4.6
Length of cloaca crevice (largest size)	LV	2.6
Tail width (length of widest part of tail base)	LBT	3.8
Body width (length of widest part of belly)	BW	7.1
Supraciliary Scales	SCS R/L	4/4
Supraciliary granules	SCG R/L	8/8
Supraocular scales	SOS R/L	4/4
Supralabials	SL R/L	8/8
Infralabials	IL R/L	7/7
Loreals	LO R/L	2/2
Supra temporals scales	STS R/L	2/2
Chin Shields	CS R/L	5/5
Dorsal scales (number of scales on dorsum from behind occipital to above vent)	DS	49
Mid body scales (scales in transverse rows at mid body)	RBS	30
Ventral scales (number of enlarged scales on belly from forelimb insertion to above femoral pores)	VS	21
Number of gular scales in a straight median series (including collar)	GS	15
Number of collar scales (on ventral side)	NCS	3
Number of transverse series of ventral scales counted in straight median series between collar and the row of scales separating the series of femoral pores	NVS	23
Number of femoral pores R/L	NFP	9/9
Scale between Femoral pores	SBFP	3
Lamellae R/L (sub-digital lamellae, the one touching the claw included)		

..continued on the next page

TABLE 1.

Finger 1	LAM1F	6/6
Finger 2	LAM2F	9/10
Finger 3	LAM3F	13/14
Finger 4	LAM4F	17/17
Finger 5	LAM5F	9/9
Toe 1	LAM1T	8/7
Toe 2	LAM2T	12/12
Toe 3	LAM3T	15/15
Toe 4	LAM4T	19/19
Toe 5	LAM5T	12/11

Systematics

Ophisops agarwali sp. nov.

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Figs.-1, 2 and 3; Table 1

Holotype. BNHS 2750, adult female, from a plateau near Bhuvoro (22.52824°N 74.13162°E; ca. 630 m a.s.l.), Ratanmahal, Dahod district, Gujarat, India, collected by Raju Vyas on 30 April 2000.

Etymology. The specific epithet is a patronym, honouring Dr. Ishan Agarwal for his significant contributions to the study of reptile systematics and biogeography (especially of geckos and lacertids of south Asia), and constant inspiration to the authors.

Suggested Common Name. Agarwal's lacerta; Agarwal's snake-eye.

Diagnosis. The new species was morphologically diagnosed as *Ophisops* based on the absence of a distinct collar, presence of a large transparent disc on the lower eyelid and digits not fringed laterally (Boulenger 1921; Smith 1935). A small bodied *Ophisops* characterized by (1) snout-vent length up to 40 mm; (2) two frontonasals present; (3) prefrontals not in contact; (4) enlarged tympanic scale absent; (5) 30 scales at mid-body; (6) 19 lamellae underneath the fourth toe; (7) five chin shields, first two in contact medially; (8) 15 scales between symphysis of chin shields and ventral plates; (9) large mental scale, extending beyond second supralabial; (10) females with 9 femoral pores on either side interrupted by three poreless scales.

Comparison. Here, we provide comparison of the new species with its Indian congeners (Table 2). Morphologically *Ophisops agarwali* sp. nov. differs from all the large bodied species based on its smaller adult size (SVL up to 40 mm vs. SVL >50 mm in *Ophisops leschenaultii*, *O. microlepis*, *O. pushkarensis* and *O. kutchensis*).

Ophisops agarwali sp. nov. differs from *O. nictans* (Fig. 4A, 4B, 4C) in having two frontonasals (vs. single frontonasal); lower eyelid fused with upper eyelid (vs. lower eyelid distinct); five chin shields (vs. six chin shields); 15 gular scales (vs. 17–18) between symphysis of chin shields and ventral plates; 8 supraciliary granules (vs. 11–12) and a dorsolateral stripe from behind the eye onto the tail absent (vs. present).

Ophisops agarwali sp. nov. differs from *O. jerdonii* (Fig. 4D, 4E, 4F) in having two frontonasals (vs. single frontonasal); five chin shields (vs. six chin shields); four supraciliary scales (vs. three) and a dorsolateral stripe from behind the eye onto the tail absent (vs. present).

Ophisops agarwali sp. nov. is most similar to *O. beddomei* (Fig. 4G, 4H, 4I) in having single frontonasal but differs in having five chin shields (vs. six chin shields); 15 gular scales (vs. 17–18) between symphysis of chin shields and ventral plates; four supraciliary scales (vs. three); enlarged tympanic scale absent (vs. present); mental extending beyond the second supralabial (vs. mental extending up to or beyond first supralabial) and six dorsal scales (vs. three-four) in contact with each parietal scale.

TABLE 2. Comparison of different species of Genus *Ophisops* from India.

Characters	Species name							
	<i>Ophisops agarwali</i> sp.nov.	<i>Ophisops</i> <i>beddomei</i>	<i>Ophisops</i> <i>jerdonii</i>	<i>Ophisops</i> <i>nictans</i>	<i>Ophisops</i> <i>leschenaultii</i>	<i>Ophisops</i> <i>microlepis</i>	<i>Ophisops</i> <i>pushkarensis</i>	<i>Ophisops</i> <i>kutchensis</i>
Maximum snout-vent length	40.8 mm	36 mm	45 mm	45 mm	57 mm	61.5 mm	62.7 mm	53.4 mm
Lower eyelid	Fused	Fused	Fused	Distinct	Distinct	Fused	Fused	Fused
Chin shields	5	6	6	6	6	6	6	6
Scales between symphysis of chin shields and ventral plates	15	17–18	16–18	17–18	19–25	21–29	21–29	21–29
Frontonasal Scale	2	2–3	1	1	1	1	1	1
Tympanic Scale	Undistinguished from temporals	Distinct	Distinct	Distinct	Distinct	Distinct	Distinct	Distinct
No. of dorsal scales in contact with each parietal scale	6	3–4	4–5	4–5	7–8	7–8	7–8	6–8
Dorsal scales	49	43–45	44–47	31–35	>90	>120	133–148	113–129
Mid body scales	30	26–32	28–33	26–30	42–50	56–61	57–62	50–58
Ventral scales	21	24–29	23–29	19–23	24–27	26–31	28	26



Figure 1. *Ophisops agarwali* sp. nov. (holotype, BNHS 2750), dorsal view (A); lateral view (B) and ventral view (C).

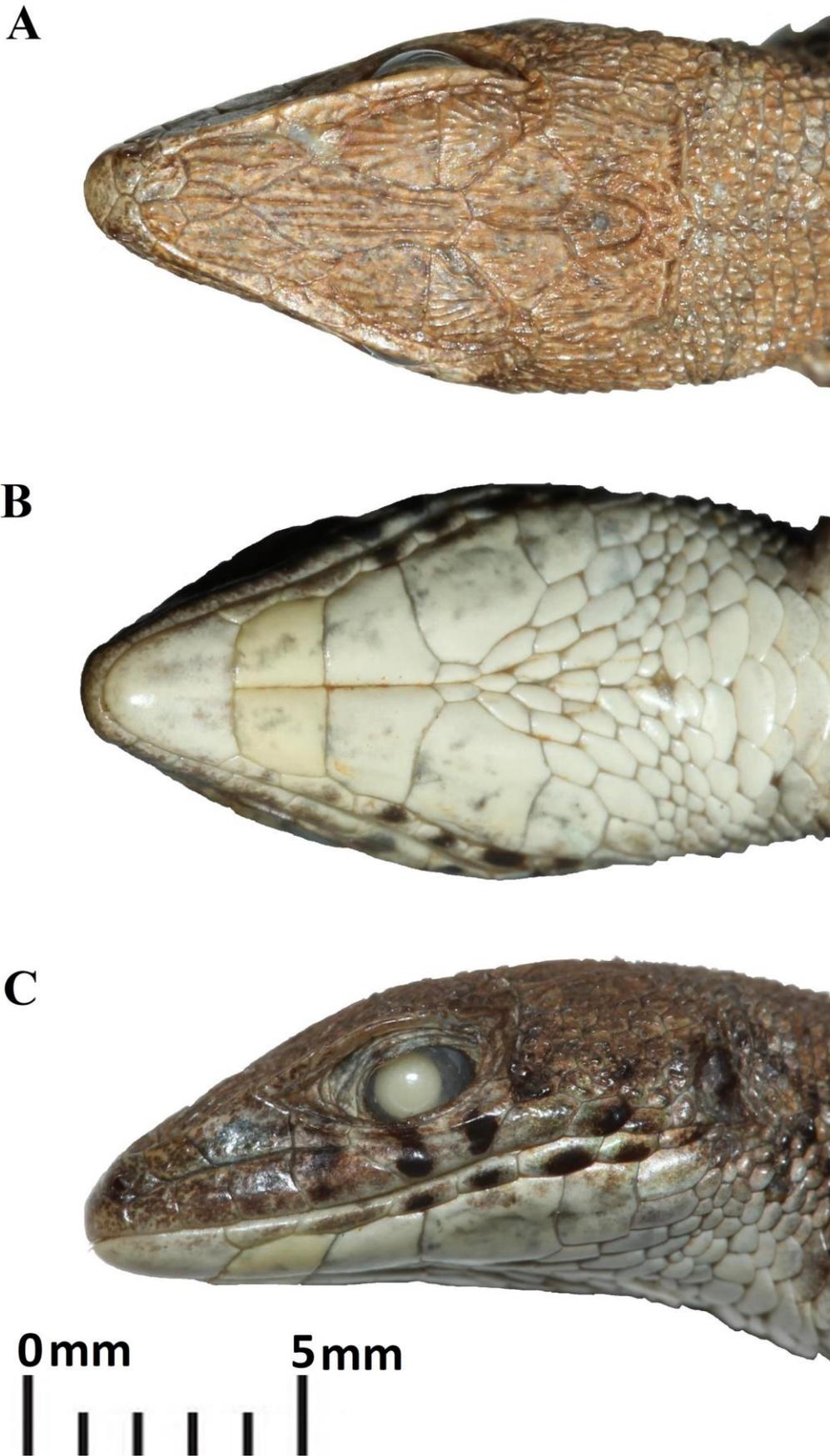


Figure 2. *Ophisops agarwali* sp. nov. (holotype, BNHS 2750), dorsal view of head (A); ventral view of head (B) and lateral view of head (C).

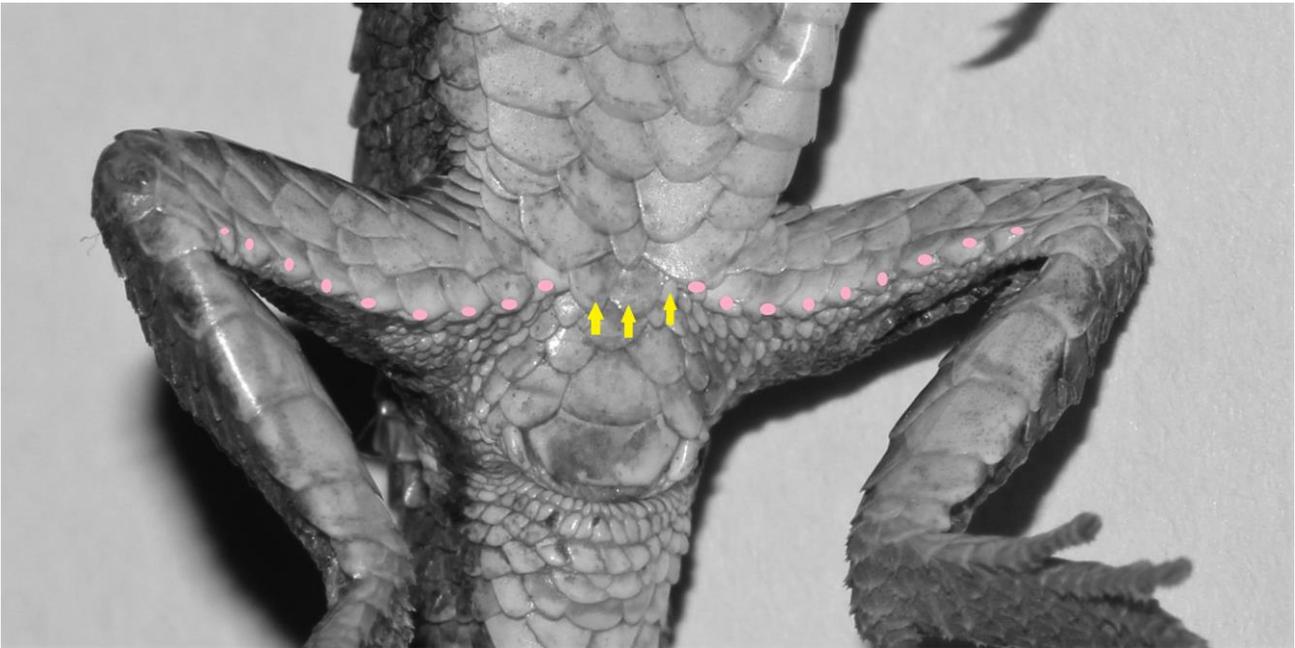


Figure 3. *Ophisops agarwali* sp. nov. (holotype, BNHS 2750), view of cloacal region showing precloacal femoral pores (marked with pink colour) and poreless scales (marked with yellow arrow).

Description of holotype. Adult female in relatively good condition apart from minor artefacts of preservation: body and tail slightly curved towards left side; fore limbs slightly extended, facing backward. SVL 40.8 mm. Head short ($HL/SVL = 0.28$), more than twice longer than wide ($HL/HW = 2.43$), depressed ($HH/HL = 0.34$), slightly broader than neck, upper head scales keeled and finely striated. Loreal region slightly concave with sharp canthus rostralis. Snout acute ($IN/IO = 0.28$), slightly projecting beyond lower jaw. Eye small ($ED/HL = 0.15$); pupil round; supraciliary scales distinct, elongate, four on either side. Tympanum elongate, small ($TD/HH = 0.31$), covered anteriorly by four scales; eye to ear distance almost twice the eye diameter ($EE/ED = 1.95$). Nostril elliptical, laterally oriented, closer to the snout tip than to eye ($NE/SE = 0.81$) and between four nasals; a nasal, supranasal and a pair of postnasals on each side. Body slender ($BW/SVL = 0.17$), trunk not elongate ($TRL/SVL = 0.48$). Tail longer than SVL ($TL/SVL = 1.41$). Fore limbs and hind limbs slender and relatively well developed; hind limbs longer than fore limbs ($LFL/LHL = 0.64$); forearm and tibia short ($FL/SVL = 0.12$; $CL/SVL = 0.18$); digits long and slender, ending in a sharp and moderately curved claw; subdigital lamellae distinct, entire, distinctly keeled, bicarinate on both manus and pes; number of subdigital lamellae including claw sheath: left manus 6-10-14-17-9; right manus 6-9-13-17-9; left pes 7-12-15-19-11; right pes 8-12-15-19-12. Relative length of digits (measurements in mm in parentheses): right manus I (1.83) < II (2.68) < V (3.16) < III (4.24) < IV (4.7); right pes I (2.84) < II (3.34) < III (4.22) < V (4.54) < IV (5.92).

Rostral wider (1.9 mm) than high (1.1 mm), situated between supranasals dorsally and in contact with first supralabials and nasals. Paired supranasals roughly triangular, in contact medially, touching the nasal laterally and first pair of postnasals posteriolaterally. A pair of almost equal sized frontonasals, roughly pentagonal, strongly in contact with supranasals and post nasals anteriorly; anterior loreal laterally and prefrontals posteriorly.

A pair of roughly pentagonal prefrontals, not in contact with each other, a small lanceolate shaped scale wedged between the prefrontals; touching the frontonasal anteriorly, and the anterior and posterior loreals laterally; posteriorly in strong contact with first anterior supraocular and frontal.

Frontal lanceolate, elongate (3.6 mm), broader anteriorly; feebly touching the scale separating prefrontals, in strong contact with prefrontals anteriorly, laterally touching first, second and third supraoculars, and posteriorly in strong contact with frontoparietals. A pair of frontoparietals, roughly pentagonal, in contact with each other medially, anteriorly in strong contact with frontal, laterally touches third and fourth supraoculars, posteriolaterally touching parietals, posteriorly interparietal. Interparietal single, roughly pentagonal, posterior margins curved, with distinct pineal eye, anteriorly in strong contact with frontoparietals, laterally touching parietals and occipital posteriorly. A pair of parietals, roughly

hexagonal, longer (2.3 mm) than wide (1.5 mm), separated from each other by interparietal, anteriorly in strong contact with fourth supraocular and frontoparietal on both sides, laterally touching two supratemporals on both sides, posteriorly in contact with six small dorsal scales on both sides. Occipital roughly pentagonal, broader than wide, laterally in contact with parietals and anteriorly with interparietal. Four supraoculars, the first and fourth smallest, separated from supraciliaries by a single row of 8 supraciliary granules on both sides.

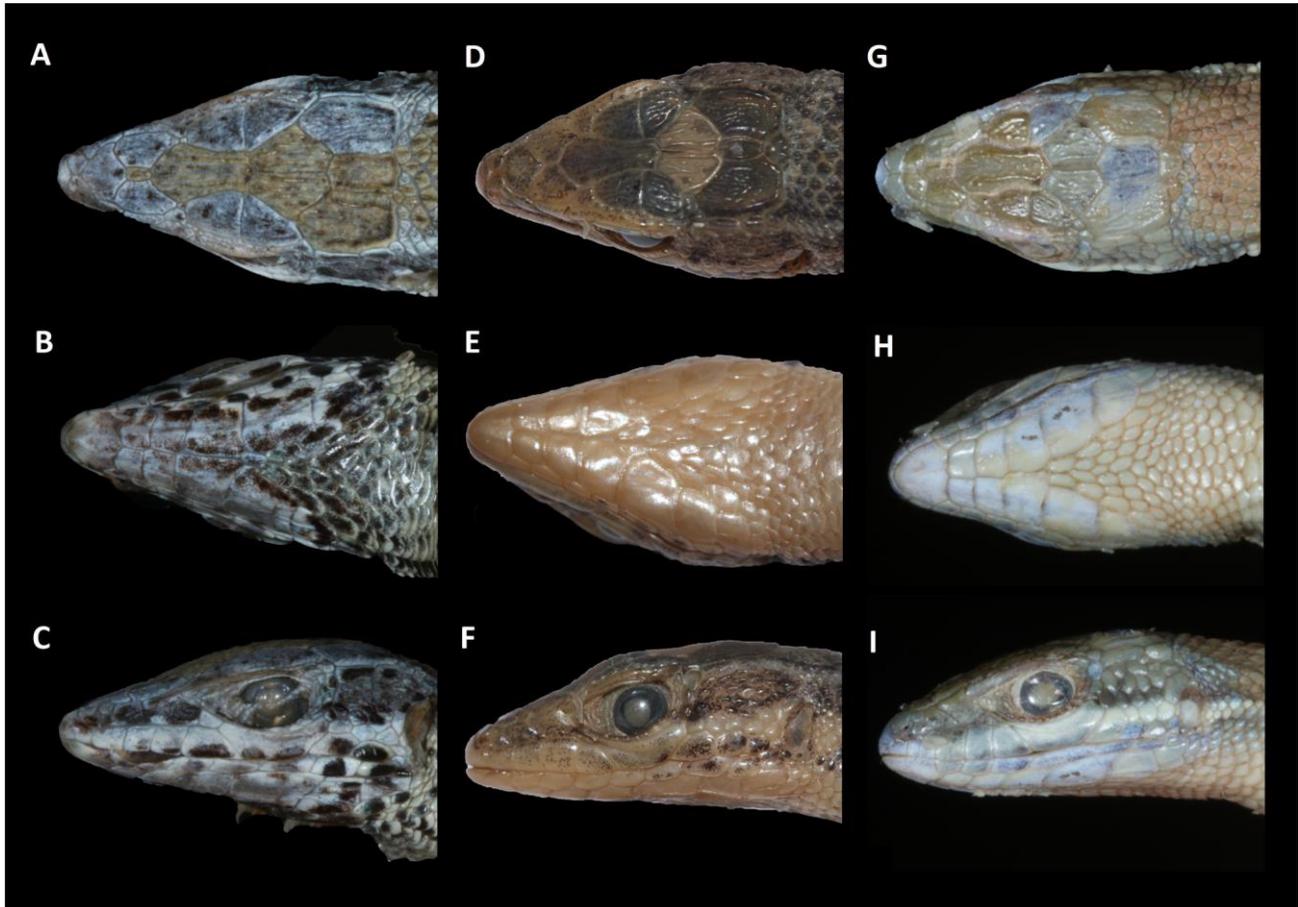


Figure 4. Head scalation of three small bodied species of Indian *Ophisops*, other than the new species: A–C. *Ophisops nictans* (syntype, NHM 1946.9.3.89); D–F. *Ophisops jerdonii* (BNHS 1805); G–I. *Ophisops beddomei* (syntype, NHM 1946.9.4.12).

Nostril elliptical, situated on contact line between nasal and supranasal. Postnasals smaller than the anterior loreal. Two loreals, anterior roughly rectangular and about the size of the first supralabial, bordered by posterior loreal, prefrontal, frontonasal, postnasal, nasal, and the first and second supralabials; posterior loreal much larger than anterior, becoming broader posteriorly, bordered by preoculars, the first supraciliary, prefrontal, anterior loreal, and the second and third supralabials. Preocular similar in size to anterior loreal, roughly rectangular. Eight supralabials, the fifth being largest and forming the lower border of the eye, gradually decreasing in size in either direction. Three moderately enlarged postoculars. Two supratemporals on each side, the anterior ones are largest. Temporal scales as large as or slightly bigger than postoculars, rough, uncarinate or bi or tricarinate, subimbricate, arranged in three to five rows.

Seven infralabials on either side. Mental large, longer (2.7 mm) than wide (2.2 mm), in strong contact with the first infralabial and first pair of chin shields. Five chin shields on either side, the third being largest, gradually decreasing in size in either direction, two anterior chin shields strongly in contact with each other medially, posterior three separated from each other by gular scales. 15 gular scales between symphysis of chin shields and ventral plates.

Dorsal pholidosis heterogeneous in shape, size, orientation and carination; composed of smaller, strongly pointed, keeled, imbricate scales throughout, 30 scales in a transverse row across midbody; 49

scales in longitudinal, vertebral series; scales on dorsal aspect strongly keeled, directed backwards, those on flanks, directed backwards and upwards, lowermost rows largest and smooth, others are feebly keeled; scales on the neck smaller, gradually increasing in size posteriorly and laterally. Ventral plates, heterogeneous, arranged in six transverse rows on belly, midventral series with 23 scales in a longitudinal series; gular scales smaller gradually increasing in size towards the collar, elongate, subimbricate, those on neck as large as or slightly smaller than gular scales, weakly pointed and imbricate; scales on pectoral region larger than those on neck, strongly imbricate; those on belly much enlarged, subimbricate, rectangular, except single outermost row on either side cycloid. Indistinct collar, vaguely defined by a fold of skin with granular scales on shoulders and three larger cycloid imbricate scales ventrally. Preanal scale large, roughly hexagonal, smooth, anteriorly bordered by five sub-equal scales and surrounded by another row of 13 cycloid, imbricate scales of variable size, those on posterior aspect smallest. Femoral pores 9 on either side, medially interrupted by three poreless scales.

Scales on the fore limbs heterogeneous in shape and size, those on the palmar and plantar faces slightly smaller than or equal to the associated lamellae, imbricate, strongly keeled. Scales on dorsal surface of upper arm much larger than those on body dorsum, weakly pointed, strongly imbricate, smooth, except those on elbow, which are keeled. Ventral surface of upper arm with smaller, smooth, subimbricate scales. Scales on forearms similar to those on upper arms, three rows on anterior surface larger and smooth, of which single median row much enlarged, subimbricate and almost rhombus shaped; scales on ventral surface of forearms smaller, imbricate and keeled; a column of 3–4 enlarged scale bordering the palm on ventral surface circular, imbricate and having serrated edges.

Scales on hind limbs heterogeneous in shape and size, posterior surface of the thigh with much smaller, granular scales, becoming enlarged, pointed, strongly keeled, imbricate towards anterior surface, ventral surface of thigh covered with two rows of much enlarged, smooth, strongly imbricate scales, with anterior most single row largest and rhombus shaped; scales on dorsal surface of shank like those on forearm, ventral aspect of shank covered with two rows of much enlarged, imbricate, smooth scales, of which the median row is largest and roughly hexagonal, posterior most 2–3 scales are bi- or tricarinate.

Scales on the dorsal and lateral aspect of the tail arranged in regular whorls, cycloid at the base, becoming gradually elongated distally, strongly keeled, imbricate and pointed. 14 scales in the 10th whorl behind the vent. Ventral aspect of the tail with strongly imbricate scales, strongly pointed and keeled; ventral scales near the base of the tail smooth, gradually becoming keeled towards tip of the tail.

Coloration in alcohol. Dorsal ground colour olive brown, without any dorso-lateral stripe, a just discernible ventrolateral stripe that runs from the shoulder, just above the forearm insertion and terminating at groin. Flanks below ventrolateral stripe with marbled lighter and darker markings, some enlarged scales with blueish tint. Forelimbs olive brown with scattered, irregular lighter and darker spotting with a black patch on shoulder, hindlimbs with thick dark reticulations outlining lighter ocelli on the postaxial surface of hindlimbs. Head dorsum suffused with scattered, indistinct black markings, first four supralabials olive brown and remaining supralabials mottled white, with black blotches, temporal region with some darker markings, iris bluish black. Venter white with mottled black markings, especially on the third to sixth infralabials. Tail colour similar to dorsum, fading to mottled white on the venter.

Distribution and habitat. *Ophisops agarwali* sp. nov. is diurnal, and was seen active at noon, searching for food. The specimen was collected along with other squamates including Beddome's snake-eyed lizard (*Ophisops beddomei*), bronze grass skink (*Eutropis macularia* (Schneider, 1801)) and spiny-headed fan-throated lizard (*Sitana spinaecephalus* Deepak, Vyas & Giri, 2016) from open grass patch of the plateau (elevation ~650 m asl) near Bhuvero village, Dahod District, Gujarat. The plateau is covered with grass, shrubs and large deciduous trees, that includes, Timru / Tendu (*Diospyros melanoxylon*), Charoli (*Buchanania lanzan*), Sadad (*Terminalia crenulate*), Mahudo (*Madhuca indica*), Teak (*Tectona grandis*) with scattered Bamboo Clube (*Bambusa arundinacea* / *Dendrocalamus strictus*), the periphery of the plateau has large boulders. The north-western side of the plateau is part of the Ratanmahal Wildlife Sanctuary, Gujarat and the south-east external side of the plateau is part of Kattiwada, Madhya Pradesh. These entire forest tracks are part of the western Vindhya (also known as Vindhyaçal) Mountain Range and known as the Malwa Hills. The Ratanmahal forest region falls in the tropical dry deciduous forest and further classified into four sub-types, i.e. 5A/C 1b teak forest; 5A/C 2 southern dry mixed deciduous forest; 5/E 9 dry bamboo brakes; and 3B/C 2 southern moist mixed deciduous forest (Champion & Seth 1968).

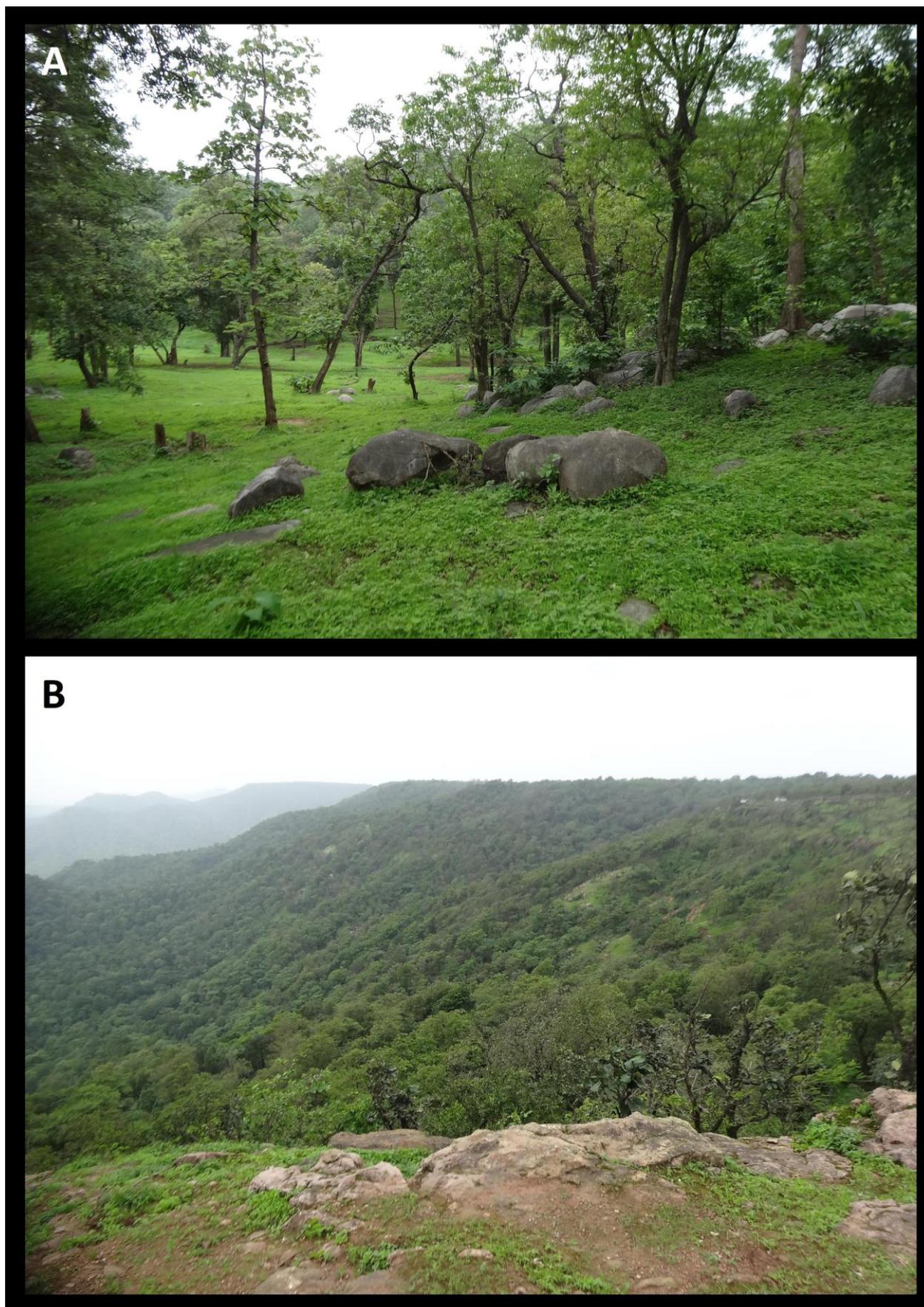


Figure 5. Habitat photo of *Ophisops agarwali* sp. nov., (A) a plateau in monsoon and (B) view of valley from plateau near Bhuvero, Ratanmahal, Dahod, Gujarat, India.

Discussion

Ophisops agarwali sp. nov. is the fourth endemic species of reptile described from the state of Gujarat and is the first endemic reptile from the Vindhya Hill Range. It is also the third species of *Ophisops* described from India after a gap of almost 150 years (Agarwal *et al.* 2018; Uetz *et al.* 2020). With the description of *O. agarwali* sp. nov., the diversity of *Ophisops* in Gujarat has grown to five species. Gujarat shares its border with the neighbouring country Pakistan, from where, two species *O. jerdonii* and *O. elegans* are reported (Uetz *et al.* 2020). However, recent phylogenetic studies of *Ophisops* show that the present known diversity of this genus is just a fraction of the true diversity of this poorly studied genus (Agarwal & Ramakrishnan 2017; Montgelard *et al.* 2020). In their phylogenetic study, Agarwal & Ramakrishnan (2017) have recovered three species complexes within the small bodied clade of the genus *Ophisops*. The new species should be tentatively placed in the *O. beddomei* complex until it is confirmed using molecular data. Further detailed taxonomic studies of populations of each species within the genus across their range are required to resolve the taxonomic identity of putative new species, after which the number of species in this group is likely to grow.

Gujarat state in western India is very rich in habitat diversity and supports a unique and diverse fauna (Rodgers *et al.* 2002; Vyas 2007). The reptilian diversity is considered to be poorly documented (Vyas 2007; Patel *et al.* 2018; Patel & Vyas 2019). However, increasing studies reporting new records, new species discoveries, and taxonomic revisions in recent years have contributed greatly to the understanding of the reptilian diversity of Gujarat (Vyas & Prajapati 2012; Vyas & Patel 2013; Patel *et al.* 2015, 2016, 2019a, 2019b; Mirza *et al.* 2016, 2018; Vyas 2017; Mirza & Patel 2018; Agarwal *et al.* 2018). The present study demonstrates that the reptiles of Gujarat are still far from being fully known.

The single known specimen of the new species was collected two decades ago and recent extensive searches to collect additional specimens of the species from the area were not successful. This may be the result of habitat degradation, probably due to on-going anthropogenic activities on the plateau, such as temple development and intensive seasonal collection of tendu leaves (bidi-patta), mahua flowers and other minor forest products. We noticed the usual traditional practice of clearing forest ground by fire and burning of forest undergrowth and leaf litter prior to collection of tendu leaves and mahua flowers and fruits. Such destructive practices have prevailed in the area for a long period, and they certainly have a negative effect on the forest habitat and contribute to the gradual degradation of the plateau's biodiversity, especially terrestrial life forms that use forest floor as their primary micro-habitat. This reflects the possibility that *Ophisops agarwali* sp. nov. may have been lost before any understanding or evaluation could be gained about its existence or identity; which reflects the need for proper taxonomic documentation of animals of such poorly studied regions in the country and appropriate conservation implications to prevent the demise of additional taxa.

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APPENDIX 1.

Material examined.

Ophisops leschenaultii: BNHS 1414, BNHS 1415, Talakona, Tirupati, Chittoor district, Andhra Pradesh.

Ophisops beddomei: BNHS 585, Koynanagar, Satara district, Maharashtra; BNHS 1242, Ratnagiri, Maharashtra, India; BNHS 1262, Manipal, Udipi, Karnataka; BNHS 1224, BNHS 1225, MCBT, Chennai, Tamil Nadu; BNHS 1562-1, BNHS 1562-2, Bhuvero, Ratanmahal, Dahod, Gujarat. HP 101, HP 102, near Mahal, Dang, Gujarat; HP 103, 104, Saputara, Dang, Gujarat; HP 105, near Dharampur, Valsad, Gujarat.

Syntypes (images): NHM 1946.9.4.6-15, 'Brummagherry Hills, Wynaad' (= Brahmagiri hills, Karnataka).

Ophisops jerdonii: BNHS, 1594, Pune, Maharashtra; BNHS, 1601, Yawal WLS, Maharashtra; BNHS, 1805, Nabhdungar, Sam, Jaisalmer, Rajasthan; HP 106, HP 107, HP 108, near Junagadh, Gujarat; RV 101, Kutch, Gujarat; RV 102, Surendranagar, Gujarat.

Ophisops pushkarensis: BNHS 1726, BNHS 1727, Jessore WLS, Gujarat.

Ophisops kutchensis: HP 109, HP 110, near Dwarka, Gujarat.

Ophisops microlepis: Holotype (images): ZSI 2236, 'Korba in Bilaspur, the eastern part of Chhatisgarh division, Central Province' (in Chhatisgarh, central India).

Ophisops nictans: Syntypes (images): 1946.9.3.89-92, 'Cuddapah, Madras' (=Kadapa, Andhra Pradesh).

Ophisops elegans: BNHS 901, Iraq.