



STATUS SURVEY OF INDIAN GOLDEN GECKO, *CALODACTYLODES AUREUS* (BEDDOME, 1870) IN EASTERN GHATS, INDIA

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INTRODUCTION

The Eastern Ghats are isolated hill ranges spreading across states of Andhra Pradesh, Odisha, Tamil Nadu and Karnataka in Peninsular India and covers an area of about 1750 km. It lies in 11° 30' to 21° 0' N Latitudes and 77° 22' to 85° 20' E Longitudes. It is included under 6°C eastern highlands of the Deccan plateau and one of the biologically richest biogeographic zones of India (Rodgers *et al.*, 2008).

Golden Geckos are distributed throughout the world and belong to the family Gekkonidae under the Genus *Calodactylodes*. The Genus *Calodactylodes* consists of two species namely, Indian Golden Gecko, *Calodactylodes aureus* (Beddome, 1870) and Sri Lankan Golden Gecko, *Calodactylodes Illingworthorum* (Deraniyagala, 1953). The Indian Golden Gecko was discovered by Beddome, 1870 and Boulenger, 1890 and it was rediscovered after 115 years in Tirupati Hills, Chittoor District, Andhra Pradesh by Daniel and Bhusan (1985).

The Indian Golden Gecko is a protected species and included under Schedule I (part-II) of IWPA, 1972 and had long been considered rare and poorly studied. The Golden Gecko inhabits rocky area with deep stream valleys and has been found to occur at an elevations between 50 to 1000 meters. Present study reports current status along with its conservation, ecology, threats and recent distribution patterns in Eastern Ghats. The study was designed to throw light on (i) present status and population of Indian Golden Gecko and (ii) recent threat and distribution of Indian Golden Gecko in Eastern Ghats.

TAXONOMY

Systematic position of Indian Golden Gecko

Phylum CHORDATA

Sub Phylum VERTEBRATA

Class REPTILIA

Order SQUAMATA

Sub order SAURIA

Family GEKKONIDAE

Genus *Calodactylodes*

Species *Calodactylodes aureus*
(Beddome, 1870)

Common Name: Indian Golden Gecko

Field Notes: It has pronounced yellowish or dark brown colour with large oviform head distinct from neck and a strong, rounded supraorbital and canthal ridge. Limbs are long and slender. Head covered with small granules. Digits are slender and clawed. Tail is long cylindrical and slender covered with squarish scales.

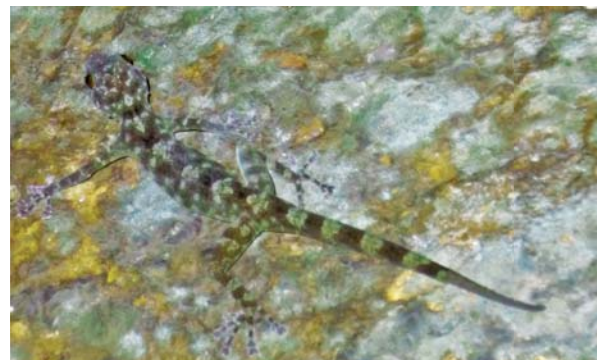


Fig. 1. Adult Golden Gecko on rock at Maredumilli, East Godavari

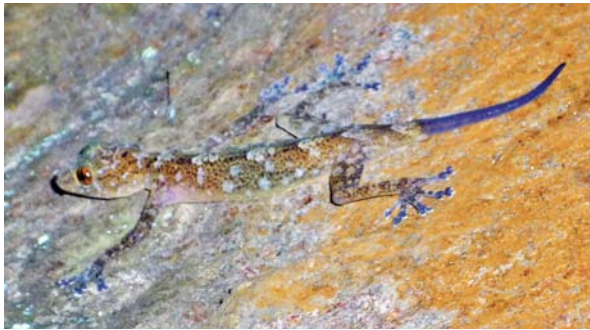
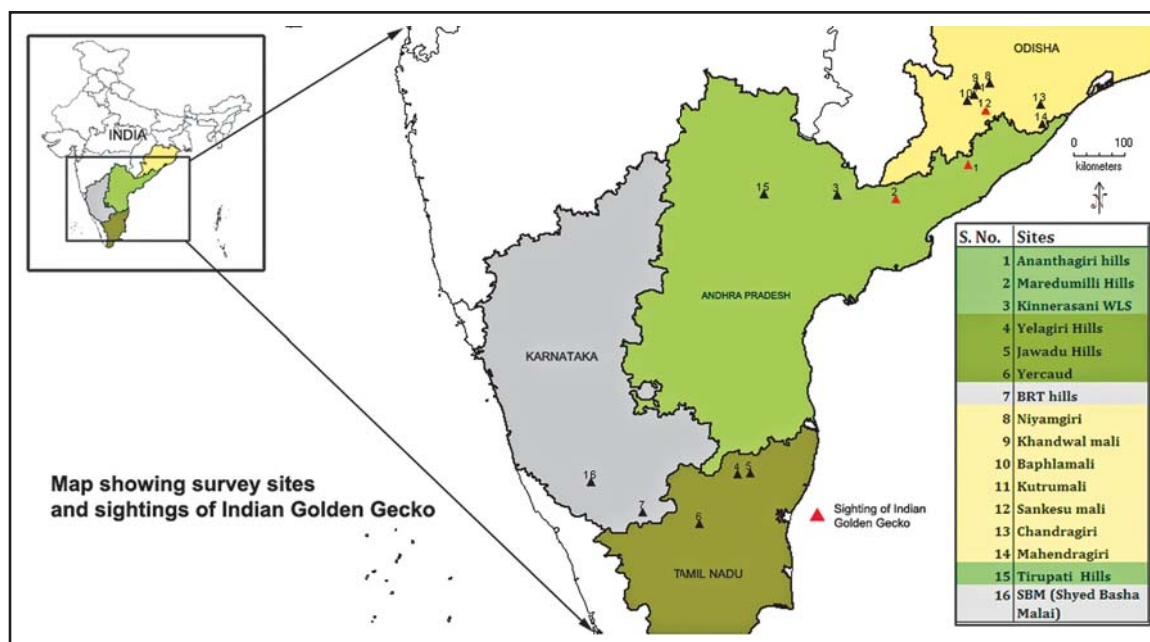


Fig. 2. Adult Golden Gecko on rock of Sankesumali Rayagada

Known distribution: The Golden Gecko *Calodactylodes aureus* were recorded from Tirupati hills, Chittoor District, (Daniel *et al.*, 1986); in Araku valley (Chettri & Bhupathy, 2010) recently from Sheshachalam and Velikonda ranges (Guptha *et al.*, 2012) and also reported from Perantalapally (Papikonda hills) in Khammam District (Javed *et al.*, 2007), Maredumill hills in Rajamundry District, Ananthagiri hill in Vishakhapatnam District, Andhra Pradesh (Sreekar *et al.*, 2010); It has been reported and photographed from Castle rock, Karnataka; Balamadi hill, Vellore and Vellore hill fort, North Arcot District, Tamil Nadu; Valli Malai and Sathgar hill in Vellore District, Shyed Basha Malai in Krishangiri district from Tamil Nadu

(Kalaimani & Nath, 2012). Niyamgiri hill ranges of Rayagada, Kalahandi District of Odhisha (Dutta *et al.*, 2005).

Study areas: The study was carried out in Eastern Ghats spread over four states and survey carried out at different localities which are as follows; 1. Andhra Pradesh: Ananthagiri hills, Visakhapatnam District ($18^{\circ} 14' N$ & $82^{\circ} 50' E$, elevation above 1000 meters), Maredumill hills, Rajamundry District ($17^{\circ} 56' N$ & $82^{\circ} 23' E$, elevation 900 meters) and Kinnerasani Wildlife sanctuary, Khammam District ($17^{\circ} 40' N$ & $80^{\circ} 39' E$); 2. Tamil Nadu: Yelagiri hills ($17^{\circ} 40' N$ & $80^{\circ} 53' E$) and Jawadu hills, Vellore District ($12^{\circ} 42' N$ & $70^{\circ} 06' E$), Yercaud hills, Salem District ($11^{\circ} 44' N$ & $78^{\circ} 12' E$); 3. Karnataka: Biligiri Rangaswamy hills, Chamarajanagara District ($11^{\circ} 59' N$ & $77^{\circ} 8' E$); 4. Odisha : Niyamgiri Hills ($19^{\circ} 33' N$ & $83^{\circ} 25' E$), Khandwalmali Hills ($19^{\circ} 29' N$ & $83^{\circ} 10' E$) and Karlapat from Kalahandi District; Baphlamali Hills ($19^{\circ} 18' N$ & $82^{\circ} 56' E$), Kutrumali Hills ($19^{\circ} 28' N$ & $83^{\circ} 06' E$) and Sankesumali ($19^{\circ} 11' N$ & $83^{\circ} 18' E$) from Rayagada District; Chandragiri Hills ($19^{\circ} 17' N$ & $84^{\circ} 17' E$) and Mahendragiri Hills ($18^{\circ} 58' N$ & $84^{\circ} 24' E$) from Gajapati District; 5. Tirupati Hills ($13^{\circ} 42' N$ $79^{\circ} 21' E$), Chittoor



Map 1. Map showing the study areas and sighting localities of Indian Golden gecko

District from Andhra Pradesh and Shyed Basha Malai (12° 32' 44.5" N and 78° 12' E), Krishnagiri District from Tamil Nadu.

TOPOGRAPHY AND CLIMATE OF THE STUDY AREAS

(i) Anantagiri Hills

Nature of Terrain: It comprises of undulating hilly terrain.

Elevation: 1000 meters.

Climate: Ananthagiri Hills enjoy mild and moderate climate throughout the year.

Temperature: The temperatures rarely cross 32° C and are never below 7° C.

Rainfall range: The hill receives approximately 900-1700 mm rainfall.

Type of Vegetation: The vegetation is of mixed deciduous forest with orchids and ferns as undergrowth. The forests are of secondary types due to shifting cultivation and comprises of rocks and streams.

(ii) Maredumilli Hills

Nature of Terrain: It comprises of undulating hilly terrain

Elevation: 900 meters

Climate: It is hot during summer and temperature varies between 34-44° C.

Temperature: Average ranges between 23.5-43° C

Rainfall range: Average rainfall is 100-140 cm

Type of Vegetation: The vegetation are characterised by dry deciduous with patches of moist deciduous forests intermingled with scrub.

(iii) Kinnersani Wildlife Sanctuary

Elevation: It has an elevation of 12-600 meters

Climate: It is cool, fresh and pleasant and typical Indian climatic condition where summer is dry and hot, temperature rose 50° C and in

monsoon little rain, winter is cold and temperature averages from 28–34° C.



Habitat: Tropical moist deciduous and semievergreen Forest

Temperature: The temperature ranges from 10-49° C

Rainfall range: Average rainfall is 1334 mm.

Type of Vegetation: It is of tropical dry deciduous, tropical moist deciduous, tropical semi evergreen, dry teak, and tropical thorn forest types.

(iv) Yelagiri Hills

Nature of Terrain: It comprises of hilly terrain

Elevation: It is located at an elevation of 1050 meters above the sea level.

Climate: The weather consists of summer, South East monsoon, North West monsoon and winter. Summer begins from March and it is very hot. Winter is very cool and relatively warmer. The weather remains moderate and pleasant throughout the year.

Temperature: The temperature varies between maximum of 30° C and minimum is 18° C.

Rainfall range: It receives annual rainfall of 800-900 mm.

Type of vegetation: The vegetation is herbs, shrubs and trees and many ethnobotanical plants were also noticed.

(v) Jawadu Hills

Nature of Terrain: It comprises of hilly terrain

Elevation: 1100-1150 meters

Climate: Subtropical

Temperature: 17^o to 36.5^o C

Rainfall range: The average rainfall is 1100 mm

Type of Vegetation: The hill consists of dense forest.

(vi) Yercaud Hills

Nature of Terrain: It comprises of hilly terrain.

Elevation: It is located at an altitude of 1,515 metres above sea level.

Climate: The climate is moderate and pleasant, winters are fairly mild, starting in September and ending in December. During winter, the hills are covered in mist.

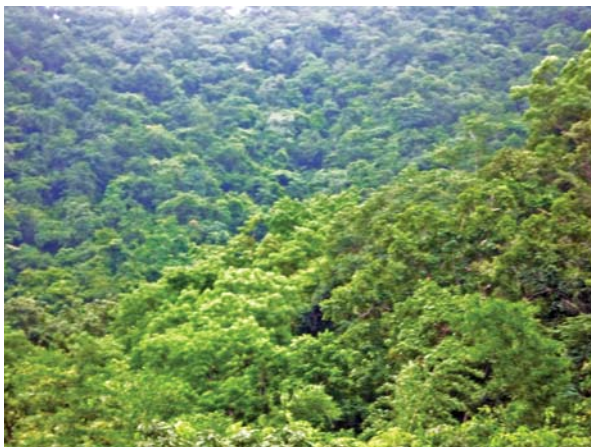
Temperature: The temperature ranges from 15^o C to 30^o C throughout the year.

Rainfall range: Rainfall is 1500–2000 mm.

Type of Vegetation: The Shevaroy range is covered with green grasses and has not any considerable growth of forests. In addition, coffee and citrus fruits, most notably oranges, are grown in abundance apart from bananas, pears and jackfruit in the hill.

(vii) Biligiri Rangaswamy Temple Hills

Nature of Terrain: It comprises hilly and rocky terrain



Habitat: Evergreen deciduous Forest

Elevation: 1400-1800 meters

Climate: There is a wide range of climatic condition

Temperature: 9 to 16^o C and 20 to 38^o C

Rainfall range: average rainfall is 600-3000 mm

Type of Vegetation: The Hills has evergreen, deciduous, dry and scrub and even high-altitude vegetation.

(viii) Niyamgiri Hills

Nature of Terrain: It forms a distinct phyto-geographical zone because of its height and its highly precipitous topography.

Elevation: It runs in a southwest alignment with a maximum elevation of 1306 meters.

Climate: It is pleasant and tropical climate

Temperature: 15-45^o C

Rainfall range: 115-145 cm

Type of Vegetation: It also has most pristine forests and tropical deciduous type.

(ix) Khandualmali Hills

Nature of Terrain: It comprises of mountain, hilly interspersed with rivers and valleys.

Elevation: It is lying at an elevation of 2310 meters above sea level.

Climate: It consist of all five season namely summer, rainy, autumn, winter and spring summer is hot and dry.

Temperature: 15-45^o C

Rainfall range: 115-145 cm.

Type of Vegetation: It is one of a wealthy reservoir of natural resources like bauxite. The hill comprises of tropical deciduous forests, there is occurrence of semi evergreen, moist deciduous, moist peninsular, sal type and grasslands in different parts of the hill.

(x) Baphlamali Hills

Nature of Terrain: It comprises of rocky terrain.

Elevation: It has highest peak of 1056 meters.

Climate: The relative humidity is normally high during the monsoon and post-monsoon months sometimes being more than 85% which favours growth of bryophytes in the hills.

Temperature: the maximum temperature goes up to 42° C and the minimum drops to 5° C.

Rainfall range: The average annual rainfall is 1485 mm.

Type of Vegetation: It is one of the rich bauxite deposit areas in the Eastern Ghats of India. It is basically of tropical moist deciduous type with many riparian evergreen elements, patchy bamboo thickets and shrub.

(xi) Kutrumali Hills

Nature of Terrain: It comprises of rocky terrain

Elevation: It has an elevation of 850 meters.

Climate: It is humid and pleasant.

Temperature: It ranges from 42-5° C

Rainfall range: The average rainfall is 1440 mm

Type of Vegetation: Kutrumali consists of tropical moist deciduous type of plants. There is occurrence of semi-evergreen moist deciduous, moist peninsular sal type of grasslands at different parts of the hill

(xii) Sankesumali/Hills

Nature of Terrain: It is a hilly range abounds with meandering waterfalls.

Elevation: It lies at an elevation of 400-600 meters

Climate: The climate in the area is extreme in summer and reaches 36° C and in winter dropping to 13° C with ample rainfall during monsoon.

Temperature: 13-36° C

Rainfall range: Ample rainfall

Type of Vegetation: The forest is deciduous type.

(xiii) Chandragiri Hills

Nature of Terrain: It comprises of hilly terrain

Elevation: 1350 meters.

Climate: It is moderate and pleasant

Temperature: 16-45° C

Rainfall range: 1403.30 mm

Type of Vegetation: The hill comprises of tropical deciduous type of vegetation with moist peninsular sal and dry deciduous forest type.

(xiv) Mahendragiri Hills

Nature of Terrain: It comprises of hilly terrain with undulating topography

Elevation: The hill had elevation of 1500 meters above mean sea level.

Climate: It is moderate and pleasant.

Temperature: 16-45° C

Rainfall range: The annual rain fall is 1551.6 mm.

Type of Vegetation: The hill comprises of grasses, charanockites and khondalites. The forest comprises of tropical moist deciduous and tropical dry deciduous type and the vegetation can be classified broadly into four types-Sal, mixed deciduous, grasslands and scrub forests.

(xv) Tirupati Hills

Nature of Terrain: It comprises of undulating with terrain covered valleys.

Elevation: It varies from 150 -1130 meters.

Climate: The rain fall received from northeast monsoon and southwest monsoon.

Temperature: It varies from 12° to 44° C.

Rainfall range: The average rainfall is 900 mm

Type of Vegetation: Vegetation is of mixed dry deciduous and moist deciduous types.

(xvi) Shyed Basha Hills

Nature of Terrain: It comprises of rocky terrain

Elevation: It has elevation of 700-1200 meters

Climate: It experiences tropical climate during the summer and is generally warm and dry. Monsoon season brings substantial amount of rainfall and experiences a long monsoon. Winters are generally pleasant and comfortable. There are three distinct seasons that can be seen in the region.

Temperature: The temperature ranges from 38° C to 28° C

Rainfall range: the average rainfall ranges from 55-150 mm

Type of Vegetation: Vegetation consist of grasses, small scrub and trees

STUDY PERIOD

First survey was undertaken to Ananthagiri hills, Vishakhapatnam District; Maredumilli hills, Rajamundry District and Kinnerasani Wildlife Sanctuary, Khammam District from Andhra Pradesh for the period from 16.9.2011 to 5.10.2011 (20 days); second survey was undertaken to Yercaud hills, Salem District; Yelagiri hills and Jawadu hills, Vellore District from Tamil Nadu and Biligiri Rangaswamy hills, Chamarajanagara District from Karnataka for the period from 13.8.2012 to 1.9.2012 (20 days); third survey was undertaken to Niyamgiri and Khandwalmali hills, Kalahandi District, Baphlamalai, Kutrumali hills and Sankesumali, Rayagada District and Chandragiri and Mahendragiri hills, Gajapati District from Odisha for the period from 12.7.2012 to 03.08.2012 (22 days) and fourth survey was undertaken to Tirupati hills, Chittoor District from Andhra Pradesh and Shyed Basha Malai, Krishnagiri District from Tamil Nadu for the period from 18.11. 2013 to 09.12. 2013 (22 days).

METHODOLOGY

The study is an outcome of four surveys carried out in different localities of Eastern Ghats for the period from 2011 to 2013 (three years). Each survey comprises of twenty days each in the field with a team of four personnel. The study was carried out using visual encounter survey method

where transects of 1000 meter length were laid randomly in and around covering different habitats. The areas with different habitats like rocky crevices, rock boulders, water bodies with rocky surfaces, scrub jungle, dense forest, open forest, high elevated area with rocky habit, etc were covered during the survey.

The data collected during day time was confined to number of individuals, number of un-hatched eggs, number of egg deposition sites, nearest habitats, other species in the same habitat etc. The geckos were photographed using a Panasonic Lumix DMC-FZ 10 Digital camera, geographical coordinates and altitude were also recorded using GPS-16

ECOLOGY AND BEHAVIOUR

Habit and Habitat: It is diurnal, active during day and night. It inhabits rocky crevices, rock boulders, it prefers rocky area with deep stream valleys and high elevated rocky hills.

Food and feeding Habit: Indian Golden Gecko feeds on insects such as crickets, mealworms and wax worms.

Distribution: India: *Calodactylodes aureus* recorded from southern Andhra Pradesh, from Sheshachalam and Velikonda ranges; Vellore region of North Arcot District of Tamil Nadu, recently been reported and photographed from Castle rock, Karnataka and Niyamgiri Hills of Kalahandi and Rayagad District of Odisha.

Notable behaviour: During the survey it has been observed that the Indian Golden Gecko always skip from one rock to another and enters in between crevices of rocks to avoid the notice of the observer. It also prefers single rock/boulder at a high elevation.

RECENT OBSERVATIONS AND RESULTS

The survey was carried out in 16 localities under 11 Districts of four states namely Andhra Pradesh, Odisha, Tamil Nadu and Karnataka. Out of which four Districts from Andhra Pradesh, three Districts from Odisha, three Districts from Tamil Nadu and

one District from Karnataka respectively were surveyed from Eastern Ghats. The Golden Gecko was encountered in rocky caves and crevices of large boulders during day time and it was recorded at an elevation of 200-950 meters.

During the survey we encountered a total of 22 Golden Gecko in rocky caves and rock boulders. Out of these only four were bright golden yellow which were recorded at Sankesumali, Rayagada, Odisha and the rest were dark brown recorded from Ananthagiri and Maredumilli Hills of Andhra Pradesh. The highest number of Geckos were recorded from Ananthagiri Hills, Vishakhapatnam District, followed by Maredumilli Hills, Rajamundry District and Sankesumali, Rayagada District of Odisha. In addition we also recorded 42 egg deposition sites at different localities. The Geckos were found in both vertical and horizontal crevices in the rocks and caves. The Gecko always prefers undisturbed locality where there are less human activities. We encountered them on large rock builders, rocky caves and moist habitat where it always tries to skip from one rock to another and in between rocky caves.

The Golden Gecko is active and in good number nearby deep stream valleys and rocky area. It always runs/skips to hide in between the rocks. Sometimes it enters between the rocks and makes it difficult to locate its presence. The Gecko found to lay eggs attached on the vertical and horizontal roof of caves and rock boulders. During the survey we recorded 42 egg deposition sites at different localities.

In addition to Golden Gecko sympatric reptilian species were also observed commonly during the survey. Among these *Psammophilus dorsalis* were common at Yelagiri Hills, Jawaadu Hills, Yercaud hills BRT hills and Borighat and *Hemidactylus sp.* *Eutropis carinata*, *Sitana ponticeriana* and *Gecko gecko* were also encountered frequently during the survey.

The present study indicates presence of a small population of Golden Gecko in the study areas where we encountered the species from three localities out of 16 study areas. In this study we recorded 12 examples from Ananthagiri Hills, 6 from Maredumilli Hills, Andhra Pradesh and four examples from Sankesumali, Rayagada District of Odisha. For the first time we recorded four examples of Golden Gecko from Sankesumali. During the survey at Tirupati Hills, we had an opportunity to survey at Malwadigundam, it was also called as home of Golden Gecko as per the Biolab Scientist at Alipiri. The habitat seems very suitable for Gecko where large rock, caves, deep stream valley. However, we did not encounter single specimen of Golden Gecko during whole day survey. It indicates Golden Gecko appear to have shifted to safer habitat due to local disturbance.

The present study also shows that the distribution range of Indian Golden Gecko is larger than the previously known. This study adds a new locality for this species at Sankesumali, Rayagada District from Odisha. It also infers that the species may change the habitat or extending its distribution due to habitat loss and human habitation.

TABULATION OF OBSERVATIONS AND RESULTS

Table 1. Number of individual and locality where Indian Golden Gecko sighted during survey.

State/District	Locality	Status of area	No. of individual recorded	No. of egg attachment site sighted
Andhra Pradesh/ Vishakhapatnam	Ananthagiri hill	Forest/hill	12	22
Andhra Pradesh/ Rajamundry	Maredumilli hill	Forest/hill	06	14
Odisha/Rayagada	Sankesu mali	Forest /hill	04	12

Table 2. Showing the Description of sites where Indian Golden Gecko was encountered

Name of the Site	Habitat Type	No. of Individual	Latitude N	Longitude E	Altitude (in Meters)
Ananthagiri Hills	Natural Forest/ Hill/Rock	02	18° 13' 978''	68° 00' 375''	756
		03	18° 13' 493''	86° 00' 529''	894
		01	18°13' 970''	83° 00' 320''	826
		02	18°15' 503''	83° 00' 258''	890
		04	18° 14' 549''	83°01' 032''	724
Maredumilli Hills	Natural Forest / Hill /Rock	01	17° 36' 063''	81° 42' 300''	486
		02	17° 36' 064''	81° 42' 305''	426
		02	17 ° 36' 060''	81° 42' 300''	430
		01	17° 36' 068''	81° 42' 468''	434
Sankesumali Hill	Natural Forest/ Hill/Rock	02	19° 11' 179''	83° 18' 905''	248
		02	19° 11' 182''	84° 17' 305''	258

PRESENT STATUS OF INDIAN GOLDEN GECKO IN EASTERN GHATS

Indian Golden Gecko was discovered in the year 1870 by Beddome and it was rediscovered after 115 years by Daniel (1986). Later many studies have been conducted by researchers and reported new localities of the species. In the present study a viable but small population of Indian Golden Gecko were recorded from Ananthagiri Hills, Visakhapatnam District. Maredumilli Hills, East Godavari District also provided suitable habitat for the species and observed six examples in the areas. In addition, four examples of Indian Golden Gecko were recorded for the first time from Sankesu Mali, Rayagada District of Odisha.

The previous studies recorded a small population of Golden Gecko in South Odisha such as Karlapat, Niyamgiri and Mahendragiri. Two specimens of Indian Golden Gecko were recorded from the rock crevices found near Shova village in Araku valley (Chettri and Bhupathy, 2010), one specimens of Golden Gecko was recorded from Seshachalam Biosphere Reserve (Gupta *et*

al., 2012), and small population of Geckos were reported from Ananthagiri, Maredumilli and Peantalapally (Sreekar *et al.*, 2010). Studies by Kalaimani and Nath (2012, 2013) reported good breeding population of Golden Gecko from Tamil Nadu, Eastern Ghats.

PRESENT THREATS TO THE SPECIES IN EASTERN GHATS

The Indian Golden Gecko is under threat due to mining activities at Niyamgiri Hills of Odisha and Shyed Basha Malai, Krishnagiri District of Tamil Nadu, construction factories at Niyamgiri Hills namely Vedanta and fruit juice factory at Shyed Basham Malai. In Shyed Basha Malai, Krishnagiri District foothills are surrounded by human habitations, caves and rock boulders are polluted by continuous human activities. Ananthagiri Hills and Maredumilli Hills of Andhra Pradesh are also surrounded by human habitations and deforestation activities for cultivation. At Mahendragiri and Chandragiri hills, Gajapati District, Odisha foot hills are surrounded by human habitation and disturbances due to

human activity such as man-made fire, where we noticed burning of trees to remove forest and using lands for cultivation. At Baphlamali and Kutrumali Hills, Rayagada District major threat of the habitat is cattle grazing. At Tirupati Hills, Chittoor District, Andhra Pradesh disturbances are due to continuous influx of pilgrimage throughout the year. At Yelagiri hills, where cultivation of coffee and other commercial plantation resulted in loss of habitat. At Jawadu and Yercaud Hills we observed man made activities such a fire to remove forest and using land for agricultural purposes.

Previous studies by Rajashekhar and Nandakumar (2007) reported that rock boulders are being blasted for construction of roads and buildings near Vellore town in Tamil Nadu. Trade was considered to be the major threat to the Indian Golden Gecko (Molur and Walker, 1998), but we have not come across any such incidence during our survey in these areas. However, we come across the inhabitants at Niyamgiri Hills who told us that they were killing the Golden Gecko because there was an old belief that seeing it indicate bad incidences. Hence they kill Golden Gecko, one inhabitant showed us the tail of Golden Gecko killed four days back.

CONSERVATION MEASURES SO FOR TAKEN AND RECOMMENDATIONS:

Destruction and fragmentation of habitats is one of the main threats to the survival of the many species on earth. In addition, trade on endangered species and climate change are also cause threat and these are directly caused by human action. Prevention of disappearance of species is a priority goal at local, regional and national level.

No conservation measures so far initiated to protect the Indian Golden Gecko and its habitat. Therefore, it is time to initiate conservation measures. The two important conservation measures are (i) Conservation of habitats of the species focussing on maintenance and restoration of the habitats by establishing protected sites (ii) dealing with direct influence of the species as well as their eggs, breeding sites and resting places-it is not only on geographical area where species lives but refers to the whole of the territory of the species. Identification of breeding sites and resting places are very important in the light of conservation and protection of the species because these are crucial in the life cycle of the animal. In addition, the species can be protected by (i) building special water tanks around human habitations, so that it can lay eggs (ii). Creation of awareness among public to protect the habitat and (iii) Initiation of long term management plan where the species can be protected in the wild without harming the habitat of the species.

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