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Please cite this article as:

Bilaskar, M. and Walke, S. (2025): Land leech (*Haemadipsa zeylanica*) predating *Indosylvirana indica* (Indian golden-backed frog) in Agumbe, India. *Acta Herpetol.* **20**. doi: https://doi.org/10.36253/a_h-17768.

Land leech (*Haemadipsa zeylanica*) predating *Indosylvirana indica* (Indian golden-backed frog) in Agumbe, India

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Submitted on: 29th April 2025; **revised on:** 1st May 2025; **accepted on:** 14th May 2025

Editor: Enrico Lunghi

Running title: Land leech predating *Indosylvirana indica*

Abstract. This study documents the first recorded instance of ectoparasitism of the Indian golden-backed frog (*Indosylvirana indica*) by the land leech (*Haemadipsa zeylanica*) in Agumbe, India. Observations indicate a specimen of *I. indica* was infested by *H. zeylanica*, with the leech attached to the frog's tympanum. While leeches are known ectoparasites of amphibians and can disrupt their health by serving as vectors for pathogens, this association had not been previously documented for *I. indica*. Our findings highlight the need for further research into leech-anuran interactions to better understand ecological dynamics and their implications on amphibian health.

Keywords. Anura, Brown leech, endemic, Haemadipsidae, Jawed land leech, predation, Ranidae, type leech (Cochin)

Empirical evidence of anuran–leech parasitic associations suggests that anurans represent a principal host group for leeches (Berven and Boltz, 2001; Merilä and Sterner, 2002). Leeches are extensively documented as ectoparasites of amphibians, exhibiting parasitic interactions across multiple life stages, including ovum, embryonic (Burgin and Schell, 2005), and adult phases (Merilä and Sterner, 2002). These hematophagous organisms not only inflict direct physiological stress through blood-feeding and tissue damage but also play a potential role as mechanical vectors in pathogen transmission. Notably, leeches have been implicated in the dissemination of protozoan and fungal pathogens, including *Ichthyophonus* spp. and *Trypanosoma* spp., thereby contributing to the epidemiology of infectious diseases within amphibian populations (Delima et al., 2024).

In India, the ecological and parasitic associations between leeches and anurans remain insufficiently investigated and represent a relatively underexplored area of research. Numerous field observations have been reported by herpetologists; however, the majority of these accounts remain undocumented in peer-reviewed literature. To date, there are no published accounts documenting leech–anuran interactions involving species of the genus *Indosylvirana*. Nevertheless, a prior published record reports the presence of leeches affixed to vocalizing male’s rhacophorid frogs (*Raorchestes* sp.) within Silent Valley National Park, situated in the Western Ghats of India (Zachariah et al., 2016).

Indosylvirana indica, the Indian golden-backed frog, is a species of frog endemic to Western Ghats, north of the Palghat Gap in the states of Karnataka and Kerala (Biju et al., 2014; Frost, 2019). This species was formerly considered conspecific with *Indosylvirana temporalis*, but was subsequently recognized as a distinct species based on morphological and molecular evidence (Biju et al., 2014). On 06 June 2024, at 12.43 PM in the Agumbe Forest, Shimoga district, Karnataka, India (13.5087°N, 75.0959°E; elevation 660 m asl), we observed an individual of *I. indica* being parasitized by a leech (Fig. 1). The posterior end of the leech

was attached to the frog's tympanum and anterior was towards the narrower end of the frog's mouth. The species of leech was identified as *Haemadipsa zeylanica cochiniensis*, which is considered a land leech (Fogden and Proctor, 1985). This leech is endemic to India, having type locality Cochin (Chandra, 1982; Mandal, 2004). Land leeches (*Haemadipsa* spp.), known for biting humans and cattle's (Chandra, 1982), are widely distributed throughout rainforests from Madagascar and India to Southeast Asia, the western Pacific, and Australia. During the 1977–1978 joint expedition to Gunung Mulu National Park, Sarawak, conducted by the Sarawak Forest Department and the Royal Geographical Society, researchers studied leech species in the area. Two of the three *Haemadipsa* species known from Borneo—*Haemadipsa zeylanica* and *H. picta*—were recorded in the park. *H. zeylanica* was found to be the more abundant and widespread species, primarily occurring at ground level, while the rarer *H. picta* was often observed climbing up to two metres into the undergrowth. Both species attacked humans, but only a single instance of non-human predation by *Haemadipsa* species—specifically *H. zeylanica* Moore and *H. picta* Moore—on a frog has been reported (Fogden and Proctor, 1985).

However, land leeches, particularly species like *Batrachobdella algira*, have been documented parasitizing various amphibians, including the endemic Sardinian *Speleomantes* salamanders (Ben Ahmed et al., 2015; Manenti et al., 2016). These leeches feed on amphibians in both aquatic and terrestrial environments, often attaching to their hosts, consuming their blood, and sometimes acting as vectors for micro-parasites such as *Trypanosoma* and *Lankesterella* (Jiménez Sánchez, 1997). Despite the limited number of documented cases, the parasitic relationship between land leeches and amphibians, including potential impacts on body condition, warrants further study, as some reports suggest negative effects on the hosts' health (Elliot and Dobson, 2015). While leech predation on amphibians has generally been seen as opportunistic without causing immediate death, the role of environmental factors, such as

stable microclimates in terrestrial habitats, may influence the extent of this parasitism and its long-term consequences for amphibian populations (Rocha et al., 2012). The study performed by Lunghi et al. (2018) also revealed a strong association between environmental features, such as high humidity and water hardness in karst cave systems, and leech prevalence. While *B. alghira* did not significantly reduce the Body Condition Index (BCI) of its salamander hosts overall, individuals carrying heavier parasite loads exhibited a decline in BCI, suggesting cumulative physiological costs (Lunghi et al., 2018). This pattern parallels the potential, yet undocumented, fitness effects that *H. zeylanica* may have on *I. indica* when attachment duration or infestation intensity is high. These findings together highlight that leech–amphibian associations, though often overlooked, can be influenced by shared ecological variables and may bear sublethal consequences worthy of further investigation. To the best of our knowledge, this represents the first documented instance of ectoparasitism by a land leech in *I. indica*, thereby expanding our understanding of host-parasite interactions within this species. While prior observations have reported mosquitoes (*Uranotaenia* sp.) engaging in hematophagy on *I. indica* in the Western Ghats (Kalki et al., 2020), there are no published records detailing leech parasitism in this amphibian. This novel finding underscores the need for further research into the ecological dynamics and potential health implications of such parasitic relationships in amphibian populations.

ACKNOWLEDGMENTS. We thank Deepak Deshpande and Amatya Sharma for their assistance in confirming the identification of the species and Virendra Gaikwad for helping me with photo editing.

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148 FIGURES:



149

150 **Fig. 1.** Land leech (*Haemadipsa zeylanica*) attached to the tympanum of *Indosylvirana indica*