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Ecological Observations and New Distribution Records of *Lytorhynchus paradoxus* (Günther, 1875): Expanding Its Range Beyond the Desert Regions of Punjab, Pakistan

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Abstract
The discovery of new localities for poorly understood species is important for advancing knowledge of their distribution and informing conservation efforts. This study presents the first detailed analysis of the Sindh Awl-headed snake, *Lytorhynchus paradoxus* (Günther, 1875) based on a field survey conducted in July and August 2024 in the Cholistan Desert, Yazman Mandi, Bahawalpur (29.10833°N, 71.74167°E), central-southern Pakistan. Six specimens were documented, providing insights into the species' distribution range, diel activity pattern and reproductive strategy. Previous records from Pakistan often lacked specific locality data, and this research addresses that gap by providing detailed morphological characteristics, sex identification, and exact geographic coordinates. Additionally, a recent sighting and subsequent killing of a specimen by a resident in Chak 50 WB, Vehari district, Punjab (30.108611°N, 72.159167°E), extends the known range of *L. paradoxus* by approximately 150 km, contributing a new locality to its distribution. These findings enhance the understanding of the species' ecology in arid environments and emphasize the need for further studies to assess its conservation status and ecological role within its habitat.

Keywords: *Lytorhynchus paradoxus*, Pakistan, Psammophilous, Cholistan, Snake.

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INTRODUCTION

Lytorhynchus paradoxus (Günther, 1875), commonly known as the Sindh Awl-headed snake, is a non-venomous colubrid snake (Anderson, 1898) native to the arid regions of the Indian subcontinent. Many desert-dwelling reptiles, including *L. paradoxus*, have not been extensively studied, leaving their ecological roles insufficiently understood (Baig et al., 2008). Historically, *L. paradoxus* was considered endemic to the Thar Desert of Pakistan, with early records largely confined to the Cholistan Desert and adjacent areas in Punjab, as well as parts of Sindh and Balochistan (Smith, 1943; Minton, 1966; Leviton & Anderson, 1970; Baig et al., 2008; Ali et al., 2012). Notable localities in Pakistan include the Cholistan Desert, Bahawalpur Division, Muzaffargarh, Multan, Hyderabad, Jacobabad, Sanghar, Thar Parkar, and Zhob Districts.

However, more recent surveys and reports have expanded the species known distribution beyond Pakistan. It has been recorded in Rajasthan, India, with sightings in Ramgarh and Sam in Jaisalmer District, and Chohtan in Barmer District (Bhide et al., 2004; Agarwal et al., 2009; Agarwal & Srikanthan, 2013; Yati et al., 2016). Early assumptions of its endemism in the Thar Desert have been questioned by

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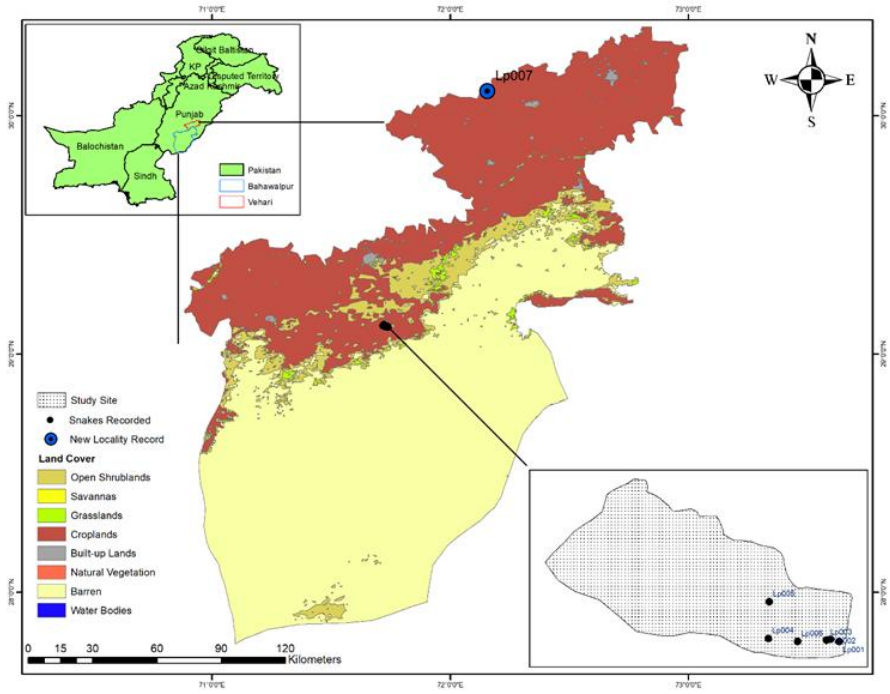

FIGURE 1. Map of the study area, showing the district of Bahawalpur and the newly recorded locality of *Lytorhynchus paradoxus* in district Vehari. The map also illustrates the land cover distribution across both districts.

these expanding records, suggesting that *L. paradoxus* may be more widespread and adaptable within desert habitats than previously thought. Recent field surveys, including this study, along with new sightings by local residents, further support the idea that this species is not as geographically restricted as previously believed.

Despite these growing distribution records, significant gaps remain in our understanding of *L. paradoxus*. Ecological data on its habitat preferences, activity patterns, and reproductive biology are limited. Desert snakes like *L. paradoxus* play important roles in regulating populations of small vertebrates and invertebrates, and their behavior can provide insights into the adaptability of species in harsh, arid environments (Sharma & Upadhyay, 2011). Furthermore, understanding the distribution and ecology of such species is critical for their conservation, as desert ecosystems are increasingly threatened by habitat degradation, climate change, and human encroachment (Babar et al., 2020).

This study addresses the existing knowledge gaps by providing a comprehensive overview of *L. paradoxus* distribution, including new locality records from the Cholistan Desert. We also presented new insights into the species physical characteristics, behavior, and ecological preferences. This study enhances the understanding of *L. paradoxus*, thereby informing conservation efforts and biodiversity management strategies. Additionally, this research contributes valuable data into the ecological roles of desert reptiles, a field that remains largely understudied in herpetology (Agarwal & Srikanthan, 2013; Yati et al., 2016).

MATERIAL AND METHODS

In July and August 2024, over two-months period, all specimens were collected using the hand-picking method, which is highly effective for collecting small reptiles, mainly when covering large areas with limited time in the fields (Baig et al., 2008). The survey was carried out by three individuals at the study sites, using hand lamps and torches to minimize the risk of encountering venomous snakes (Mukherjee, 2023). We also utilized snake hooks to inspect shrubs and bushes for hidden specimens. We used a 20x magnifying glass for scale counting and a digital Canon 200D SLR camera to photograph the specimens for detailed examination.

FIGURE 2. (A) Dorsal view of *Lytorhynchus paradoxus*, showing entire body morphological characteristics. (B) Lateral view (specimens Lp002, Lp004). (C) Ventral view of the head, highlighting the arrangement of infralabials and mental scales (specimen Lp005). (D) Dorsal view of the head, showing the prefrontal and frontal scales (specimen Lp006). Photographs by Mudassar Basri.

Gender identification was performed using popping and probing techniques (Creer et al., 2012; Harding & Callaghan, 2015). The probing involved gently inserting a sanitized and lubricated probe into the cloaca, directed towards the tail tip, to check for hemipenes in males (Lambert et al., 2009; Halliday & Adler, 2012). The popping or manual eversion technique involved applying firm but gentle pressure to the ventral side of the tail, approximately three-quarters of the way from the cloaca to the tip, and then sliding the thumb towards the cloaca (Buchan et al., 2005; Marshall et al., 2018). This method can cause the hemipenes to evert in males, appearing as two reddish structures, whereas in females, no such structures emerge (Aldridge & Brown, 1995; Hayes et al., 2009). While the popping method is generally considered less safe due to the potential for injury, it is effective when performed by professionals who carefully handle the technique.

Species identification was based on established literature (Smith, 1943; Minton, 1966; Leviton and Anderson, 1970; Bhide et al., 2004). Measurements were taken with a measuring tape in centimeters, and dorsal scale counts were recorded at mid-body (Ishan Agarwal and Achyuthan N. Srikanthan, 2013). Geographic coordinates for each collection site were recorded using GPS, information regarding weather conditions, habitat profile and activity and behavior of species were recorded (Moradi et al., 2013). The collected specimens were fed a diet of live juvenile mice and provided water ad-lib to maintain their health (Cooper, 2024). The collected snakes were released back into their natural habitat within a few days.

RESULTS

We collected six specimens (two females and four males) of *L. paradoxus* between 9:00 PM and 4:00 AM, demonstrating their nocturnal activity. The survey was conducted in an approximate 2 km by 6 km patch of Lesser Cholistan, situated west of Yazman Mandi, south of Chak 56 DB, north of Chak 101 DB and Chak 103 DB, and east of Chak 59 DB (Fig. 1). A local person from Chak 50 WB Vehari shared a photograph of a killed snake for identification. We identified it based on visible characteristics and confirmed it to be *L. paradoxus*. Detailed measurements, scale counts, coordinates, and timestamps for each specimen are provided in Table 1.Morphologically, all six specimens exhibited consistent features as described by Smith (1943), Minton (1966), and Leviton and Anderson (1970).

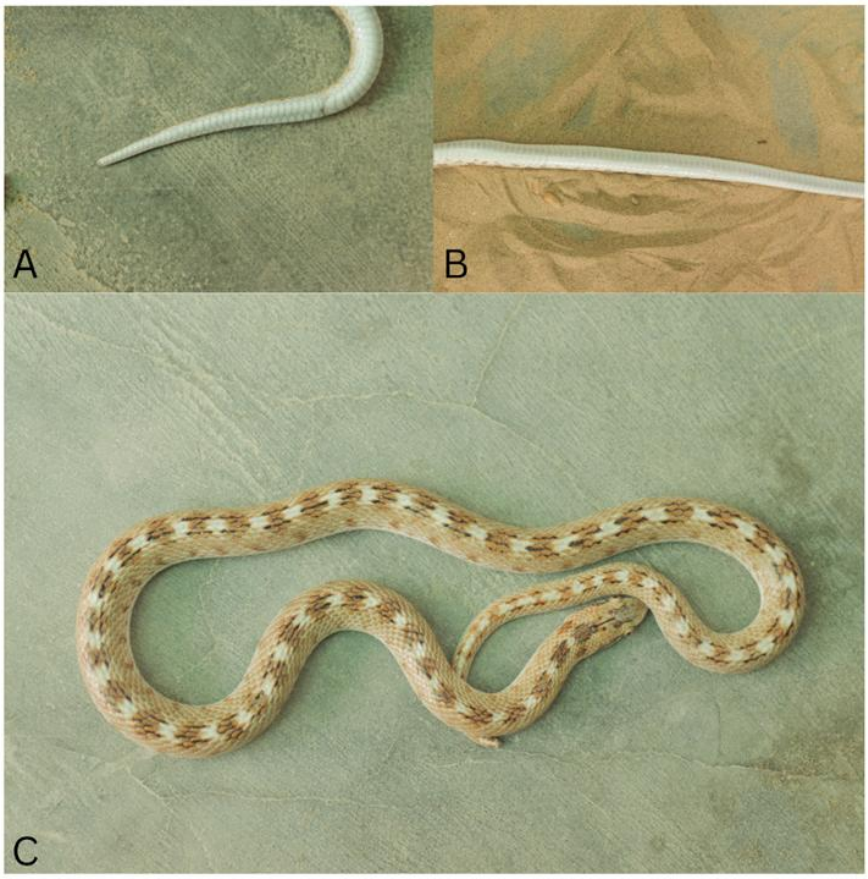

FIGURE 3. (A) Ventral view of *Lytorhynchus paradoxus*, showing subcaudal scale variation with 37 subcaudal scales (specimen Lp001). (B) Ventral aspect of *L. paradoxus*, exhibiting a patternless white coloration (specimen Lp003). (C) Complete dorsal view of *L. paradoxus* (specimen Lp001). Photographs by Mudassar Basri.

The rostral scale was pointed and visible from above. Each snake had eight supralabials, with the 5th in contact with the eyes. Loreal: 1, Preoculars: 2, Presubocular: 1, Postoculars: 2, and Anterior temporals: 2. dorsal scales were smooth, arranged in 19, mid-body rows, and the ventral scales ranged from 168 to 185, angulated laterally, with divided anal scale. The subcaudal scales were paired; older literature cites a range of 40 to 53. Notably, we recorded one female specimen with only 37 subcaudals. These snakes typically measured up to 40 cm in length. Their dorsal coloration was glossy greyish-brown with 40 to 51 white rectangular vertebral spots or alternating white and dark brown spots throughout the body, with dark brown or chocolate brown interspaces. The eyes had vertically elliptical pupils, the head was slightly broader than the neck, and it featured a depressed and pointed snout. The ventral side was patternless white (Figs. 2 and 3).

Habitat

The habitat of Lesser Cholistan, where we found *L. paradoxus*, is characterized by expensive sandy areas with sparse vegetation. This environment features low sand dunes and flat sandy patches, with flora including *Calotropis gigantean*, *Aerva javanica*, and *Citrullus colocynthis* (Fig, 4). These plants provide minimal cover. However, they are crucial for the ecosystem, offering shelter and foraging grounds for various species, including the observed reptiles. The sparse vegetation and sandy terrain are typical of arid desert environments, providing an ideal habitat for *L. paradoxus* and other desert-adapted wildlife.

TABLE 1. Morphometric, Meristic and Spatiotemporal Data of *Lytorhynchus paradoxus*. Abbreviations: **SVL** – Snout-Vent length; **TaL** – Tail Length; **TL** – Total Length; **V** – Ventral Scales; **A** – Anal Scale; **Sc** – Subcaudal Scales; **Dors** – Dorsal Scales; **SL** – Supralabials; **IL** – Infralabials; **L** – Loreal; **AT** – Anterior Temporals; **PrO** – Preoculars; **PtO** – Postoculars; **Alt** – Altitude; **Long** – Longitude; **Lat** – Latitude.

Characters	Lp001	Lp002	Lp003	Lp004	Lp005	Lp006	Lp007*
SVL (cm)	25	32.5	28.7	31.8	17.5	29	-
TaL (cm)	4	5.6	5.6	5	2.50	5	-
TL (cm)	29	38.1	34.3	36.8	20	34	-
V	181	176	171	183	177	177	-
A	2	2	2	2	2	2	-
Sc	37	43	46	44	42	45	-
Dors	19	19	19	19	19	19	-
SL	8(5)	8(5)	8(5)	8(5)	8(5)	8(5)	-
IL	9	9	9	9	9	9	-
L	1	1	1	1	1	1	-
AT	2	2	2	2	2	2	-
PrO	2	2	2	2	2	2	-
PtO	2	2	2	2	2	2	-
Sex	♀	♂	♂	♀	♂	♂	-
Alt (m)	74	81	82	82	82	80	132.83
Time	21:34:22	22:39:19	01:03:38	1:56:55	02:37:32	03:42:58	11:02:18
Date	27.07.2024	27.07.2024	28.07.2024	28.08.2024	28.08.2024	28.07.2024	25.06.2024
Long (Decimal)	71.74159	71.74073	71.74035	71.73465	71.73473	71.73750	72.15583
Lat (Decimal)	29.11174	29.11196	29.11188	29.11204	29.11563	29.11175	30.10287

Note: Lp007* was sighted and killed by local. Coordinates were obtained after visiting the location.

Behavior

Behaviorally, upon approach, the snakes initially attempted rapid escape, followed by diving through the sand. When further provoked, they coiled their bodies, hid their heads, and hissed, with some exhibiting caudal luring behavior. After the perceived threat had passed, the snakes would quickly escape. Tail curling was also noted, and notable, the snakes did not attempt to bite even once. According to our observations, they mainly feed on small beetles and juveniles of *Gerbillus cf. gleadowi* (Murray, 1886), but according to older literature, *Crossobamon orientalis* is also included in their diet. Field observations in 2020 and 2021 during April revealed that females typically laid a single egg.Other reptiles encountered during the survey included two *Spallerosophis arenarius* (Boulenger, 1890), Five to six *Crossobamon orientalis* (Blanford, 1876), numerous *Acanthodactylus cantoris* (Günther, 1864), and a single *Eremias cholistanica* (Baig & Masroor, 2006). No other snakes were recorded in the past two years, except for a *Platyceps ventromaculatus* (Gray, 1834) observed near the eastern edge of the study area on April 6, 2022, and a *Spalerosophis atriceps* (Fischer, 1885) spotted near a water disposal site on June 12, 2022. The latter location has become a source of pollution, further degrading this habitat.

FIGURE 4. Landscape view of study area, showing the habitat features of *Lytorhynchus paradoxus*. Photograph by Mudassar Basri.

FIGURE 5. Killed specimen of *Lytorhynchus paradoxus* (specimen Lp007) from Vehari. Photograph by Faisal Hashmi.

New Sighting

A new sighting of *L. paradoxus* was reported from Chak 50 WB, Vehari (30.108611°N, 72.159167°E), situated about 76 km away from the edge of the Cholistan Desert (Fig. 5). The specimen was found in a semi-arid environment characterized by sandy soil with sparse vegetation. The area shows patches of grass and scattered shrubs, indicative of a desert margin habitat. This type of habitat supports species adapted to arid conditions, with vegetation providing minimal cover and food resources.

DISCUSSION

Our study, in conjunction with the new sighting from Chak 50 WB, Vehari, suggests that *L. paradoxus* is not as rare as previously believed within its known distribution range. The sighting in Vehari, located approximately 76 km from the Cholistan Desert, challenges earlier assumptions that the species is restricted solely to true desert habitats. This finding aligns with more recent studies that have noted the adaptability of *L. paradoxus* to semi-desert and arid environments, broadening the understanding of its ecological range. Previously, *L. paradoxus* was primarily documented in the Cholistan Desert (Baig et al., 2008) and parts of Rajasthan, India (Agarwal et al., 2009; Yati et al., 2016). However, our results suggest that the species can also inhabit environments that are not strictly desert, supporting the hypothesis that *L. paradoxus* may be more ecologically flexible than originally thought (Bhide et al., 2004; Ishan Agarwal & Srikanthan, 2013).

Our findings further reveal that *L. paradoxus* is exclusively nocturnal, a behavioral trait that corroborates earlier observations made by Minton (1966) and Leviton & Anderson (1970), who noted the species tendency to be active during the night. This behavior is characteristic of many desert-dwelling snakes, which often rely on nocturnal activity to avoid the extreme heat of the day (Sharma & Upadhyay, 2011). In line with previous reports (Smith, 1943; Baig et al., 2008), we observed that *L. paradoxus* retreats to shelters such as vegetation roots or burrows during the day, indicating its adaptation to the hot, dry conditions of its habitat. The species diurnal inactivity and reliance on cryptic refuges during daylight hours are consistent with the behaviors of other desert colubrids, which utilize subterranean or vegetative cover for thermoregulation and predation avoidance (Sewlal & Minton, 1999).

Regarding reproductive behavior, our study corroborates the findings of Baig et al. (2008) that *L. paradoxus* typically lays one or two eggs per clutch. This low reproductive output may be linked to the species habitat in arid environments, where reproductive success is often limited by environmental factors such as temperature and food availability (Fitzgerald & LeFebvre, 2015). In this context, the species feeding habits, primarily targeting beetles from the *Pimeliinae* subfamily, also align with previous reports that indicate its preference for small arthropods, which are abundant in desert ecosystems (Agarwal et al., 2009).

Human-induced habitat destruction, particularly due to the expansion of housing and agricultural activities, represents a growing threat to *L. paradoxus*. As noted by Babar et al. (2020), desert-adapted species are increasingly at risk due to the conversion of arid landscapes into cultivated fields and urban developments. Our findings also suggest that *L. paradoxus* may exhibit some level of adaptability to modified landscapes, as evidenced by its presence in agricultural fields near human settlements. Similar observations have been made for other desert species, such as the desert monitor (*Varanus griseus*), which has been found to persist in disturbed habitats (Akman et al., 2023). This adaptability could offer *L. paradoxus* a degree of resilience to anthropogenic changes in its environment, but it also raises concerns about the long-term viability of populations in these altered habitats.

By integrating previous records with our new findings, we provide a more comprehensive understanding of *L. paradoxus* distribution, habitat preferences, and ecological requirements. Our study reinforces the importance of conserving both true desert habitats and semi-arid environments, which are crucial for the survival of *L. paradoxus* and other similarly adapted species. Conservation efforts should focus not only on the protection of pristine desert habitats but also on mitigating the impacts of human activities in these regions. As climate change and human encroachment continue to alter desert ecosystems, it is vital to monitor these populations closely to ensure their persistence in a rapidly changing world (Sharma & Upadhyay, 2011; Babar et al., 2020).

CONCLUSION

This study provides valuable herpetological insights into least concern but lesser-known *L. paradoxus*, documenting its distribution, morphology, and nocturnal behaviors in the Cholistan Desert and a new locality record from Chak 50 WB, Vehari. The species demonstrates remarkable adaptations to arid and semi-arid habitats, with observations of unique defensive strategies and feeding behaviors that deepen our understanding of its ecology. Human interactions, including habitat encroachment and accidental killings, highlight this species' challenges. These findings emphasize the importance of targeted conservation efforts and continued herpetological research to safeguard both *L. paradoxus* and the fragile ecosystems it inhabits.

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LITERATURE CITED

Agarwal, I., & Srikanthan, A. N. 2013. Further records of the Sindh Awl-Headed Snake, *Lytorhynchus paradoxus* (Günther, 1875), from India with notes on its habitat and natural history. *Russian Journal of Herpetology*, 20(3), 165–170.

Agarwal, I., Iyengar, A., 2013. Further records of the Sindh Awl-headed Snake, *Lytorhynchus paradoxus* (Günther, 1875), from India with notes on its habitat and natural history. *Russian Journal of Herpetology* 20(3), 165–170. https://doi.org/10.30906/1026-2296-2013-20-3-165-170.

Agarwal, I., Mistry, V., Tillack, F., 2009. On the Rajasthan toad-headed lizard, Bufoniceps laungwalaensis (Sharma, 1978), an endemic agamid from the Thar desert. *Sauria* 30, 37–48.

Akman, B., Yıldız, M.Z., Aydoğdu, M., Bozkurt, M.A. and Üçeş, F., 2023. Species conservation action plan for *Varanus griseus* (Daudin, 1803) Distributed in Southeastern Anatolia. *Forestist*, 73(2): 131–137.

Aldridge, R. D., & Brown, W. S. 1995. Reproductive biology of the western diamondback rattlesnake. *Journal of Herpetology*, 29(3), 330–335.

Ali, M., Habibullah, H., Anwar, M., Nawaz, M., 2012. Herpetofauna in the province of Balochistan, Pakistan. *Herpetological Review* 24(1), 59–62.

Anderson, J. 1898: Zoology of Egypt, vol. 1. Reptilia and Batrachia. Bernard Quaritch, London, 371. https://doi.org/10.5962/bhl.title.45263

Babar, M., et al., 2020. Impact of climate change on desert ecosystems and biodiversity. *Environmental Conservation Journal* 47(2), 121–136.

Baig, K. J., Masroor, R., & Arshad, M. 2008. Biodiversity and ecology of the herpetofauna of Cholistan Desert, Pakistan. *Russian Journal of Herpetology*, 15(3), 193–205.

Bhide, K., Captain, A., Khandal, D., 2004. First record of *Lytorhynchus paradoxus* (Günther, 1875) from the Republic of India, with notes on its distribution. *Hamadryad* 28(1 & 2), 123–126.

Buchan, L. A. J., Cuthbert, R. J., & Ward, P. 2005. Techniques for sex determination in snakes. *Journal of Zoology*, 267(2), 217-223.

Cooper, J. E. 2024. Terrestrial reptiles: lizards, snakes, and tortoises. In R. Hubrecht & J. Kirkwood (Eds.), The UFAW Handbook on the Care and Management of Laboratory and Other Research Animals, 853–880. Wiley-Blackwell.

Creer, S., Di Francesco, V., & Hopley, S. 2012. Field techniques for gender identification in snakes: A comparative study of eversion and probing methods. *Herpetological Review*, 43(1), 56–63.

Fitzgerald, L.A., LeFebvre, R., 2015. Reproductive ecology of desert snakes. *Herpetological Ecology* 51(3), 298–305.

Günther, A., 1875. Second report on collections of Indian Reptiles obtained by the British Museum. *Proceedings of the Zoological Society of London* 1875, 224–234.

Halliday, T. R., & Adler, K. 2012. The reptile manual: Techniques for studying herpetofauna. Springer.

Harding, K., & Callaghan, C. 2015. Herpetology methods: Identifying sex in snakes. *Journal of Herpetological Science*, 12(3), 187–192.

Hayes, W. K., Sutherland, M., & McCleery, R. 2009. Observational techniques in snake sex identification: An evaluation of manual eversion and probing. *Wildlife Methods Review*, 21(1), 45–49.

Kumawat, R., Purohit, A., 2021. Some snakes of the arid and semiarid regions of the Thar Desert in Rajasthan, India. *Reptiles & Amphibians* 28(1), 73–76. https://doi.org/10.17161/randa.v28i1.15321.

Lambert, M., Eastman, M., & Weller, M. 2009. Investigating the efficacy of cloacal probing and other methods in sexing snakes. *Herpetological Journal*, 15(4), 233–240.

Leviton, A.E., Anderson, S.C., 1970. Review of the snakes of the genus *Lytorhynchus*. Journal of the Linnean Society of London, *Zoology* 37(7), 249–274.

Marshall, L., Jones, T., & Pollock, B. 2018. A manual on the eversion method for gender identification in reptiles. *Reptile Conservation Handbook*, 34(2), 88–94.

Minton, S.A., 1966. A contribution to the herpetology of West Pakistan. *Bulletin of the American Museum of Natural History* 134, 27–184.

Moradi, N., Shafiei Bafti, S., Sehhatisabet, M.E., Zadhoush, B., Rastegar-Pouyani, E., 2023. Contribution to the knowledge of the genus *Lytorhynchus* Peters, 1863 (Reptilia: Squamata: Colubridae) with special reference to the Iranian taxa. *Journal of Vertebrate Biology* 5(4), 15–31.

Mukherjee, S., 2023. Snake Rescue Manual: Guidelines on Snake Rescue, Snakebite Management, and Community Education for Snake Conservation. *Journal of Science, Humanities and Arts*—JOSHA., 10(1) DOI: 10.17160/josha.10.1.855.

Sewlal, J.M., Minton, S.A., 1999. Behavior and ecology of desert-dwelling snakes. *Herpetological Review* 30(4), 200–210.

Sharma, R., Upadhyay, R., 2011. Ecology of desert reptiles: Adaptive strategies in arid environments. *Journal of Arid Environments* 75(3), 245–257.

Smith, M.A., 1943. The fauna of British India, Ceylon and Burma, including the whole of the Indo-Chinese subregion. Reptilia and Amphibia. Vol. III. Serpentes. Taylor and Francis. https://doi.org/10.5962/bhl.title.48423.

Yati, K., Kachhawa, D., Kumawat, K.R., Sharma, K.K., Sharma, V., 2016. A sighting of the Sind Awl-headed Snake *Lytorhynchus paradoxus* (Günther, 1875) from western Rajasthan: *Habitat preferences. Reptile RAP* 18, 23–24.