Russian Journal of Herpetology Vol. 6, No. 3, 1999, pp. 231 – 240

TWO NEW SPECIES AND A SUBSPECIES OF BLIND SNAKES OF GENUS *Typhlops* FROM AZAD KASHMIR AND PUNJAB, PAKISTAN (Serpentes: Typhlopidae)

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Submitted August 11, 1998.

Two new species and one new subspecies are described of the blind snakes of genus *Typhlops* from Azad Kashmir and Punjab, Pakistan. Taxonomic affinities of the new taxa are discussed and a key is provided for identification of 18 midbody scale typhlopid snakes of Himalayas.

Key words: New species, *Typhlops*, Western Himalayas.

INTRODUCTION

Dr. Stoliczka (1871) described *Typhlops porrectus* from eight specimens collected from different localities in western Bengal, India and Bangladesh, on the basis of: 18 midbody scales which are reduced to 11 – 12 at midtail; incompletely divided nasal scale, nasal suture touching second supralabial; preocular scale wedged between second and third supralabial, while ocular between third and fourth supralabial; body diameter 2.5 – 3 mm; 416 – 440 scales along middorsum of body. Unfortunately, the holotype of *T. porrectus* is not available, apparently lost, however, four of the syntypes are reported to be in Naturhistorisches Museum Wien (NMW[2]) (Hahn, 1980; Tiedeman et al., 1994).

Since 1871 several taxa of blind snakes with 18 midbody scales have been described and put in the synonymy of *T. porrectus* by subsequent workers (Wall, 1913; Smith, 1941).

Laboratory study of the present collection of 18 midbody scale blind snakes from Azad Kashmir and Punjab, Pakistan, reveals that they belong to two morphologically distinct groups:

***porrectus* Group.** Thin, weak bodied, light-brown snakes almost answering to the description of *T. porrectus* by Dr. Stoliczka: incompletely divided nasal scale; there is a pattern of micro-striations on the surface of the flared parts of body scales; total body length 130 – 210 mm; body diameter 1.8 – 1.9; tail straight, with very gradual taper, with a terminal cone; total length/body diameter ratio 87 – 91; mid-dorsals 412 – 461.

Further remarks on the taxonomy of blind snakes of this group await data from 4 syntypes of *T. porrectus* which are stated to be available in NMW (Hahn, 1980).

***madgemintonai* Group.** Stout, thick bodied, dark brown snakes; body length rarely exceeds 190 mm; body diameter 2.5 – 2.7; middorsals 337 – 342; variations in the extent of the narial suture: 100, 75, 50, or 25% complete; total body length/body diameter ratio 62 – 76; tail with strong ventral curve, tail tapers suddenly at its mid, ends in a thick sharp cuspidate spine with embossed round base.

This paper deals with three distinct geographical variations in *madgemintonai* Group, which are being described as new taxa.

MATERIAL AND METHODS

The snakes for the present study were preserved in 10% formaldehyde.

Laboratory studies were carried under binocular microscope. Measurements taken are: total length — from anterior tip of rostral scale to the tip of tail spine; tail length — from posterior border of cloacal aperture to the tip of tail spine; number of scale rows

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[2] **Abbreviations.** AMNH) American Museum of Natural History, Washington, USA; MCZ) Museum of Comparative Zoology, Harvard, Cambridge, USA; MSK) personal collections of the author, Herpetological Laboratory, 15/6 Darul Saddar North, Rabwah 35460, Pakistan; NMW) Naturhistorisches Museum Wien, Austria.

1026-2296/99/0603-0231

around body were counted by inserting a micropin at any point at midbody from where the counting is started, turning the body until the micropin is reached from the other side; subcaudals were counted from posterior border of the cloacal opening to the base of the tail spine; dorsal caudals were counted from the level of anal aperture to the base of the spine along dorsal side of the tail; middorsals include all scales along middorsum of body and tail from prefrontal to the base of the tail spine; ratios calculated from the data are: total body length/tail length, total body length/diameter of the body, tail length/tail breadth.

During description of the species values appearing in parenthesis pertain to the taxa referred to as the closest congener of the taxon which is being described.

To study internal morphology, only posterior half of the animal was operated upon. The dissection dish was prepared by fixing a flat piece of Balsa-wood (a type of soft wood) in a large Petri dish. The animal was fixed on the wood with small entomological pins and dissected by fine scissors.

Etymology. The new species *Typhlops madgemintonai* and subspecies *Typhlops madgemintonai shermanai* is named in honor of Mrs. Madge Minton and Dr. Sherman A. Minton, Jr., in recognition of their pioneering work on the herpetology of Pakistan. The second species *Typhlops ahsanai* is named in honor of my late mentor Professor Dr. Ahsanul-Islam (1927 – 1974), retired Principal, Government College, Lahore, who initiated me in the herpetological studies of Pakistan.

TAXONOMIC CONSIDERATIONS

Robb (1966b) divided family Typhlopidae in two genera *Typhlops* and *Ramphotyphlops*, on the basis of differences in male reproductive organs. I define these genera further as follows:

Genus *Typhlops*

1. The long pineal retractor muscle is inserted at the extreme tip of the relatively short thick hemipenis, so that the entire organ is pulled inside out when the muscle is contracted.

2. The hemipenis and its retractor muscle both are straight.

3. Retrocloacal sacs described by Guibe (1948) and Robb (1966a) are absent.

4. The supranasal cleft complete or incomplete, extends horizontally so that-little of the anterior nasal scale is exposed on dorsal side.

5. A rectal caecum may be present or absent, when present it is small, opening in rectum through a narrow neck (McDowell, 1974).

Genus *Ramphotyphlops* (*Typhlina* sensu McDowell, 1974)

1. The pineal retractor muscle is inserted at about the middle of the organ so that the distal part of the organ remains permanently drawn out as a solid awn.

2. Usually hemipenis and the associated retractor muscle are helically coiled.

3. A pair of retrocloacal sacs is present, opening in rectum posterior to the openings of vas deference and ureter.

4. A long rectal caecum is always present, which opens insensibly in the rectum.

Taxonomic Considerations of Internal Anatomy

The blind snakes in the present collection show a mixture of *Typhlops* and *Ramphotyphlops* characters in their internal anatomy. MSK 0949.93, a male, was partially dissected to find details of its internal morphology (Fig. 1).

The right testis is smaller, lies well anterior to the left, which is larger and divided in three lobes, both are fusiform. A finely convoluted vas deference with nacreous shine runs backwards, along sides of the intestine, after arising from inner side of the testis.

Kidneys are flat thick structures, composed of thick tubules, right lies at a higher level than left. Ureter is given from the inner side of the kidney, which runs along outer side of the vas deference of its side. At about mid-rectum ureters fuse with the vas deference of their side to continue as a short blind seminal vesicle, which at its middle gives an ejaculatory duct and opens on the side of the lateral side of the cloacal opening.

From the sides of the tail, a pineal sac runs forward as a blind tubule, narrowing at its middle, giving laterally a curved solid awn and continuing to the side of the cloacal aperture, where it opens in front of the ejaculatory orifice of its side.

In the posterior half of the body, the intestine narrows to form the ileum, which posteriorly broadens in an elongated rectum. A distinct rectal caecum, which is about 10 times longer than its breadth, runs along

the side of the ileum and opens insensibly in the rectum at the ilio-rectal junction.

The absence of retrocloacal sacs, presence of an elongated rectal caecum and horizontal disposition of the supranasal suture, put present collection of blind snakes in genus *Typhlops*. However, permanently drawn out pineal awn is a typical ramphotyphlopid character. While neither hemipenis nor retractor muscle are helically coiled as in ramphotyphlopids. Due to presence of preponderance of the typhlopid characters 1 have placed present series of blind snakes in genus *Typhlops*.

Typhlops madgemintonai NEW SPECIES

Holotype. MSK 0904.93, (Fig. 2*a*, *I*), an adult male, from under vegetation in a green plot along a torrent, near house of Master Muhammad Sadiq, Goi Madan, District Kotli, Azad Kashmir, 33°30′ N and 74°00′ E, elevation 1315 m, July 17, 1993, collector Muhammad Sharif Khan.

Paratype. MSK 0931.94, (Fig. 2*a*, *II*) collected from under a pine tree, in hilly terrain, near Barmoach village, 1 – 2 km E of Goi Madan, elevation 1493 m, June 13, 1994, Master Muhammad Sadiq.

Diagnosis. The new species differs from its apparent closest congener *T. porrectus* Stoliczka (1871) (characters in parenthesis), in having completely divided nasal scale (undivided); fewer middorsals 336 – 364 (414 – 465), presence of a tail spine (cone); dorsal body color dark brown (yellowish brown), ventrum light brown (yellowish); the subcaudal colorless area extends dorsally to include base of the spine (colorless area confined to subcaudals only), micro-ornamentation of body scales of micropits (microstriations).

Description of holotype MSK 0904.93 (all measurements in mm). (Fig. 2). Adult male, partially dissected, for pholidosic counts and measurements see Table 1.

Head depressed, snout rounded in dorsal and lateral profile, strongly projecting over mouth; rostral narrow, about 1/3rd of the head width, with uniform diameter, does not extend to ocular level, broadly rounded at the tip.

Naris elongated, oblique, upper end tipped forward, more anterior than lateral. Nasal scale completely divided on right, nearly so on left side, supranasal suture horizontal, joins rostral scales at mid lateral line, inferiorly extends obliquely backwards to

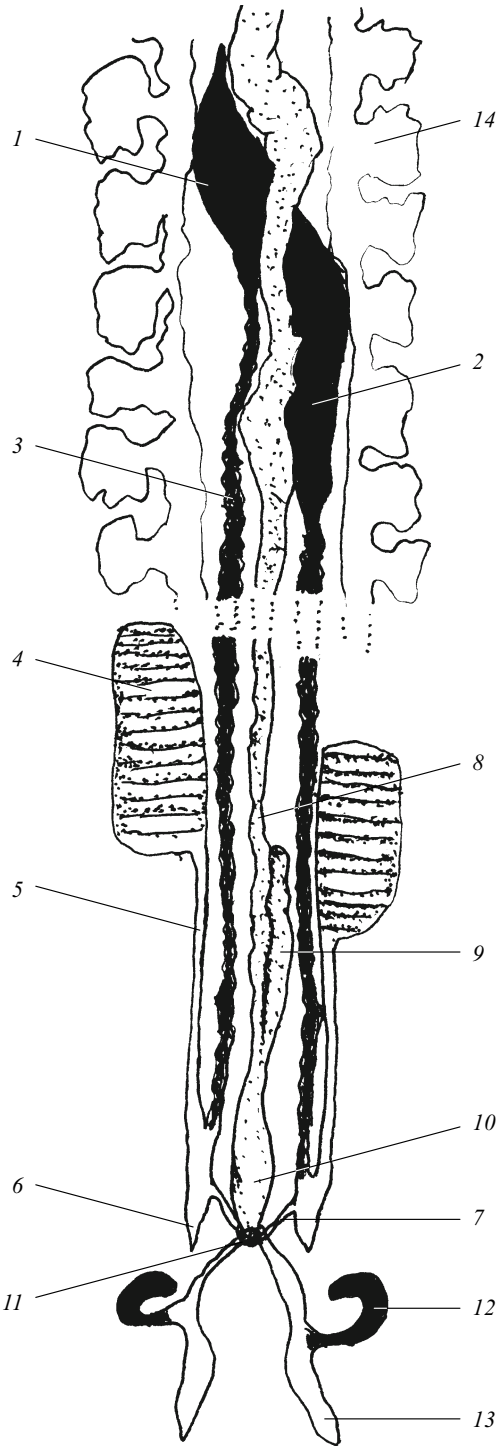
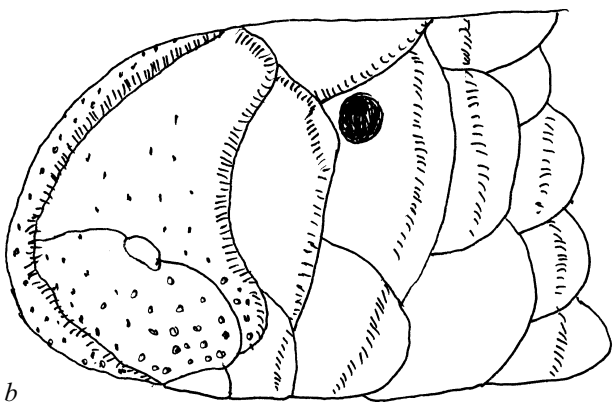


Fig. 1. *Typhlops madgemintonai* new species, internal anatomy: *1*) right testis; *2*) left testis; *3*) vas deference; *4*) right kidney; *5*) ureter; *6*) seminal vesicle; *7*) ejaculatory duct; *8*) ileum; *9*) rectal caecum; *10*) rectum; *11*) cloacal aperture; *12*) peneal awn; *13*) peneal sheath; *14*) fat bodies.

a



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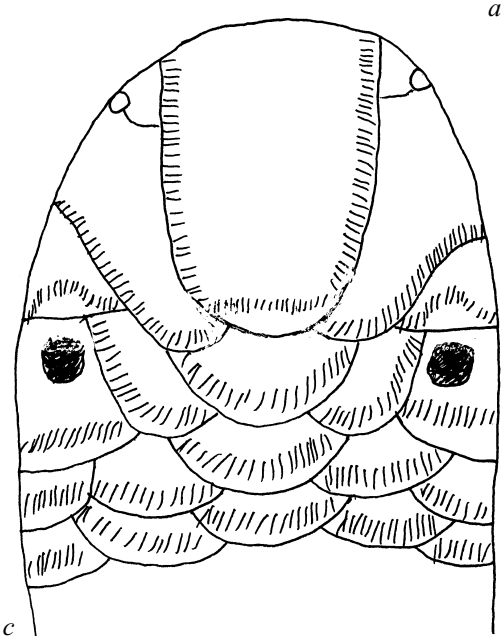


c

Fig. 2. *a*) *Typhlops madgemintonai* new species; *b*) scales of lateral side of the head; *c*) scales of dorsal side of head.

join second supralabial. The anterior nasal (N_1) smaller, inferiorly overlaps first supralabial (SL_1) and posterolaterally the posterior nasal (N_2). The N_2 extends along the rostral to the top of the head, where both are separated by a large transverse prefrontal, the preocular is narrower than ocular, suture between them slightly bent forward, inferiorly wedged between SL_2 and SL_3, while ocular is wedged between

TABLE 1. Morphometrics of Blind Snakes of *madgemintonai* Group from Azad Kashmir and Punjab, Pakistan

Parameter	MSK 0904.93 *Typhlops madgemintonai*, holotype	MSK 0931.94 *T. madgemintonai*, paratype	MSK 0357.95 *T. madgemintonai shermanai*, holotype	MSK 0651.97 *T. m. shermanai*, paratype	MSK 0648.97 *T. m. shermanai*, paratype	MSK 0903.93 *T. ahsanai*, holotype
Total length, mm	200	170	192	150	120	170
Tail length, mm	3.7	3.95	2.5	2.5	2.0	2.5
Diameter at:						
Midbody, mm	2.6	2.7	2.2	1.15	1.3	2.5
Vent level, mm	2.7	2.8	2.2	1.15	1.3	2.1
Midtail, mm	2.0	2.4	1.5	0.85	1.1	1.8
Scale counts:						
Midbody, mm	18	18	18	18	18	18
Vent level, mm	18	18	18	18	18	16
Midtail, mm	13	14	14	14	13	12
Dorsocaudals, mm	11	12	11	10	10	9
Subcaudals, mm	10	9	9	8	8	7
Middorsals, mm	342	337	364	340	336	341
Ratios:						
Total length/body diameter	76	62	87	130	92	68
Tail length/tail width	1.3	1.4	0.9	2.17	1.5	1.1
Total length/tail length	54	43	76	60	60	68

SL_3 and SL_4. Eye distinct, located in preocular-supraocular-ocular notch.

Four supraoculars, anterior overlapping posterior successively: SL_1 hardly seen, is longer than its height, overlapped by N_1 and N_2; the SL_2 is about twice higher then long, overlapped by N_2, overlaps preocular; SL_3 is about three times as higher as long, overlapped by preocular, overlaps ocular; ocular overlapped by SL_3, overlaps SL_4. The narrow postocular also overlaps SL_4. The supralabial imbrication formula being:

$$\begin{array}{ccccccc} N_1 & & N_2 & & Poc & & Oc + Postoc \\ SL_1 & - & SL_2 & - & SL_3 & - & SL_4 \\ N_2 & & Poc & & Oc & & \end{array}$$

Five infralabials, with a distinct median mental notch. Body with regular diameter of 2.6 mm which at anal level increases to 2.7, reduced to 2 mm at mid tail. Five precloacal scales. Tail ends in a sharp cuspidate spine with thick embossed base, partially covered with a rosette of ultimate caudal scales.

The prefrontal, frontal and inter parietals are large, longer than broad. The supraocular is oblique, about twice as long as broad; parietals vertical, about twice longer than broad.

The posterior one third of the body forms a complete ventral coil.

Color. The Formalin stored snakes have uniform dark brown dorsum, light brown ventrum. Snout, labia, circum-anal and subcaudal region is colorless. The subcaudal colorless area extends dorsally to include tail spine and its base.

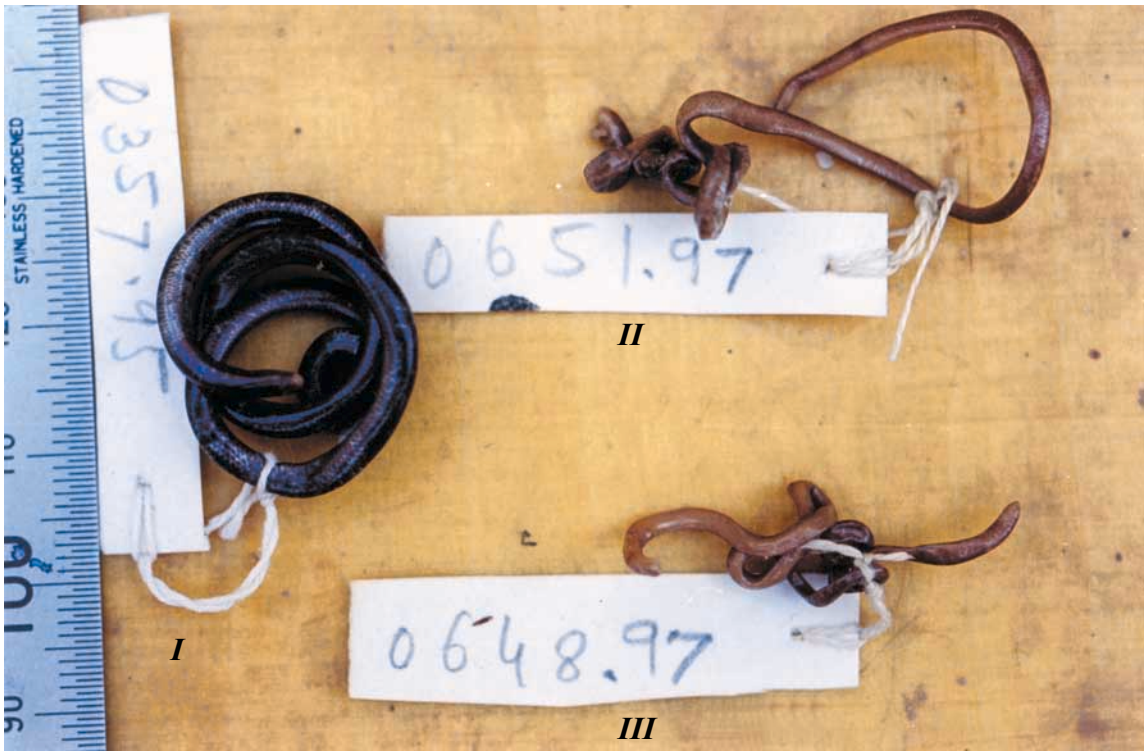
Disposition of squamous glands. The squamous glands are confined to the sutures of lateral head scales, forming more or less diagonal lines running on to the respective supralabial, however, there is no glandular line running on SL_4. The ocular-preocular line forms a distinct preocular bend in front of eyes which appear as if located in that bend.

On body scales the squamous glands are arranged in a transverse light line running across the middle of scales.

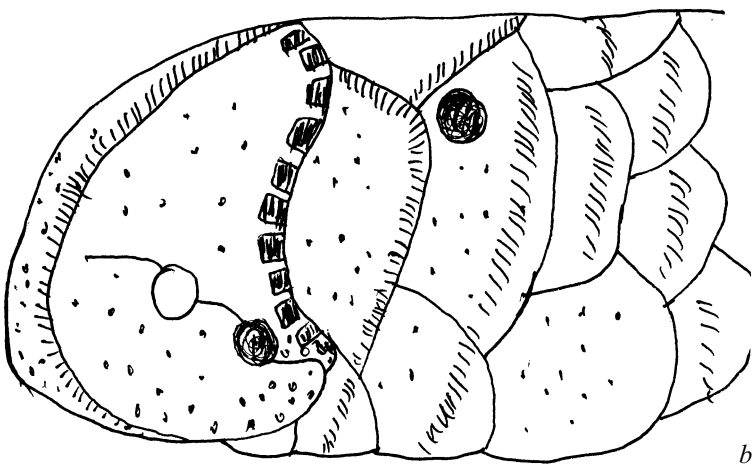
Micro-ornamentation of scales. Sense skin organs, in the forms of spinules, pits etc., are universal in squamates (Landmann, 1976; Underwood, 1967). They are generally concentrated on the anterior head scales, become rarer on the posterior parts of the body (Orejas-Miranda et al., 1977). In *madgemintonai* Group the microspinules are scattered all over the lateral head scales not extending on head dorsum and rest of the body. They are especially prominent and thicker on the lower parts of N_1 and N_2.

The flared part of body scales are heavily pitted with micropits.

Variations. Paratype MSK 0931.94 is morphologically close to the holotype, except minor varia-



a



b

Fig. 3. *a*) *Typhlops madgemintonai shermanai* new subspecies; *b*) scales of lateral side of head.

tions (Table 1). Like holotype the posterior one third part of the paratype is strongly curved ventrally and injured in both specimens almost at the same point.

Range. Type locality is about 2 km from the finding point of the paratype lying across a low hill, in rough hilly rocky terrain with moderate vegetation of pine forested countryside and terraced paddy fields around.

Typhlops madgemintonai shermanai
NEW SUBSPECIES

Holotype. MSK 0357.95, an adult snake, (Fig. 3*a*, *I*), from under leaflitter at the roots of a pine tree, west of Charnali village about 2 km W of Goi Madan, District Kotli, Azad Kashmir, 33°30′ N and 74°00′ E, elevation 1320 m, May 22, 1995, collector Muhammad Sharif Khan.

a

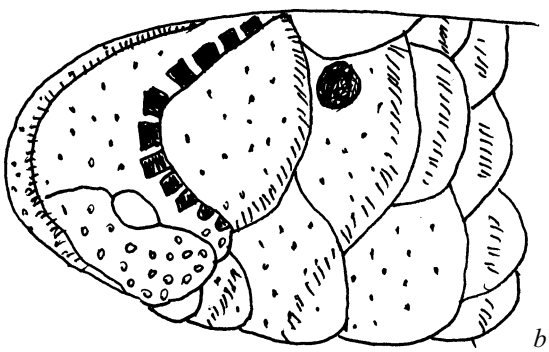


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Fig. 4. *a*) *Typhlops ahsanai* new species; *b*) scales of lateral side of head.

Paratypes. Two, MSK 0648.97, MSK 0651.97 (Fig. 3, *II*, *III*), both juveniles, from moist soil from western bank of Chenab River, near Rabwah, District Jhang, Punjab, Pakistan, August 24, 1997, by Muhammad Sharif Khan.

Diagnosis (Fig. 3*b*). *Typhlops madgemintonai shermanai* is morphology similar to *T. madgemintonai*, except that the supranasal suture is 50% complete; naris round; a subnarial pit in the inferior nasal suture; preocular and ocular scales subequal; the row of squamous glands, along slightly curved preocular-nasal suture, are thickened.

Variations. Table 1 details out pholidosic and measurable variations in the type series of *T. m. shermanai*. Both juveniles, MSK 0648.97, MSK 0651.97, except of their small midbody diameter and total size have the same basic morphology as diagnosed for the holotype. Both paratypes, when collected, were intertwined with each other, fearing breaking their bodies, attempt to dislodge them from each other was abandoned, and were put alive in the preservative. Like holotype, the supranasal suture extends to 50% of the distance between naris and rostral scale, however, body color of paratypes is light brown, and there is no

subnarial pit and the squamous glands along preocular-nasal suture are not thick.

Distribution. *T. m. shermanai* has southwest extended wider distribution, it reaches northwestern Punjab, Pakistan. Generally blind snakes are known good swimmers, they swim long distances in flood waters (Khan, 1980). Flood water in Chenab River washes down around Rabwah, which might have carried these mountainous specimens to their present locality in Punjab, Pakistan.

Typhlops ahsanai NEW SPECIES

Holotype. MSK 0903.93, an adult, (Fig. 4*a*), from under a pile of stones, along a torrent, Nadari village, 2 km E of Goi Madan, District Kotli, Azad Kashmir, 33°30′ N and 74°00′ E, elevation 1315 m, July 17, 1993, collector Muhammad Sharif Khan.

Diagnosis (Fig. 4*b*). *Typhlops ahsanai* belongs to *madgemintonai* Group, differing in having 75% complete supranasal suture; anterior nasal scale overlaps the first supralabial and anterior ventral part of the posterior nasal scale; the posterior nasal scale is deeply scalloped behind so that the preocular scale extends deep in the postnasal concavity so formed; preocular scale is larger than ocular; the preocular-nasal suture is studded with thick squamous glands; preocular scale is in contact with only third supralabial; posterior nasal scale is in contact with second and third supralabial.

The supralabial imbrication formula for *Typhlops ahsanai* is:

$$\begin{matrix} N_1 & & N_2 & & Poc & & Oc + Postoc \\ SL_1 & - & SL_2 & + & SL_3 & - & SL_4 \\ N_2 & & Poc & & Oc & & \end{matrix}$$

Distribution. New species *Typhlops ahsanai* is known only from its type locality.

DISCUSSION

Diminutive size of blind snakes has always posed problems to workers to agree on a set of clear cut morphological characters for defining taxa, so almost every worker has developed his own set of morphological characters for defining taxa on which he or she is working (McDowell, 1974; Wallach, 1993).

The universal distribution of blind snakes, despite their apparent little powers of locomotion and specialized habits, is an enigma for scientists to understand. Apart from well known example of universal distribution of *Ramphotyphlops braminus*, recently southeast Asian blind snake *Typhlops diardi* has been reported from Azad Kashmir in the western Himalayas, almost 1000 km northwest of its known southeast Asian range (Khan and Khan, 1996; Khan, 1998).

McDowell (1974) reported four species of blind snakes belonging to genus *Ramphotyphlops* with 18 midbody scales from southeast Asian islands which he has placed in *Ramphotyphlops* (*Typhlina*) *guentheri* group. However, there is a long list of blind snakes belonging to genus *Typhlops*, with 18 midbody scales which have been described from time to time from throughout Indo-Pakistan subcontinent: *T. filiformis* Dumeril and Bibron, 1844 type locality "probably" India; *T. mirus* Jan, 1860 from Ceylon; *T. porrectus* Stoliczka, 1871 from Bengal, eastern Himalayas; *T. andamanensis* Stoliczka, 1871 from Andaman island, Indian Ocean. *T. floweri* Boulenger, 1888 from Siam; *T. beddomei* Boulenger, 1890 from Travancore, Anaimalai Hills, Cochin State, Tinnevelly, southern India; *T. mackinnoni* Wall, 1910 from Mussorie, western Himalayas; *T. venningi* Wall, 1913 from Burma; *T. tindalli* Smith, 1941 from Nilambur, Malabar Southern India; *T. ceylonicus* Smith, 1941 Peradeniya, Ceylon; *T. loveridgei* Constable, 1947 from Ambala, Kulu Valley, northwestern India; *Typhlops meszoelyi* Wallach (in press) from Assam, Darjeeling, India.

Typhlops beddomei, *ceylonicus*, and *tindalli* differ from present series of blind snakes from Azad Kashmir and Punjab, Pakistan, apart from other characters, in having nasals in contact round the tip of rostral; *T. andamanensis* and *mirus* have small subocular scales which separate preocular and ocular from supralabials while there is no tail spine in *T. floweri*.

The reported, morphology of long known species of 18 midbody scale blind snake from eastern Himalayas *Typhlops porrectus* Stoliczka (1871) is confusing. Since holotype of this taxon is lost. Workers have identified every blind snake with 18 midbody scales, from different localities in the subcontinent, as *T. porrectus*. Resulting reports carry wide range of variations in pholidosic counts, body diameter and total body length in different accounts of porrectus (Jan, 1863; Boulenger, 1890, 1893; Wall, 1911; Smith, 1941). Constable (1949) described *T. loveridgei*, from northern Punjab, India, with 18 midbody scales, on the basis of completely divided

nasal, infranasal cleft arising from preocular, preocular in contact with only third supralabial and the body is stated to be thinner and longer in this species. Dumeril and Bibron's (1844) description of *T. filiformis* is the oldest report on 18 midbody blind snake. Unfortunately its type locality is not known, probably it is from "India." Fortunately its holotype is available in MNHN, although in poor state of preservation, it appears morphologically close to the "classic" description of *T. porrectus* (Wallach and Wynn, personal communication).

Blind snakes of an area are known to exhibit wide morphological variations. Taylor (1947) described five new species and two already known from 36 blind snakes collected from a site in Sri Lanka. Similarly, McDowell (1974) reported about 20 species from New Guinea and Solomon's Islands. Present set of species is described from Azad Kashmir, within a radius of 5 km of Goi Madan, District Kotli, Azad Kashmir, one extended 300 – 400 km southwestern in Punjab, Pakistan.

Key for identification of blind snakes with 18 midbody scales of genus *Typhlops* of Himalayas

Dumeril and Bibron (1844) and subsequent authors (Jan, 1863; Boulenger, 1890) reported 20 midbody scales in *T. filiformis*, however, recent reexamination of its type MNHN 929 reveals to have 18 midbody scales. Similarly, Constable (1949) reported complete division of nasal scale in *T. loveridgei*, reexamination of its type MCZ 2283 reveals it has incompletely divided nasals. Following key includes these corrections:

1. Midbody diameter rarely exceeds 2 mm . . . . . *T. porrectus* (= *filiformis*?)
   Midbody diameter exceeds 2 mm 2
2. Nasal scale completely divided . . . . . *T. madgemintonai*
   Nasal scale incompletely divided 3
3. Middorsals 400 or more 4
   Middorsals less than 400. 5
4. Posteriorly the posterior nasal scale is deeply scalloped. . . . . *T. meszoelyi*
   The postnasal not scalloped. . . . . *T. loveridgei*
5. Preocular in contact with third supralabial only . . . . . *T. ahsanai*
   Preocular in contact with 3rd and 4th suplalabials . . . . . *T. madgemintonai shermanai*

Acknowledgments. The author wishes to thank Master Mohammed Sadiq for his help in arranging for author's stay during collection tours of present series of snakes from Goi Madan and around, Azad Kashmir. My profound thanks are for Mr. Van Wallach, Department of Herpetology, Museum of Comparative Zoology, Harvard University, Cambridge, USA, for supply of pertinent literature and data on MCZ and AMNH type specimens. Dr. Addison Wynn, National Museum of Natural History, USA, is also to be thanked for sharing ideas and providing literature. Help of Mr. Colin McCarthy, Department of Zoology, The Natural History Museum, London, in providing literature, is thankfully acknowledged.

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