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Cover: A Warty Hammer Orchid *Drakaea livida* gets pollinated by a male thynnine wasp through 'sexual deception' — a colour pencil reproduction of photos by ron_n_beths (flickr.com) and Rod Peakall; Water colour reproduction of Flame Lily *Gloriosa superba* — photo by Passakoran_14; and a bag worm and its architectural genius (source unknown). Art work by Pannagarsi G.



A review of 21st century studies on lizards (Reptilia: Squamata: Sauria) in northeastern India with an updated regional checklist

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Abstract: The current study reviews saurian research undertaken in the 21st century in northeastern India. The scope of this review encompasses new species descriptions, range extensions, diversity assessments, systematic revisions, and species rediscoveries. In addition, it incorporates miscellaneous contributions, particularly those addressing myths, ecological aspects, conservation threats, and human-wildlife interactions documented from different states of the region. Based on published works from northeastern India, an updated checklist of the region's lizard fauna is presented. The checklist comprises 84 species representing six families and 19 genera, with their conservation status assessed according to the International Union for Conservation of Nature (IUCN) Red List of Threatened Species.

Keywords: Diversity, ecology, myths, range extension, rediscovery, saurian research, species description, systematics.

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Author contributions: MB drafted the manuscript, compiled data from various sources, and prepared the checklist of lizards with their regional distribution, accompanied by a map illustrating the study localities. MJ conceptualized the manuscript and contributed to the study's design. NS enhanced the manuscript's fluency and supervised its preparation. ARB assisted in designing the study.

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INTRODUCTION

Lizards are a diverse group of ectothermic reptiles belonging to the order Squamata and are primarily confined to tropical regions. Globally, around 12,500 reptile species have been described, of which 929 occur in India (Uetz et al. 2025). Despite lizards contributing a considerable number to these figures (nearly 446 from India; Uetz et al. 2025), they have received comparatively less attention, as snakes represent a more prominent and culturally familiar group, whereas lizards remain relatively less recognized among the general public.

Foundational contributions towards establishing baseline data on Indian lizards were made by several authors, including Günther (1864), Boulenger (1885, 1890), and Smith (1935), which laid the groundwork for future studies in the country. Eight states of India, namely, Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, and Sikkim, collectively form northeastern India, a region that lies within the Himalaya and Indo-Burma biodiversity hotspots and harbours exceptionally high levels of species richness and endemism.

During the British colonial period, significant contributions from northeastern India included several new species descriptions of the order Sauria, notably by Gray (1845, 1846, 1853), Blyth (1854), Jerdon (1870), and Daudin (1802), and later by Annandale (1905, 1908, 1912, 1913) and Boulenger (1885, 1887, 1917).

The recent integration of molecular techniques in lizard taxonomy has greatly aided in identifying and resolving cryptic species complexes that were once considered conspecific. Studies in the 21st century have primarily focused on describing new species from various complex groups, as well as taxonomic revalidations, and revisions of earlier-described species using molecular phylogenetics. This surge in new species descriptions underscores the region's historical underestimation in terms of saurian diversity, largely due to limited sampling efforts (Purkayastha et al. 2020c).

With respect to genetic markers, most studies have relied exclusively on mitochondrial genes, while relatively few have employed both mitochondrial, and nuclear markers (Giri et al. 2019; Gowande et al. 2021; Mirza et al. 2022a), which are considered more robust for species delimitation. In the past eight years (2018–2025), 34 new species of lizards were described from northeastern India. The majority of these belong to the genus *Cyrtodactylus* Gray, 1827, which is recognized as the third largest vertebrate genus in the world (Agarwal et al. 2018a,b; Giri et al. 2019; Purkayastha et al. 2020a,

2021, 2022; Kamei & Mahony 2021; Mirza et al. 2021, 2022a,b; Bohra et al. 2022; Lalremsanga et al. 2022b, 2023a; Mahony & Kamei 2022; Boruah et al. 2024; Bharali et al. in press; Sayyed et al. 2025).

The current study reviews saurian research undertaken in northeastern India during the 21st century and presents an updated checklist of the region's lizard fauna.

MATERIALS AND METHODS

Relevant literature was obtained from the Reptile Database, Web of Science, and Google Scholar with additional references sourced by cross-checking citations within reviewed articles. The study was conducted between May 2023 and September 2025. The checklist was compiled from all peer-reviewed publications on lizards from northeastern India available up to September 2025, supplemented with data from Uetz et al. (2025). The conservation status of each species was verified using the International Union for Conservation of Nature (IUCN) Red List of Threatened Species. In total, 73 publications were reviewed, and classified into six subcategories: new species discoveries, range extensions, diversity assessments, systematic revisions, rediscoveries, and miscellaneous contributions.

RESULTS

New species discovery

In recent years, northeastern India has witnessed a surge in new species discoveries and descriptions. Since the beginning of the 21st century, there has been a marked increase in taxonomic efforts employing integrative approaches that combine morphological assessments with molecular phylogenetic analyses, mostly involving mitochondrial genes, particularly in geckos.

Following the restriction of *Cyrtodactylus khasiensis* Jerdon, 1870, to the Khasi Hills of Meghalaya by Agarwal et al. (2018a), at least 27 new species of the genus have since been described from northeastern India, including records from Tripura (Agarwal et al. 2018a), Assam (Agarwal et al. 2018b; Purkayastha et al. 2020a; Bharali et al. in press), Meghalaya (Agarwal et al. 2018b; Purkayastha et al. 2021, 2022; Kamei & Mahony 2021), Mizoram (Purkayastha et al. 2021, 2022; Lalremsanga et al. 2022b, 2023a; Bohra et al. 2022; Boruah et al. 2024), Nagaland (Agarwal et al. 2018b; Boruah et al. 2024), Manipur (Mahony & Kamei 2022; Boruah et al. 2024), and

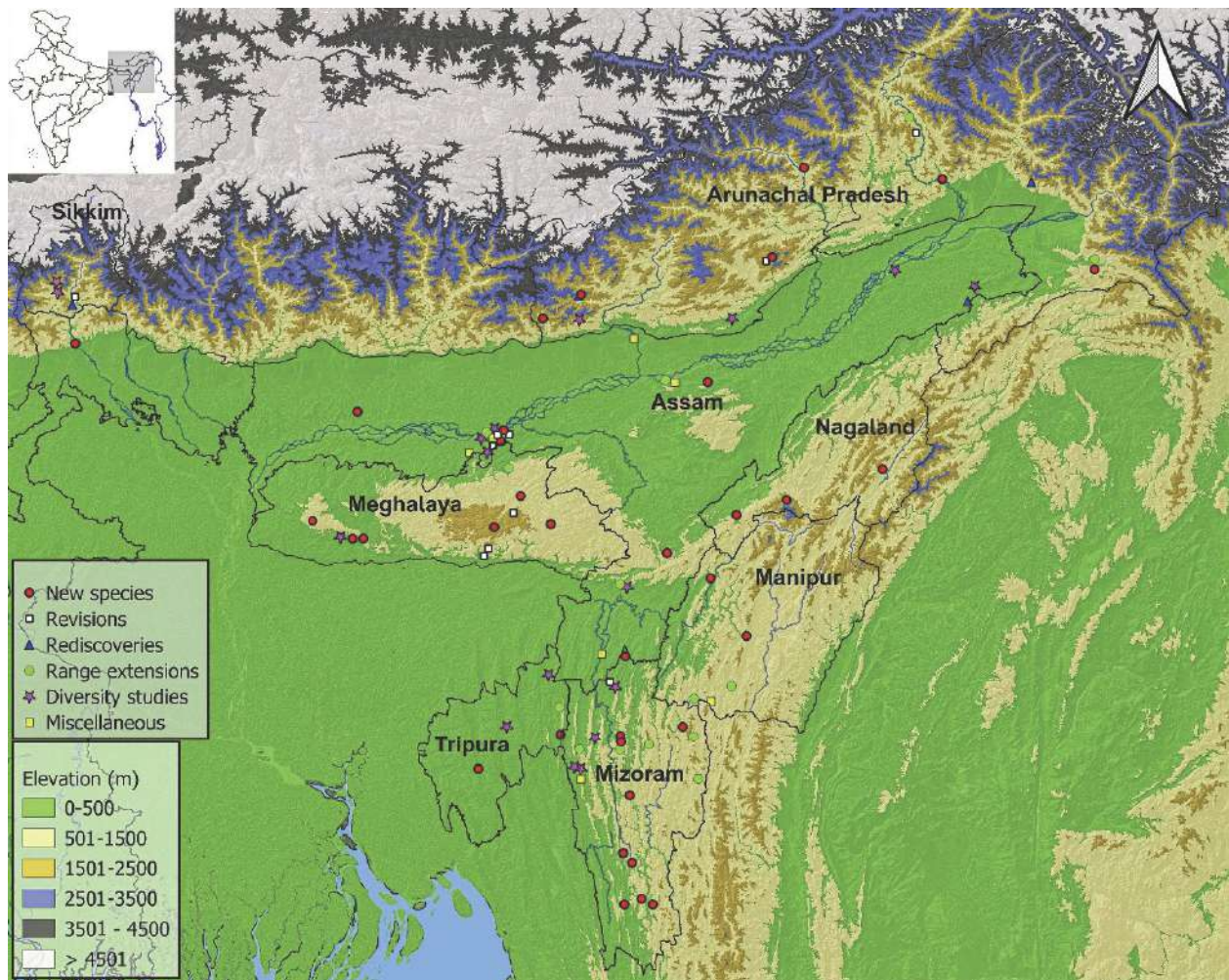


Figure 1. Map of northeastern India showing the patterns of saurian research conducted in 21st century (inset: map of India showing the area of interest).

Arunachal Pradesh (Mirza et al. 2022b; Boruah et al. 2024). Outside of *Cyrtodactylus*, several additional discoveries have contributed to the region's saurian diversity. Mahony (2009) described *Cristidorsa otai* (formerly *Japalura otai*) solely based on external morphology from Mizoram and simultaneously designated a lectotype for *Japalura sagittifera* from Upper Burma (present-day Myanmar) to stabilize its taxonomy. Datta-Roy et al. (2013) described *Sphenomorphus apalpebratus*, a spectacled lygosomatine skink from the sacred forests of Mawphlang, Meghalaya, which is distinguished from congeners by the presence of a permanent spectacle (brille) covering the eyes permanently. Giri et al. (2019) revised the genus *Oriocalotes* using morphological evidence in conjunction with nuclear and mitochondrial genomic data, placing it as a junior synonym of *Calotes*, thereby reassigning *O. paulus* to *Calotes paulus*, and also described *Calotes zolaiking* from Aizawl District,

Mizoram, supported by morphological, phylogenetic, and osteological analyses. Wagner et al. (2021) revised the *Calotes mystaceus* complex using mitochondrial genes (12S rRNA and COI) and described *Calotes geissleri*, which had long been misidentified as *C. mystaceus* in northeastern India, while restricting *C. mystaceus* sensu stricto to the Irrawaddy Delta of southern Myanmar. Mirza et al. (2022a) established the genus *Problepharus* through the revision of *Ablepharus*, *Asymblepharus*, and *Himalblepharus*, and described *Problepharus apatani* from Talle Valley, Arunachal Pradesh, based on morphology, molecular data, and micro-CT scans of the skull. Lalremsanga et al. (2023b) described *Gekko mizoramensis*, a parachute gecko from Mizoram formerly considered conspecific with *Gekko lionotum* Annandale, 1905. Based on morphology and mitochondrial ND2 data, the species was recovered as a sister taxon to *G. popaense* within the *lionotum* group. Mirza et al.

Table 1. Distribution of lizards across northeastern India.

State abbreviations: AS—Assam | AR—Arunachal Pradesh | MI—Mizoram | ML—Meghalaya | TR—Tripura | SI—Sikkim | MA—Manipur | NA—Nagaland. IUCN Red List categories: EN—Endangered | VU—Vulnerable | NT—Near Threatened | LC—Least Concern | DD—Data Deficient | NE—Not Evaluated.

	Family	Scientific name	Common name	IUCN Red List status	Distribution in northeastern India	Citations
1	Varanidae	<i>Varanus bengalensis</i> (Daudin, 1802)	Bengal Monitor	NT	AR, AS, MI, SI, TR	Sinha et al. (2021), Das et al. (2009), Purkayastha et al. (2020c), Purkayastha et al. (2011), Sengupta et al. (2019), Islam & Saikia (2013), Purkayastha (2018), Mahananda et al. (2023), Lalrinchhana & Solanki (2015), Jha & Thapa (2002), Chettri et al. (2009), Purkayastha et al. (2020b), Ahmed et al. (2009), Choudhary & Choudhary (2019), Purkayastha (2013)
2	Varanidae	<i>Varanus flavescens</i> (Hardwicke & Gray, 1827)	Yellow Monitor	EN	AS	Purkayastha et al. (2020c), Islam & Saikia (2013), Purkayastha (2018), Mahananda et al. (2023), Ahmed et al. (2009), Purkayastha (2013)
3	Varanidae	<i>Varanus salvator</i> (Laurenti, 1768)	Asian Water Monitor	LC	AS, MI, NA, TR	Islam & Saikia (2013), Malsawmdawngliana et al. (2022), Lalrinchhana & Solanki (2015), Majumder et al. (2012), Ahmed et al. (2009), Choudhary & Choudhary (2019), Purkayastha (2013)
4	Gekkonidae	<i>Cnemaspis assamensis</i> Das & Sengupta, 2000	Assam Day Gecko	VU	AS	Purkayastha et al. (2020c), Purkayastha et al. (2011), Purkayastha (2018), Chandramouli et al. (2021), Mahananda et al. (2023), Ahmed et al. (2009), Das & Ahmed (2007), Sengupta et al. (2021), Purkayastha (2013)
5	Gekkonidae	<i>Cnemaspis brahmaputra</i> Sayyed, Das, Amarasinghe, Bhattacharjee & Purkayastha, 2025	Brahmaputra Day Gecko	NE	AS	Sayyed et al. (2025)
6	Gekkonidae	<i>Cyrtodactylus aaronbaueri</i> Purkayastha, Lalremsanga, Bohra, Biakzuala, Decemson, Muansanga, Vabeiryureilai & Rathee, 2021	Aaron Bauer's Bent-toed Gecko	NE	MI	Purkayastha et al. (2021)
7	Gekkonidae	<i>Cyrtodactylus agarwali</i> Purkayastha, Lalremsanga, Bohra, Biakzuala, Decemson, Muansanga, Vabeiryureilai & Rathee, 2021	Agarwal's Bent-toed Gecko	NE	ML	Purkayastha et al. (2021), Chandramouli et al. (2021)
8	Gekkonidae	<i>Cyrtodactylus bapme</i> Kamei & Mahony, 2021	Garo Hills Bent-toed Gecko	NE	ML	Kamei & Mahony (2021)
9	Gekkonidae	<i>Cyrtodactylus barailensis</i> Boruah, Narayanan, Deepak & Das, 2024	Barail Hills Bent-toed Gecko	NE	NA	Boruah et al. (2024)
10	Gekkonidae	<i>Cyrtodactylus bengkhuaiai</i> Purkayastha, Lalremsanga, Bohra, Biakzuala, Decemson, Muansanga, Vabeiryureilai & Rathee, 2021	Bengkhuaiai's Bent-toed Gecko	NE	MI	Purkayastha et al. (2021)
11	Gekkonidae	<i>Cyrtodactylus cayuensis</i> Li, 2007	Cayu Bent-toed Gecko	LC	AR	Boruah et al. (2024)
12	Gekkonidae	<i>Cyrtodactylus exercitus</i> Purkayastha, Lalremsanga, Litho, Rathee, Bohra, Mathipi, Biakzuala & Muansanga, 2022	Indian Army's Bent-toed Gecko	NE	ML	Purkayastha et al. (2022)
13	Gekkonidae	<i>Cyrtodactylus gubernatoris</i> (Annandale, 1913)	Sikkimese Bent-toed Gecko	DD	SI	Agarwal et al. (2018a)
14	Gekkonidae	<i>Cyrtodactylus guwahatiensis</i> Agarwal, Mahony, Giri, Chaitanya & Bauer, 2018	Guwahati Hill's Bent-toed Gecko	DD	AS	Mahananda et al. (2023), Agarwal et al. (2018b)
15	Gekkonidae	<i>Cyrtodactylus jaintiaensis</i> Agarwal, Mahony, Giri, Chaitanya & Bauer, 2018	Jaintia Hills Bent-toed Gecko	DD	ML	Agarwal et al. (2018b)
16	Gekkonidae	<i>Cyrtodactylus kamengensis</i> Mirza, Bhosale, Thackeray, Phansalkar, Sawant, Gowande & Patel, 2022	Kameng Hills Bent-toed Gecko	NE	AR	Mirza et al. (2022b)

	Family	Scientific name	Common name	IUCN Red List status	Distribution in northeastern India	Citations
17	Gekkonidae	<i>Cyrtodactylus karsticola</i> Purkayastha, Lalremsanga, Bohra, Biakzuala, Decemson, Muansanga, Vabeiryureilai & Rathee, 2021	Karst Dwelling Bent-toed Gecko	NE	ML	Purkayastha et al. (2021)
18	Gekkonidae	<i>Cyrtodactylus kazirangaensis</i> Agarwal, Mahony, Giri, Chaitanya & Bauer, 2018	Kaziranga Bent-toed Gecko	DD	AS	Agarwal et al. (2018b)
19	Gekkonidae	<i>Cyrtodactylus khasiensis</i> (Jerdon, 1870)	Khasi Hills Bent-toed Gecko	DD	ML	Ahmed et al. (2009), Agarwal et al. (2018a)
20	Gekkonidae	<i>Cyrtodactylus kiphire</i> Boruah, Narayanan, Deepak & Das, 2024	Kiphire Bent-toed Gecko	NE	NA	Boruah et al. (2024)
21	Gekkonidae	<i>Cyrtodactylus lungleiensis</i> Lalremsanga, Chinliansiam, Chandra Bohra, Biakzuala, Vabeiryureilai, Muansanga, Malsawmdawngliana, Hmar, Decemson, Siammawii, Das, & Purkayastha, 2022	Lunglei Bent-toed Gecko	NE	MI	Lalremsanga et al. (2022b)
22	Gekkonidae	<i>Cyrtodactylus manipurensis</i> Boruah, Narayanan, Deepak & Das, 2024	Manipur Bent-toed Gecko	NE	MA	Boruah et al. (2024)
23	Gekkonidae	<i>Cyrtodactylus montanus</i> Agarwal, Mahony, Giri, Chaitanya & Bauer, 2018	Montane Bent-toed Gecko	CR	TR, MI	Agarwal et al. (2018b), Muansanga et al. (2020), Malsawmdawngliana et al. (2022)
24	Gekkonidae	<i>Cyrtodactylus nagalandensis</i> Agarwal, Mahony, Giri, Chaitanya & Bauer, 2018	Nagaland Bent-toed Gecko	DD	NA	Agarwal et al. (2018b)
25	Gekkonidae	<i>Cyrtodactylus namdaphaensis</i> Boruah, Narayanan, Deepak & Das, 2024	Namdapha Bent-toed Gecko	NE	AR	Boruah et al. (2024)
26	Gekkonidae	<i>Cyrtodactylus namtiram</i> Mahony & Kamei, 2022	Namtiram Bent-toed Gecko	NE	MA	Mahony & Kamei (2022)
27	Gekkonidae	<i>Cyrtodactylus ngengpuiensis</i> Boruah, Narayanan, Lalronunga, Deepak & Das, 2024	Ngengpui Bent-toed Gecko	NE	MI	Boruah et al. (2024)
28	Gekkonidae	<i>Cyrtodactylus ngopenensis</i> Bohra, Zonunsanga, Das, Purkayastha, Biakzuala & Lalremsanga, 2022	Ngopa Hills Bent-toed Gecko	NE	MI	Bohra et al. (2022)
29	Gekkonidae	<i>Cyrtodactylus septentrionalis</i> Agarwal, Mahony, Giri, Chaitanya & Bauer, 2018	Northern Bent-toed Gecko	DD	AS	Agarwal et al. (2018b)
30	Gekkonidae	<i>Cyrtodactylus siahaensis</i> Purkayastha, Lalremsanga, Litho, Rathee, Bohra, Mathipi, Biakzuala & Muansanga, 2022	Siaha Bent-toed Gecko	NE	MI	Purkayastha et al. (2022)
31	Gekkonidae	<i>Cyrtodactylus siangensis</i> Boruah, Narayanan, Aravind, Deepak & Das, 2024	Siang Valley Bent-toed Gecko	NE	AR	Boruah et al. (2024)
32	Gekkonidae	<i>Cyrtodactylus tripuraensis</i> Agarwal, Mahony, Giri, Chaitanya & Bauer, 2018	Tripura Bent-toed Gecko	LC	TR	Agarwal et al. (2018a), Purkayastha et al. (2020b)
33	Gekkonidae	<i>Cyrtodactylus urbanus</i> Purkayastha, Das, Bohra, Bauer & Agarwal, 2020	Urban Bent-toed Gecko	NE	AS, ML	Purkayastha et al. (2020a), Mahananda et al. (2023), Purkayastha et al. (2020d)
34	Gekkonidae	<i>Cyrtodactylus vairengtensis</i> Lalremsanga, Colney, Vabeiryureilai, Malsawmdawngliana, Bohra, Biakzuala, Muansanga, Das & Purkayastha, 2023	Vairengte Bent-toed Gecko	NE	MI	Lalremsanga et al. (2023a)
35	Gekkonidae	<i>Cyrtodactylus vanarakshaka</i> Bharali, Thaosen, Vabeiryureilai, Lalremsanga, Purkayastha, Bhattacharjee, Das, Bohra & Hazarika (in press)	Vanarakshaka Bent-toed Gecko	NE	AS	Bharali et al. in press

	Family	Scientific name	Common name	IUCN Red List status	Distribution in northeastern India	Citations
36	Gekkonidae	<i>Gekko gecko</i> (Linnaeus, 1758)	Tokay Gecko	LC	AR, AS, ML, MI, TR	Sinha et al. (2021), Das et al. (2009), Purkayastha et al. (2020c), Purkayastha et al. (2011), Sengupta et al. (2019), Islam & Saikia (2013), Purkayastha (2018), Chandramouli et al. (2021), Mahananda et al. (2023), Malsawmdawngliana et al. (2022), Lalrinchhana & Solanki (2015), Purkayastha et al. (2020b), Majumder et al. (2012), Ahmed et al. (2009), Das et al. (2007), Ulman & Singh (2021), Purkayastha (2013)
37	Gekkonidae	<i>Gekko mizoramensis</i> Lalremsanga, Muansanga, Vabeiryureilai & Mirza, 2023	Mizoram Gliding Gecko	NE	MI	Ahmed et al. (2009), Lalremsanga et al. (2023b)
38	Gekkonidae	<i>Hemidactylus aquilonius</i> McMahan & Zug, 2007	Northern Smooth Scaled Gecko	LC	AS, SI, TR	Purkayastha et al. (2020c), Purkayastha et al. (2011), Purkayastha (2018), Mahananda et al. (2023), Jha & Thapa (2002), Chettri et al. (2009), Purkayastha et al. (2020b), Ahmed et al. (2009), Purkayastha et al. (2010), Ranade & Purkayastha (2020), Das et al. (2011b), Purkayastha (2013)
39	Gekkonidae	<i>Hemidactylus</i> cf. <i>malcolmsmithi</i> (Constable, 1949)	Malcolm's Bow-fingered gecko	DD	AR, AS, MI, TR	Sinha et al. (2021), Purkayastha et al. (2020c), Purkayastha et al. (2011), Sengupta et al. (2019), Islam & Saikia (2013), Purkayastha (2018), Mahananda et al. (2023), Lalrinchhana & Solanki (2015), Purkayastha et al. (2020b), Ahmed et al. (2009), Purkayastha (2013), Manmath Bharali pers. obs. unpublished data.
40	Gekkonidae	<i>Hemidactylus flaviviridis</i> Rüppell, 1835	Northern House Gecko	LC	AS, SI	Purkayastha et al. (2011), Sengupta et al. (2019), Purkayastha (2018), Jha & Thapa (2002), Ahmed et al. (2009), Purkayastha (2013)
41	Gekkonidae	<i>Hemidactylus frenatus</i> Duméril & Bibron, 1836	Common House Gecko	LC	AR, AS, ML, MI, SI, TR	Agarwal et al. (2010), Sinha et al. (2021), Das et al. (2009), Purkayastha et al. (2020c), Purkayastha et al. (2011), Sengupta et al. (2019), Islam & Saikia (2013), Purkayastha (2018), Chandramouli et al. (2021), Mahananda et al. (2023), Malsawmdawngliana et al. (2022), Lalrinchhana & Solanki (2015), Chettri et al. (2009), Purkayastha et al. (2020b), Ahmed et al. (2009), Das et al. (2011b), Purkayastha (2013)
42	Gekkonidae	<i>Hemidactylus garnotii</i> Duméril & Bibron, 1836	Garnot's House Gecko	LC	AS, MI, NA, SI	Purkayastha et al. (2011), Islam & Saikia (2013), Purkayastha (2018), Mahananda et al. (2023), Lalrinchhana & Solanki (2015), Jha & Thapa (2002), Chettri et al. (2009), Ahmed et al. (2009), Purkayastha (2013)
43	Gekkonidae	<i>Hemidactylus platyurus</i> (Schneider, 1797)	Flat-tailed House Gecko	LC	AR, AS, ML, MI, SI, TR	Agarwal et al. (2010), Das et al. (2009), Purkayastha et al. (2020c), Purkayastha et al. (2011), Purkayastha (2018), Chandramouli et al. (2021), Mahananda et al. (2023), Malsawmdawngliana et al. (2022), Lalrinchhana & Solanki (2015), Jha & Thapa (2002), Chettri et al. (2009), Purkayastha et al. (2020b), Ahmed et al. (2009), Das et al. (2007)
44	Gekkonidae	<i>Hemiphyllodactylus</i> sp.	Slender Gecko	NE	AR	Deepak et al. (2022)
45	Agamidae	<i>Calotes</i> cf. <i>vultuosus</i> (Harlan, 1829)	Oriental Garden Lizard	LC	AR, AS, MI, NA, SI, TR	Agarwal et al. (2010), Sinha et al. (2021), Das et al. (2009), Purkayastha et al. (2020c), Purkayastha (2013), Purkayastha et al. (2011), Sengupta et al. (2019), Islam & Saikia (2013), Purkayastha (2018), Mahananda et al. (2023), Lalrinchhana & Solanki (2015), Jha & Thapa (2002), Chettri et al. (2009), Purkayastha et al. (2020b), Majumder et al. (2012), Ahmed et al. (2009), Das et al. (2007), Harit (2018)

	Family	Scientific name	Common name	IUCN Red List status	Distribution in northeastern India	Citations
46	Agamidae	<i>Calotes emma</i> Gray, 1845	Emma Grey's Forest Lizard	LC	AS, ML, MI, NA, TR	Das et al. (2009), Purkayastha (2013), Chandramouli et al. (2021), Malsawmdawngliana et al. (2022), Lalrinchhana & Solanki (2015), Ahmed et al. (2009), Majumder & Agarwala (2015)
47	Agamidae	<i>Calotes geissleri</i> Wagner, Ihlow, Hartmann, Flecks, Schmitz & Böhme, 2021	Geissler's Forest Lizard	NE	NA, MI, MA	Ahmed et al. (2009), Lalremsanga et al. (2010), Wagner et al. (2021), Decemson et al. (2021)
48	Agamidae	<i>Calotes irawadi</i> Zug, Brown, Schulte & Vindum, 2006	Irawaddy Crested Lizard	LC	AS, ML, MI, MA	Das et al. (2009), Chandramouli et al. (2021), Malsawmdawngliana et al. (2022), Lalrinchhana & Solanki (2015), Tariang et al. (2022), Decemson et al. (2023)
49	Agamidae	<i>Calotes jerdoni</i> Günther, 1870	Jerdon's Forest Lizard	LC	AR, AS, NA, SI, MI	Sinha et al. (2021), Purkayastha (2013), Das et al. (2009), Sengupta et al. (2019), Jha & Thapa (2002), Chettri et al. (2009), Ahmed et al. (2009), Harit (2018)
50	Agamidae	<i>Calotes maria</i> Gray, 1845	Khasi Hills Forest Lizard	LC	ML, AS, NA, MI	Chandramouli et al. (2021), Mahananda et al. (2023), Ahmed et al. (2009), Lalremsanga et al. (2010), Purkayastha (2013)
51	Agamidae	<i>Calotes medogensis</i> Zhao & Li, 1984	Medog Bloodsucker	LC	AR	Boruah et al. (2022)
52	Agamidae	<i>Calotes paulus</i> Smith, 1935	Small Forest Lizard	EN	ML	Ahmed et al. (2009), Giri et al. (2019),
53	Agamidae	<i>Calotes sinyik</i> Patel, Thackeray, Sheth, Khandekar & Agarwal, 2024	Subansiri Dragon Lizard	NE	AR	Patel et al. (2024)
54	Agamidae	<i>Calotes zolaiking</i> Giri, Chaitanya, Mahony, Lalronunga, Lalrinchhana, Das, Sarkar, Karanth & Deepak, 2019	Mizoram Montane Forest Lizard	DD	MI, ML	Giri et al. (2019), Bohra et al. (2025)
55	Agamidae	<i>Cristidorsa otaï</i> (Mahony, 2009)	Ota's Mountain Lizard	DD	MI	Mahony (2009)
56	Agamidae	<i>Cristidorsa planidorsata</i> (Jerdon, 1870)	Smooth Scaled Mountain Lizard	LC	AS, ML, MI, TR	Das et al. (2009), Sengupta et al. (2019), Chandramouli et al. (2021), Mahananda et al. (2023), Malsawmdawngliana et al. (2022), Lalrinchhana & Solanki (2015), Purkayastha et al. (2020b), Ahmed et al. (2009), Purkayastha (2013)
57	Agamidae	<i>Draco blanfordii</i> Boulenger, 1885	Blanford's Flying Lizard	LC	MI	Lalrinchhana & Solanki (2015), Jha & Thapa (2002), Ahmed et al. (2009)
58	Agamidae	<i>Draco maculatus</i> (Gray, 1845)	Spotted Flying Dragon	LC	AS	Mahananda et al. (2023), Lalrinchhana & Solanki (2015), Ahmed et al. (2009), Purkayastha (2013)
59	Agamidae	<i>Draco norvillii</i> Alcock, 1895	Norvill's Flying Lizard	NT	AS	Islam & Saikia (2013), Purkayastha (2013)
60	Agamidae	<i>Japalura andersoniana</i> Annandale, 1905	Anderson's Mountain Lizard	LC	AR	Agarwal et al. (2010), Ahmed et al. (2009)
61	Agamidae	<i>Japalura austeniana</i> (Annandale, 1908)	Abor Hills Agama	LC	AR	Agarwal et al. (2010), Ahmed et al. (2009), Mirza et al. (2024), Gowande et al. (2021), Das & Das (2007)
62	Agamidae	<i>Japalura mictophola</i> Mirza, Gowande, Thackeray, Bhosale, Sawant, Phansalkar & Patel, 2024	Mix-scaled Mountain Lizard	NE	AR	Mirza et al. (2024)
63	Agamidae	<i>Japalura sagittifera</i> Smith, 1940	Burmese Japalura	DD	AR	Kunte & Manthey (2009)
64	Agamidae	<i>Japalura tricarinata</i> (Blyth, 1853)	Three-keeled Mountain Lizard	LC	SI	Jha & Thapa (2002), Chettri et al. (2009)
65	Agamidae	<i>Japalura variegata</i> Gray, 1853	Variegated Mountain Lizard	LC	AR	Agarwal et al. (2010), Jha & Thapa (2002), Chettri et al. (2009), Ahmed et al. (2009)
66	Agamidae	<i>Ptyctolaemus gularis</i> Peters, 1864	Green Fan-throated Lizard	LC	AS, ML, MI, NA, TR	Purkayastha et al. (2020b), Purkayastha et al. (2011), Islam & Saikia (2013), Purkayastha (2018), Chandramouli et al. (2021), Mahananda et al. (2023), Malsawmdawngliana et al. (2022), Lalrinchhana & Solanki (2015), Purkayastha et al. (2020b), Ahmed et al. (2009), Harit (2018), Purkayastha (2013)

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67	Lacertidae	<i>Takydromus haughtonianus</i> Jerdon, 1870	Goalpara Grass Lizard	DD	AS	Ahmed et al. (2009), Purkayastha (2013)
68	Lacertidae	<i>Takydromus khasiensis</i> Boulenger, 1917	Java Grass Lizard	LC	AS, ML	Das et al. (2009), Islam & Saikia (2013), Chandramouli et al. (2021), Mahananda et al. (2023), Ahmed et al. (2009), Purkayastha (2013)
69	Lacertidae	<i>Takydromus sexlineatus</i> Daudin, 1802	Asian Grass Lizard	LC	MI, SI	Lalrinchhana & Solanki (2015), Chettri et al. (2009), Ahmed et al. (2009)
70	Lacertidae	<i>Takydromus sikkimensis</i> Günther, 1888	Sikkim Grass Lizard	EN	SI	Bhupathy et al. (2009)
71	Scincidae	<i>Ablepharus sikkimensis</i> (Blyth, 1854)	Sikkim Ground Skink	LC	AR, SI	Agarwal et al. (2010), Jha & Thapa (2002), Chettri et al. (2009), Ahmed et al. (2009)
72	Scincidae	<i>Eutropis carinata</i> (Schneider, 1801)	Keeled Indian Mabuaya	LC	SI, AS	Jha & Thapa (2002), Ahmed et al. (2009), Purkayastha (2013)
73	Scincidae	<i>Eutropis cf. trivitta</i> (Hardwicke & Gray, 1827)	Striped Grass Skink	LC	AR	Agarwal et al. (2010), Ahmed et al. (2009)
74	Scincidae	<i>Eutropis macularia</i> (Blyth, 1853)	Bronze Grass Skink	LC	AS, ML, MI, NA, TR	Das et al. (2009), Purkayastha et al. (2020c), Purkayastha et al. (2011), Sengupta et al. (2019), Islam & Saikia (2013), Purkayastha (2018), Chandramouli et al. (2021), Mahananda et al. (2023), Lalrinchhana & Solanki (2015), Purkayastha et al. (2020b), Majumder et al. (2012), Ahmed et al. (2009), Purkayastha (2013)
75	Scincidae	<i>Eutropis multifasciata</i> (Kuhl, 1820)	Many-lined Sun Skink	LC	AR, AS, ML, MI, TR	Sinha et al. (2021), Das et al. (2009), Purkayastha et al. (2020b), Purkayastha et al. (2011), Sengupta et al. (2019), Islam & Saikia (2013), Purkayastha (2018), Chandramouli et al. (2021), Mahananda et al. (2023), Lalrinchhana & Solanki (2015), Purkayastha et al. (2020b), Majumder et al. (2012), Ahmed et al. (2009), Das et al. (2007), Purkayastha (2013)
76	Scincidae	<i>Eutropis quadricarinata</i> (Boulenger, 1887)	Beautiful Mabuaya	LC	AS	Das et al. (2009), Ahmed et al. (2009), Purkayastha (2013)
77	Scincidae	<i>Problepharus apatani</i> Mirza, Bragin, Bhosale, Gowande, Patel & Poyarkov, 2022	East-Himalayan Skink	NE	AR	Mirza et al. (2022a)
78	Scincidae	<i>Riopa albopunctata</i> Gray, 1846	White-spotted Supple Skink	LC	AS, TR	Purkayastha et al. (2020c), Purkayastha et al. (2011), Islam & Saikia (2013), Purkayastha (2018), Mahananda et al. (2023), Purkayastha et al. (2020b), Ahmed et al. (2009), Purkayastha (2013)
79	Scincidae	<i>Sphenomorphus apalpebratus</i> Datta-Roy, Das, Bauer, Lyngdoh-Tron & Karanth, 2013	Spectacled Forest Skink	NT	ML	Datta-Roy et al. (2013)
80	Scincidae	<i>Sphenomorphus courcyanus</i> (Annandale, 1912)	Medog Skink	LC	AR	Ahmed et al. (2009), Uetz et al. 2025
81	Scincidae	<i>Sphenomorphus indicus</i> (Gray, 1853)	Indian Forest Skink	LC	AR, ML, SI, MI, AS	Agarwal et al. (2010), Islam & Saikia (2013), Chandramouli et al. (2021), Lalrinchhana & Solanki (2015), Jha & Thapa (2002), Chettri et al. (2009), Ahmed et al. (2009), Harit (2018), Purkayastha (2013)
82	Scincidae	<i>Sphenomorphus maculatus</i> (Blyth, 1853)	Spotted Forest Skink	LC	AR, ML, MI, SI, TR, AS	Das et al. (2009), Purkayastha et al. (2011), Sengupta et al. (2019), Islam & Saikia (2013), Purkayastha (2018), Chandramouli et al. (2021), Mahananda et al. (2023), Malsawmdawngliana et al. (2022), Lalrinchhana & Solanki (2015), Jha & Thapa (2002), Chettri et al. (2009), Purkayastha et al. (2020b), Majumder et al. (2012), Ahmed et al. (2009), Harit (2018), Purkayastha (2013)
83	Scincidae	<i>Tropidophorus assamensis</i> Annandale, 1912	Northeastern Water Skink	VU	AS, MI	Das et al. (2009), Lalrinchhana & Solanki (2015), Ahmed et al. (2009), Lalremsanga et al. (2022a), Purkayastha (2013)
84	Anguidae	<i>Dopasia gracilis</i> (Gray, 1845)	Assam Glass Lizard	LC	NA, SI, MI	Jha & Thapa (2002), Ahmed et al. (2009), Lalremsanga et al. (2010), Purkayastha (2013)

(2024) described *Japalura mictophola*, a montane-dwelling agamid from Arunachal Pradesh. Patel et al. (2024) described *Calotes sinyik* from the Subansiri River basin of Arunachal Pradesh, based on morphology and mitochondrial ND2 gene. Sayyed et al. (2025) described *Cnemaspis brahmaputra* from the northern bank of the Brahmaputra River, based on morphology and ND2 gene analysis. The species was recovered as the sister taxon to *C. assamensis* and together they were designated as the *C. assamensis* group within the *podihuna* clade.

Range extensions

Most studies on range extensions were based solely on classical taxonomy. Das & Ahmed (2007) reported *Cnemaspis assamensis* from the Ghorakhati Range of Kaziranga National Park, Assam thereby extending its known distribution about 200 km east of the type locality in Mayeng Reserve Forest, Kamrup District, Assam. As new state records, Das et al. (2009) documented *Tropidophorus assamensis* from the Barail Wildlife Sanctuary, Assam. Lalremsanga et al. (2010) recorded three species of lizards from Mizoram, namely, *Calotes maria* from Lengtung Wildlife Sanctuary, Champhai District; *Calotes mystaceus* (now regarded as a misidentification of *Calotes geissleri*) from Zotlang, Lunglei District; and *Ophisaurus gracilis* (now *Dopasia gracilis*) from Aizawl city. Das et al. (2011a) reported the occurrence of an invasive species of gecko, namely *Hemidactylus flaviviridis*, from Guwahati City of Assam, with remarks on its urbanized distribution. Majumder & Agarwala (2015) reported the agamid lizard *Calotes emma* from Tripura. Deepak et al. (2022) documented a specimen of *Hemiphyllodactylus* (Bleeker, 1860) from Namdapha Tiger Reserve, Changlang District, Arunachal Pradesh, representing the first record of the genus from eastern Himalaya and the Indian Himalayan region, but refrained from designating any species-specific identity to the specimen. Mirza et al. (2021) described *Cyrtodactylus arunachalensis* from Arunachal Pradesh, which was later synonymized with *C. cayuensis* by Boruah et al. (2024), thereby extending the species' range, previously known only from Xizang, China.

Only a limited number of studies have integrated molecular approaches with classical taxonomy to assess lizard distributions. Muansanga et al. (2020) recorded *Cyrtodactylus montanus* from Dampa Tiger Reserve, Mizoram. Purkayastha et al. (2020d) confirmed the occurrence of *Cyrtodactylus urbanus* from Meghalaya. Decemson et al. (2021) reported *Calotes geissleri* from the Chandel District, Manipur, which was formerly regarded as *Calotes mystaceus* but has since been

restricted to Myanmar (Wagner et al. 2021). Tariang et al. (2022) confirmed the presence of *Calotes irawadi* in Mizoram, which had earlier been misidentified as *Calotes versicolor*. Boruah et al. (2022) documented *Calotes medogensis* from Arunachal Pradesh, a species long confused with *Calotes jerdoni* due to the absence of clear morphological and molecular diagnostic data. Decemson et al. (2023) confirmed the occurrence of *Calotes irawadi* from Churachandpur District, Manipur, using both morphological and molecular evidence. More recently, Bohra et al. (2025) reported *Calotes zolaiking* from Cherrapunji, Meghalaya, marking the first record of this species outside its type locality at Durtlang, Aizawl District, Mizoram.

Diversity studies

Several studies on lizard diversity have been carried out in northeastern India over the past two decades. Books such as Jha & Thapa (2002), Ahmed et al. (2009), and Purkayastha (2013) provided comprehensive accounts of the saurian fauna of Sikkim, northeastern India, and Assam respectively. Additional diversity assessments have been conducted across different states of the region, including Assam (Das et al. 2009; Purkayastha et al. 2011; Islam & Saikia 2013; Purkayastha 2018, 2020c; Sengupta et al. 2019; Mahananda et al. 2023), Sikkim (Chettri et al. 2009), Arunachal Pradesh (Agarwal et al. 2010; Sinha et al. 2021), Tripura (Majumder et al. 2012; Purkayastha et al. 2020b), Mizoram (Lalrinchhana & Solanki 2015; Malsawmdawngliana et al. 2022; Gouda et al. 2024; Solanki & Parida 2024), and Meghalaya (Chandramouli et al. 2021).

Revisions

Several important taxonomic revisions have been conducted across different states of northeastern India. Purkayastha et al. (2010) reported *Hemidactylus aquilonius* from Assam, a member of the *H. bowringii* complex, and recommended replacing *H. bowringii* sensu stricto with *H. aquilonius* for the Indian subcontinent. They also restricted the distribution of *H. bowringii* sensu stricto to southern China and its adjacent regions. From Arunachal Pradesh, Gowande et al. (2021) conducted a detailed revision of *Pseudocalotes austeniana*, using molecular phylogenetic data derived from mitochondrial and nuclear genes. Their analysis revealed that the genus *Pseudocalotes* is polyphyletic and comprises two distinct clades. *Pseudocalotes austeniana* was not nested within either clade but instead formed a sister lineage to the genus *Japalura* sensu stricto. Accordingly, the species was transferred to *Japalura austeniana*.

Sengupta et al. (2021) re-diagnosed *Cnemaspis assamensis* based on the original type series and newly collected specimens from Guwahati, Assam. They also provided the first molecular data for the species and confirmed the presence of precloaco-femoral pores, which had been reported as absent in the original description. Boruah et al. (2022) designated a lectotype for *Calotes jerdoni* to ensure taxonomic stability and presented an expanded morphological description of the species. Lalremsanga et al. (2022a) published a comprehensive study on *Tropidophorus assamensis* from Mizoram, updating its morphological data, adding distributional notes, and providing molecular data for the first time, thereby clarifying the phylogenetic position of *T. assamensis* among its congeners.

Rediscoveries

Several notable rediscoveries have been made in northeastern India in recent decades. Das & Das (2007) reported *Japalura austeniana* from West Kameng District, Arunachal Pradesh, nearly a century after its original description by Annandale (1908) from the type locality. Bhupathy et al. (2009) rediscovered *Takydromus sikkimensis* from the lower Teesta Valley, Sikkim, and designated a neotype to resolve uncertainties regarding the identity and existence of the species. Kunte & Manthey (2009) reported *Japalura sagittifera* from the tropical forests of Mehao Wildlife Sanctuary, Arunachal Pradesh, nearly 68 years after its last documented record. Originally described from northern Myanmar, this finding confirmed a significant range extension for the species into India. Islam & Saikia (2013) rediscovered *Draco norvillii* in Jeypore Reserve Forest, Assam, more than a century after its last known record from the state.

Miscellaneous

Das et al. (2007) reported reptilian mortality along the highway bordering the southern boundary of Kaziranga National Park, Assam. Das et al. (2011b) investigated the oral microflora of *Hemidactylus frenatus* and *H. aquilonius* from Guwahati, Assam, and documented the presence of Gram-positive *Staphylococcus* strains known to cause skin infections in mammals, although not fatal. Harit (2018) provided a preliminary report on reptile road mortality in Champhai District, Mizoram, and along the Indo-Myanmar border caused by vehicular traffic. Choudhary & Choudhary (2019) documented the persecution of monitor lizards in Barak Valley, Assam. Ranade & Purkayastha (2020) reported cannibalistic behaviour in *Hemidactylus aquilonius* based on observations from Rani, Assam. Ulman & Singh (2021)

surveyed the population density, habitat preferences, and public perception of *Gekko gecko* in Nameri Tiger Reserve, Assam. Rai et al. (2023) provided insights into the sexual dimorphism and reproductive biology of *Takydromus sikkimensis*, highlighting female-biased size differences, seasonal male coloration, and a single annual breeding cycle with small clutch sizes. Thaosen et al. (2024) reported functional males in *Hemidactylus garnotii* from Mizoram, based on histological, and gonadal examinations, in a species previously considered to be entirely parthenogenetic.

DISCUSSION

Although northeastern India has witnessed a recent surge in saurian studies, research efforts remain unevenly distributed across the states. In contrast to states like Assam and Mizoram, where substantial work has been undertaken, states such as Nagaland and Manipur remain largely unexplored. These regions likely harbour undocumented taxa that may be revealed through systematic field surveys, thereby contributing to improved taxonomy, and conservation of regional herpetofauna.

Instances of misidentification were also noted among the reviewed literature. A prominent example concerns *Cyrtodactylus khasiensis*, the distribution of which was restricted to the Khasi Hills of Meghalaya by Agarwal et al. (2018a). This necessitates taxonomic revalidation of *C. khasiensis* records from Arunachal Pradesh (Agarwal et al. 2010), Nagaland (Bhupathy et al. 2013), Sikkim (Chettri et al. 2009), Tripura (Majumder et al. 2012), and Assam (Das et al. 2009; Agarwal et al. 2010; Purkayastha et al. 2011, 2020c; Islam & Saikia 2013). Similarly, Lalrinchhana & Solanki (2015) reported *Hemidactylus brookii* and *Sphenomorphus maculatus* from Dampa Tiger Reserve, Mizoram (see Figures 12 & 17 in Lalrinchhana & Solanki 2015), which appear to be conspecific with *Hemidactylus frenatus* and *Eutropis* sp., respectively. Furthermore, several checklists of saurian diversity from northeastern India such as Jha & Thapa (2002), Chettri et al. (2009), Ahmed et al. (2009), Agarwal et al. (2010), Majumder et al. (2012), and Purkayastha (2013), require updating as a number of the saurian species listed therein have since undergone taxonomic revisions. To address this, the present study provides an updated checklist of lizards from northeastern India (Table 1).

In conclusion, northeastern India holds immense potential for the discovery of many new cryptic lizard

species that remain undocumented. This potential can be realized through extensive field surveys across poorly explored regions, supported by advanced statistical approaches for ecological, and morphological analyses. Furthermore, the integration of both mitochondrial, and nuclear markers in phylogenetic frameworks will be essential for resolving species complexes, and accurately documenting the region's true saurian diversity.

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