



Galaxy Frogs (*Melanobatrachus indicus*) in Cardamom Plantations in Munnar, Kerala, India

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The Galaxy Frog, *Melanobatrachus indicus* Beddome 1878, a rare microhylid endemic to the Western Ghats, is currently known only from the states of Kerala and Tamil Nadu (Rajkumar et al. 2021). Considered to be one of the rarest Indian frogs, the species has been reported from only twelve

locations in the southern Western Ghats (Roux 1928; Daltry and Martin 1997; Vasudevan 1997; Ishwar 2000; Nixon and Bhupathy 2007; Kanagavel and Tapley 2013; Palot and Sureshan 2017; Rajkumar et al. 2021; Agashe et al. 2023) (Fig. 1). Due to its distinct evolutionary history and the extent

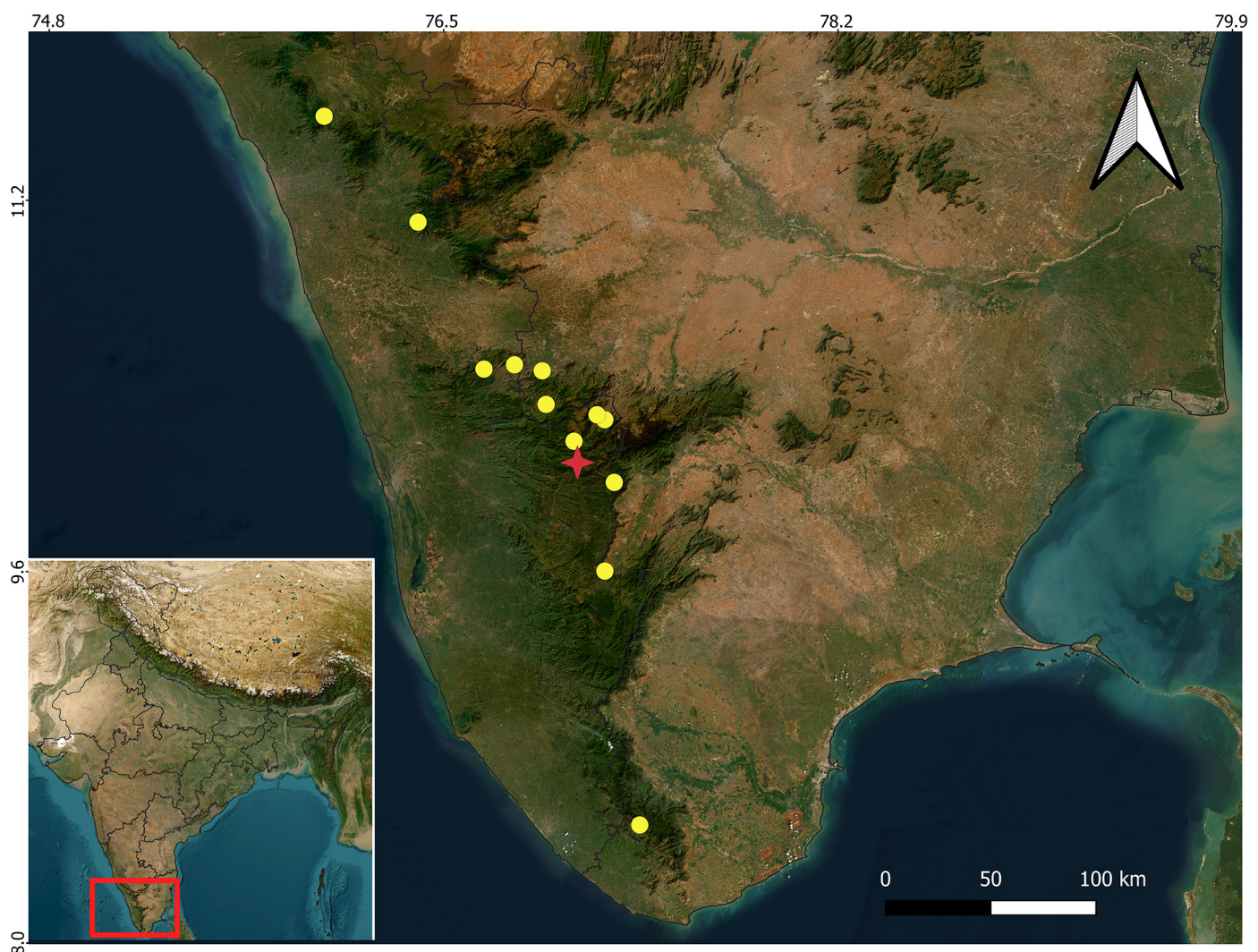


Figure 1. Currently known locality records of the Galaxy Frog (*Melanobatrachus indicus*) in the Western Ghats of India. Previously documented localities are indicated by yellow dots and the new record by the red star.

of threats, this small microhylid is considered an EDGE (Evolutionarily Distinct and Globally Endangered) species by the Zoological Society of London (Gumbs et al. 2018) and as Vulnerable (VU) on the IUCN Red List of Threatened Species (IUCN SSC Amphibian Specialist Group 2022) and Global Amphibian Assessment 2 (Re:wild, Synchronicity Earth, and IUCN SSC Amphibian Specialist Group 2023).

The biodiversity hotspot of the Western Ghats and Sri Lanka is considered one of three high-risk biodiversity hotspots in the world due to its high human population density (Cincotta et al. 2000). In 2021, the Wildlife Trust of India (WTI) initiated an Amphibian Recovery Project in Munnar (Idukki District, Kerala), southern Western Ghats. Elevation in this region is 1,000–2,695 m asl and the landscape, which includes six protected areas (four national parks and two wildlife sanctuaries), is a mosaic of forests (mid-elevation and montane wet evergreen forests, grasslands) and plantations (eucalyptus, wattle, tea, and cardamom) interspersed with human habitations.

During routine fieldwork, the project team encountered *M. indicus* (Fig. 2) on three different occasions in a cardamom plantation on 19 June, 17 July, and 31 July during the monsoons of 2023 (coordinates of this locality are being withheld due to conservation concerns). Frogs were photographed from different angles, emphasizing the scarlet blotches on venters to determine whether they could be used for individual identification (e.g., Bradfield 2004; Del Lama et al.

2011; Rajkumar et al. 2021). Frogs were on stacked piles of wood at night (2100–2230 h; temperature 18.9–21.4 °C, relative humidity 83.4–100%) and were identified as *M. indicus* using descriptions in Beddome (1878), Vasudevan (1997), and Rajkumar et al. (2021). Body markings (scarlet blotches on left forearms and the scarlet marking on venters) of frogs recorded on 19 June 2023 and 31 July 2023 at the same location differed (Fig. 2), suggesting that markings could be used to identify individual animals.

To the best of our knowledge, this is the first record of *M. indicus* from a cardamom plantation. Because cardamom plants require shade, most large native trees are conserved, providing the area with some characteristics of undisturbed forest (Anand et al. 2010). Although vegetative diversity in agroforestry systems can help conserve biodiversity (e.g., Pimentel et al. 1992), agrochemicals are employed extensively in cardamom plantations in the southern Western Ghats (Beevi et al. 2014; Joseph et al. 2020). However, the cardamom plantation where we found *M. indicus* has a history of low agrochemical use (pers. comm. with the plantation manager). For the past three years, this plantation has collaborated with the Wildlife Trust of India to conserve threatened amphibians. We recorded 21 amphibian species (20 anurans and one caecilian) in this cardamom plantation (Table 1). Most are endemic and the latest IUCN Red List assessment lists five of them as endangered. This suggests that, when managed in a biodiversity-friendly manner (i.e.,



Figure 2. Frontal and lateral images illustrating difference in markings of two Galaxy Frogs (*Melanobatrachus indicus*) encountered on 19 June 2023 (left) and 31 July 2023 (right). Photographs by Abhijith Vijay.

Table 1. Checklist of 21 species of amphibians encountered in a cardamom plantations in Munnar, Kerala, India. IUCN Red List status: (DD = Data Deficient, LC = Least Concern, NT = Near Threatened, VU = Vulnerable, EN = Endangered); endemism: WG = Western Ghats, KL = Kerala).

Species	IUCN Red List status	Endemism
Common Indian Toad (<i>Duttaphrynus melanostictus</i>)	LC	
Short-Webbed Frog (<i>Minervarya brevipalmata</i>)	DD	WG
Beautiful Dancing Frog (<i>Micrixalus adonis</i>)	EN	KL
Galaxy Frog (<i>Melanobatrachus indicus</i>)	VU	WG
Jerdon's Balloon Frog (<i>Uperodon montanus</i>)	NT	KL
Spinular Night Frog (<i>Nyctibatrachus acanthodermis</i>)	EN	KL
Mewing Night Frog (<i>Nyctibatrachus poocha</i>)	NT	WG
Don's Golden-Backed Frog (<i>Hylarana doni</i>)	NT	KL
Sreeni's Golden-Backed Frog (<i>Hylarana sreeni</i>)	LC	WG
Large Ghat Treefrog (<i>Ghatixalus magnus</i>)	VU	WG
Western Treefrog (<i>Polypedates occidentalis</i>)	LC	WG
Anamalai Flying Frog (<i>Rhacophorus pseudomalabaricus</i>)	VU	WG
Kalakad Gliding Frog (<i>Rhacophorus calcadensis</i>)	VU	WG
Beddome's Bush Frog (<i>Raorchestes beddomii</i>)	LC	WG
Griet Bush Frog (<i>Raorchestes griet</i>)	VU	WG
Jayaram's Bush Frog (<i>Raorchestes jayarami</i>)	EN	WG
Kadalar Bush Frog (<i>Raorchestes kadalarensis</i>)	NT	KL
Munnar Bush Frog (<i>Raorchestes munnarensis</i>)	EN	WG
Large Ponnudi Bush Frog (<i>Raorchestes ponnudi</i>)	LC	WG
Sushil's Bush Frog (<i>Raorchestes sushili</i>)	EN	WG
Caecilian (<i>Uraeotyphlus</i> sp.)	—	—

low agrochemical use and appropriate land and water management practices), cardamom plantations can sustain considerable amphibian diversity. An urgent need exists for more plantations in this biodiversity hotspot to adopt such frog-friendly practices, which could result in the plantations of the “Cardamom Hills” region becoming a haven for amphibian conservation outside the Protected Area network.

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