



A New Distributional Record and Morphometry of the Kashmir Rock Agama, *Laudakia tuberculata* (Gray 1827), from the Trans-Himalayan Region of Ladakh, India

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Agamids, which include both ground-dwelling and arboreal species, inhabit tropical rainforests and mountain forests as well as deserts and steppes throughout most of the Eastern Hemisphere, but they are found primarily in Australia, southern Asia, and Africa (Holmes et al. 2010). Although widely distributed throughout the Paleotropics and Palearctic, their range does not extend far into Europe and they seem to have been only recently introduced to Madagascar (Wagner et al. 2009). The southeast Asian and Asian regions are hotspots of agamid diversity, and 48 species in 17 genera have been reported in India (Venugopal 2013). High species diversity of Indian agamids corresponds to regions with evergreen forests, particularly in the Himalayas (15 species), northeastern states (13 species), and the Western Ghats (14 species) (Venugopal 2013).

Based on the taxonomy and distributional information currently available, Venugopal (2013) listed five species of *Laudakia*, of which the Kashmir Rock Agama (*L. tuberculata*) is the most commonly encountered species. Its range

extends from eastern Afghanistan and northwestern Pakistan through Kashmir and Uttar Pradesh (India) to southwestern Nepal and Tibet (Uetz et al. 2022) with an elevational range of 150–3,600 m asl (Bahuguna 2008). However, Waltner (1991) studied the elevational ecology of *L. tuberculata* in Uttar Pradesh and found several dissimilarities among populations living at different elevations. In the western Himalayas, *L. tuberculata* can frequently be spotted basking on rocks and wooden logs and also on the thatches of houses and shops near human habitation (Baig et al. 2012). The trans-Himalayan region of Ladakh (within erstwhile Jammu & Kashmir State) has an open habitat as compared to the other Himalayan regions due to which reptilian diversity is limited to ten reptilian species, including three agamids, but excluding *L. tuberculata* (Sahi and Koul 2020).

During a field survey in June 2022, we recorded eleven *L. tuberculata* (Fig. 1) basking on rocks in the Nubra Valley region (inside Karakoram Wildlife Sanctuary) in Ladakh (Fig. 2). A photographic voucher documenting this new



Fig. 1. A Kashmir Rock Agama (*Laudakia tuberculata*) recorded from the study area in Ladakh, India. Photograph by Debaprasad Sengupta.

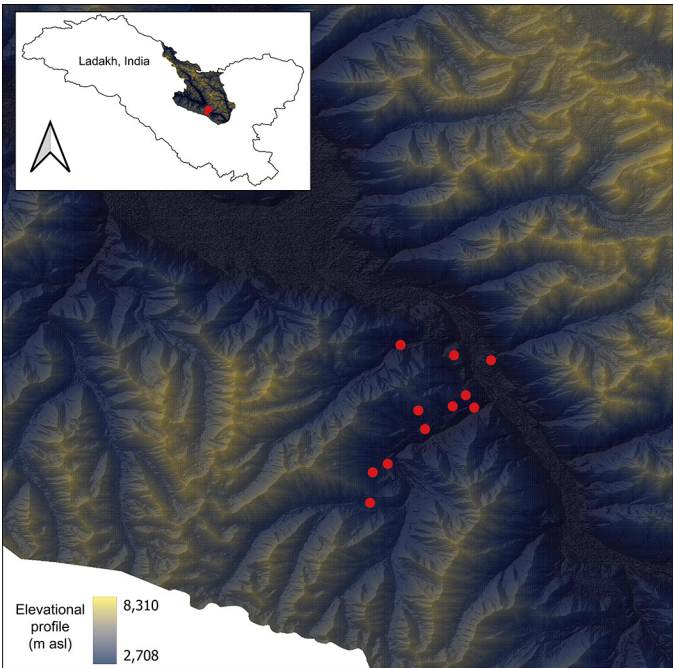


Fig. 2. The Nubra Valley in the Karakoram Wildlife Sanctuary in Ladakh, India. Red dots denote locations where *Laudakia tuberculata* was encountered.

distributional and elevational record has been deposited to the University of Kansas Digital Archive (KUDA 013867), Lawrence, Kansas, USA. The individuals were captured to record morphometric data (Table 1) and released immediately thereafter.

Ladakh is separated from the previously known distribution of *L. tuberculata* by the Karakoram Mountain Range where the species was recorded from elevations of 3,217–3,956 m asl, which is higher than the elevation mentioned by Bahuguna (2008) and is the highest elevational record for *L. tuberculata*. The elevation range of the species is 790–3,660 m

Table 1. A comparison of previously published and new morphometric data for *Laudakia tuberculata*. Measurements (in mm) are presented as means $\pm$ SE. Abbreviations: head length (HL), snout-vent length (SVL), tail length (TaL), and total length (TL).

	Present study (n = 11)	Bahuguna 2008 (n = 14)
HL	35.90 $\pm$ 2.49	34.11 $\pm$ 2.19
SVL	104.00 $\pm$ 7.84	102.50 $\pm$ 7.45
TaL	183.09 $\pm$ 13.90	178.80 $\pm$ 12.10
TL	287.09 $\pm$ 21.41	281.30 $\pm$ 18.90

asl as per the species’ IUCN Red List assessment (Das et al. 2021). The habitat where the species was recorded is open with only a few dominant floral species that included *Ephidra geradiana*, *Caragana versicolor*, and *Urtica hyperborean*. Furthermore, with a similar sample size, individuals from Ladakh are relatively larger than a population at a lower elevation (1,003 vs. 2,498 m asl) (Bahuguna 2008). Walter (1991) noted that the higher elevation populations of *L. tuberculata* have a larger body size compared to the lower elevation populations, which was confirmed in a study of 211 lizard species in China (Liang et al. 2023) and for *Phrynocephalus vlangalii* (Lu et al. 2018).

The Nubra Valley also supports populations of *Paralaudakia himalayana* and *Phrynocephalus theobaldi* (Fig. 3), the latter representing one of the lizards known to inhabit the highest elevations (to ca. 5,000 m asl) (Jin et al. 2018). The addition of *L. tuberculata* to the agamids known to occur in the region is suggestive of niche segregation in an elevational transition zone, where lower-elevational (*L. tuberculata*) and higher-elevational (*P. theobaldi*) agamids meet in a region bound by the Trans-Himalayan and Karakoram Mountain Ranges (e.g., Ferreira et al. 2017). Microhabitat use by the



Fig. 3. Two agamid species that also occur in the Nubra Valley in the Karakoram Wildlife Sanctuary in Ladakh, India: *Paralaudakia himalayana* (left) and *Phrynocephalus theobaldi* (right). Photographs by Debaprasad Sengupta.

three sympatric agamids might be competitive due to the scant vegetation and scarcity of arthropods, but differences in the openness of exploited microhabitats in which the species were encountered suggest that coexistence is promoted by spatial segregation between potentially interacting species to avoid competition. *Laudakia tuberculata* is known to feed on arthropods and a variety of plant matter that includes germinating seeds, tender leaves, buds, and flowers (Lal 1991); Kale, Cabbage, Tomato, Prickly Lettuce, Bermuda Grass, White Clover, White Mulberry, and Common Fig (Bashir et al. 2009); Madagascar Periwinkle (*Catharanthus roseus*) (Vishwakarma et al. 2019); Panicled Foldwing (*Dicliptera* aff. *paniculata*) (Nawani et al. 2020); and *Ficus squamosa* (Rai 2023). Many of these apparently essential components of the diet are either present only in small quantities or lacking entirely in the Nubra Valley region, which strongly suggests that competition for food between these agamids does occur.

Acknowledgements

This study is one of the outcomes of a project funded via a grant by REC Power Development Corporation Limited to The Celestial Earth Consultants. The authors thank the Wildlife Department, Leh, for granting permission to work in the region and all the governmental and local stakeholders for providing help in various ways during the field surveys. The authors would also like to thank Dr. Ana Motta from the Herpetology Division at the University of Kansas (KU) Biodiversity Institute for including the species image in the University of Kansas Digital Archive.

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