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Does Egg Clutch Size Determine the Abundance of Indian Golden Gecko *Calodactylodes aureus* (Beddome 1870)? An Example from SPSR Nellore District, Andhra Pradesh, India

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Abstract: The Indian Golden Gecko *Calodactylodes aureus* is an endangered, Scheduled I geckonid lizard. It is endemic to Peninsular India. It is rediscovered by many scientists in the recent past, redefining its distribution and raising lot of concerns of conservation issues. In this backdrop, we undertook a survey to record its presence in SPSR Nellore district, Andhra Pradesh, India. Following line transect method, the distribution is recorded, and we tried to relate the abundance of the animal to communal egg clutch size. 15 habitats were identified. It is observed that population size has a positive correlation to egg clutch size. Since egg clutches are prone to various threats, it is strongly suggested to initiate conservation measures.

Keywords: Indian Golden Gecko, Endangered animal, Line Transect Method, *Calodactylodes*

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Introduction

Many of the primitive and nocturnal Geckonid lizards are mainly confined to tropical countries (Daniel, 1983). The Indian Golden Gecko, *Calodactylodes aureus*, is notified as endangered

animal as per the Indian Wildlife Act, 1972. It is one of the least appreciated primitive lizards among the South Asian Herpetofauna (Deraniyagala, 1953). It has been consistently

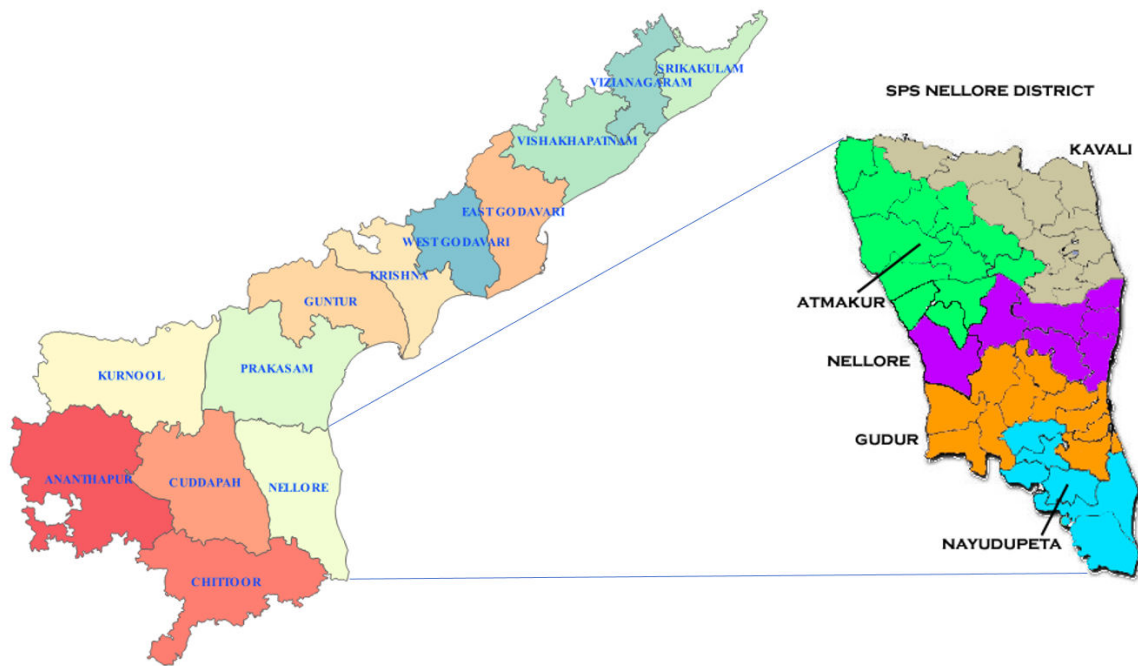


Fig. 1: Map showing SPSR Nellore District.

enlisted in various checklists (Boulenger, 1885; Wermuth, 1965; Kluge, 1993; Dilip Venugopal, 2010). Its biology is largely unknown (Aaron and Das, 2000). First reported by Beddome in 1870, it was thought to have been extinct, but later on observed in 1986 (Daniel *et al.*, 1986). Nandakumar *et al.* (2000) reported this animal from Seshachalm Biosphere Reserve. It is being cited along the East coast of India (Dutta *et al.*, 2005; Rajaskhar and Nandakumar, 2007; Javed *et al.*, 2007; Basundhara Chettri and Bhupathy, 2010; Sreekar *et al.*, 2010; Rajasekahar and Reddy, 2010; Amaranath Reddy *et al.*, 2012, 2013) and many new locations of its habitat were reported by Rajasekhar and Chakrapani (2012). Being a Gondwanian relic (Boulenger, 1885), Golden Gecko is of much interest. The present study is taken up in SPSR Nellore dist, Andhra Pradesh, India. It aims at correlating the animals abundance to its communal egg clutch size.

Materials and Methods

Study area:

Study area comprised parts of SPSR Nellore district of Andhra Pradesh (Fig. 1), surveyed between July 2011 and June 2013. Nellore District

is located at the Southern most end of Andhra Pradesh, India. It lies between $13^{\circ}30'$ and $15^{\circ}6'$ of the Northern latitude and $70^{\circ}5'$ and $80^{\circ}15'$ of the Eastern Longitude. Veligonda hills form the western border of the district. Along the coast, fertile lands are present and on the western side of the district has low westward elevation and has shrub jungles and rocky plains. Maximum temperature ranges between $40-45^{\circ}\text{C}$ during May and minimum temperature ranges from $17-30^{\circ}\text{C}$ during December.

Direct counting method was followed and conventional distance sampling method was adopted for this survey. The expanded phalanges (Rajasekhar and Chakrapani, 2012) with large trapezoidal penultimate and distal expansions are the key characters to identify this Indian Golden Gecko (Smith, 1935). Male and female can be identified by colour. Opportunistic searches were conducted among rock boulders. These were carried out over a vast area. Vertical and horizontal crevices were intensely searched. During day light searches, presence of communal egg patch and morphological correlates of the animal were recorded. Where the density of golden geckos is assumed to be high enough,

nocturnal search was conducted using line transects. Before attempting, one transect line for every 5 meters was drawn in the day time. Survey was conducted after dusk, with the help of 6V spotlights and hand torches. Morphometric details were collected as per the method given by Daniel *et al.*, (1986). Habitat analysis was done as per Kotwal (1982). Sympatric reptiles were identified according to the keys provided by Smith (1935) and Aaron and Das (2000).

Animal Description:

By noosing, a male golden gecko was captured (Fig. 2). It was observed for morphological and morphometric characters and released safely into the habitat, Sri Penusila Lakshmi Narasimha Wildlife Sanctuary (Rajasekhar and Chakrapani, 2012). Characterized by flat body, proportionately big head and oval neck, Golden gecko has a dorsal surface covered by small granules and tubercles. Squarish scales are present on the ventral surface (Smith, 1935). Long slender tail, round supra orbital, presence of canthal ridge, vertical pupil, long snout are observed. Canthal ridge has slightly larger granules (Chakrapani *et al.*, 2014). Digits have large trapezoidal penultimate and distal expansions. Each expansion is grooved and has a retractile claw (Daniel *et al.*, 1986). Golden gecko efficiently camouflages its surroundings. Dorso-ventral side of males is golden yellow (De Silva, 1995) and females have mixed colours. It has a peculiar habit of depositing eggs in communal patches, sticking the eggs to the roof of rock boulders (Fig. 3).

Results and Discussion

Unlike the Western Ghats, the Eastern Ghats are a chain of discontinuous row of hills and hillocks, running from North to South between coastal plains and plateau. This may be the reason for the discontinuous distribution of Golden Geckos in these rocky terrains. Normally these locations are known for semi-arid to arid climate. But, SPSR Nellore being a coastal district, has humid to sub-humid climate. As a result, SPSR Nellore district, experiences different temperatures, humidity and

rainfall (Hoe *et al.*, 1986). The study locations differ geologically also, as the geological formations range from Dharwar schists to the recent alluvium. These contain rich minerals.

Geologically and meteorologically Nellore district differs considerably and hence we focussed our attention on the habitat and the population of Golden geckos in the study locations. As a result, work has been carried out to see the correlation between abundance of Golden geckos and selected climatic parameters of rock boulder habitat.

In SPSR Nellore district covering 5.68 km², golden geckos were found in 15 new locations. Humidity range was between 76% and 100%. Temperature varied between 22°C and 41°C in those habitats where golden geckos were observed. Rock Boulder height varied between 1.2 m and 2.8 m. Egg clutch were found in all the 15 of the study locations. Number of eggs in one egg patch ranged from 38 in the smallest to 130 in the largest. Excreta were found in 10 locations surveyed. A total of 104 were found in the present study. The number of animals in each location ranged from 4 to 16. Consolidated survey results are given in Table 1.

Golden gecko population is more where the observed eggclutch is of larger size. In all the 15 locations surveyed in Nellore district, egg clutch was found. The number of eggs in each egg patch ranged from 38 to 130. When the egg patch size was more, naturally more animals were found in locations like Konamalleswaram. Egg patch composition in each of the study locations in SPSR Nellore district is presented in Table 2 and Figure 4.

As in the case of study in Chittoor district, a positive correlation between egg patch size and animal abundance and vice-versa could be found (Fig. 5). Karl Pearson coefficient of correlation indicates a highly positive relation between egg patch size and animal abundance ($r = 0.8475$).

Results of the t-test showed that egg clutch size is a significant factor in determining the



Fig. 2: *Calodactylodes aureus*, displaying golden yellow color, nostril, canthal ridge, vertical pupil, labials, dorsal tubercles and ear opening prominent. Photograph at Chakrateerdham of Tirumala Hills.

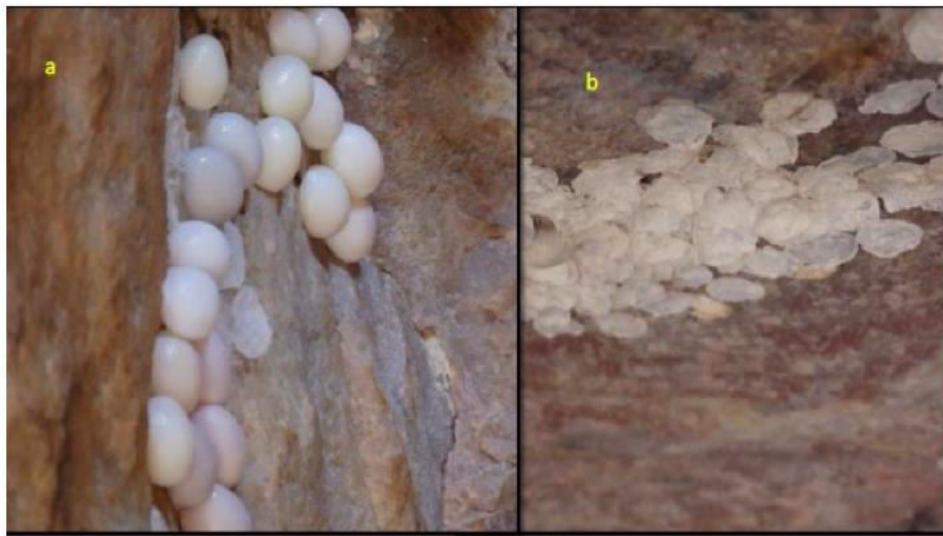


Fig. 3: Communal egg clutch of *Calodactylodes* – (a) freshly laid eggs and (b) an old scar of the egg clutch.

population size in the study locations.

As per the formula, $|t_c| = \left| \frac{r - \rho_0}{\sqrt{n-2}} \right|$

Where $r = 0.8475$

t_{tab} at 5% = $t_{n-2} = t_{15-2}$

5% = 1.771

$$|t_c| = \left| \frac{r - \rho_0}{\sqrt{n-2}} \right| = \left| \frac{0.8475 - 0}{\sqrt{15-2}} \right| = 0.2351$$

Since t_c is less than t_{tab} , the assumption that the egg clutch size is a significant factor in determining population size holds good.

To draw definite conclusion from this survey in SPSR Nellore district, the mean values of selected parameters were taken into consideration. We predicted Golden gecko populations to exist in considerable numbers.

In conclusion, we tried to estimate Golden gecko population in the entire rocky terrain of Nellore district, based on our field observations. The details of population density estimates in the study locations are given in Table 3.

Population density of Golden geckos in SPSR Nellore district was 18.29/km². It is noteworthy that, though the absolute number of Golden geckos

Table 1: Consolidated Survey results showing abundance of Golden geckos in relation to climatic variables SPSR Nellore District

S. No.	Location	Temperature (°C)	Humidity %	Egg patch size	Height of the Rock Boulder (m)	Number of animals
1	Vempalli toka	28	100	50	1.5	4
2	Udayagiri	25	100	64	1.5	6
3	Somasila	30	100	42	1.4	4
4	Panchalingalakona	30	100	44	1.5	5
5	Mallemkonda	32	98	68	1.4	14
6	Penchalakona	33	98	100	2.3	12
7	Bhairavakona	28	100	80	2.6	13
8	Akilavalasa	41	87	42	1.6	4
9	Sidduleswarakona	23	92	40	1.8	4
10	Dattanagaram	40	82	45	1.6	6
11	Attalasiddavaram	28	78	60	1.3	4
12	Stambhalakona	24	83	48	1.2	3
13	Konamalleswaram	22	100	130	2.8	16
14	Varadanapalli	27	88	38	1.5	5
15	Paravolu	24	76	60	1.8	4

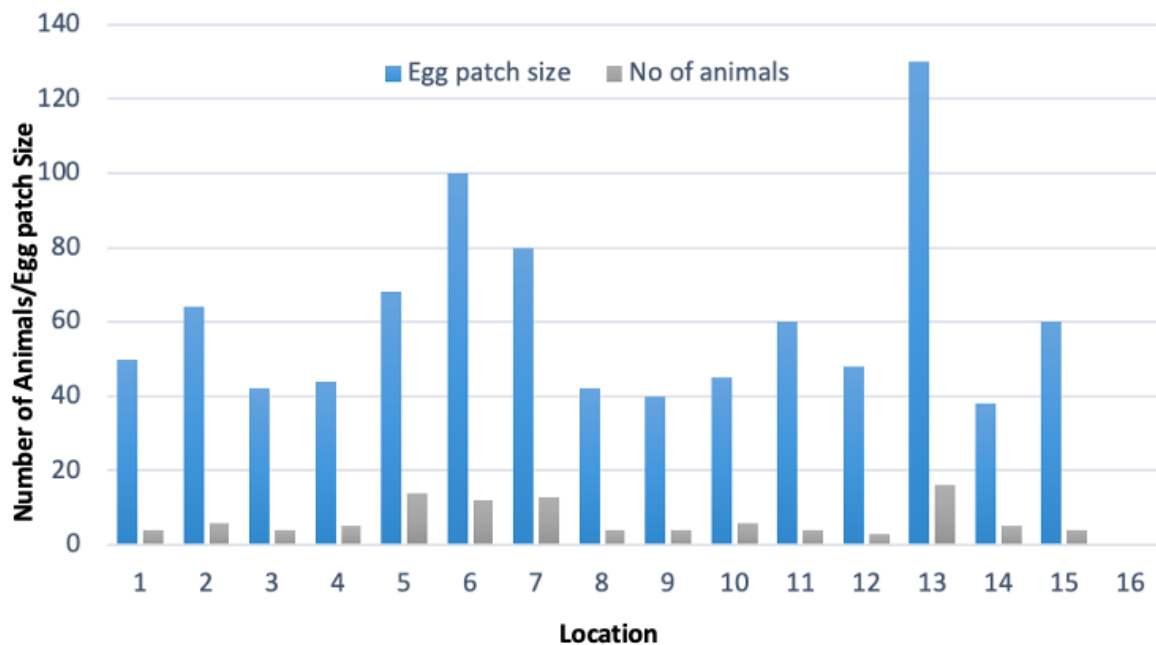


Fig. 4: Animal abundance in relation to egg clutch size in SPSR Nellore District.

Table 2: Communal egg clutch composition and animal abundance in SPSR Nellore district

S. No.	Location	No. of egg scars observed	Number of eggs observed				Number of animals
			Hatched	Unhatched	Spoiled	Total	
1	Vempallitoka	2	20	18	12	50	4
2	Udayagiri	1	15	30	19	64	6
3	Somasila	4	6	16	20	42	4
4	Panchalingalakona	3	12	8	24	44	5
5	Mallemkonda	2	22	20	26	68	14
6	Penchalakona	6	42	38	20	100	12
7	Bhairavakona	4	34	30	16	80	13
8	Akilavalasa	2	12	10	20	42	4
9	Sidduleswarakona	3	8	16	16	40	4
10	Dattanagaram	2	20	5	20	45	6
11	Attalasiddavaram	1	15	20	25	60	4
12	Stambhalakona	6	20	4	24	48	3
13	Konamalleswaram	8	54	36	40	130	16
14	Varadanapalli	1	16	10	12	38	5
15	Paravolu	0	20	14	26	60	4

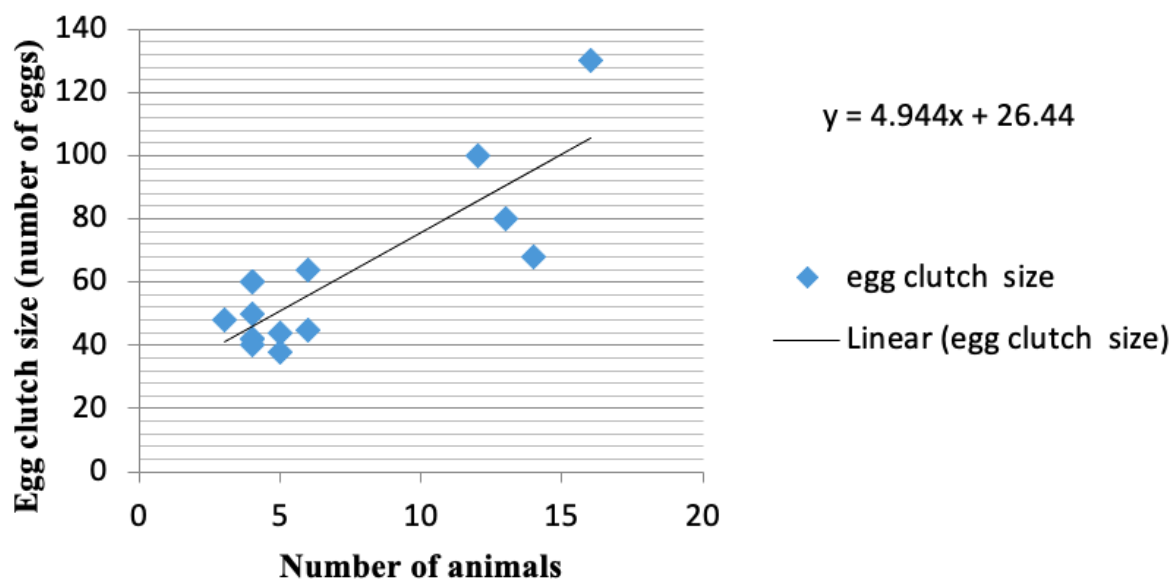


Fig. 5: Egg clutch size in relation to number of animals present in SPSR Nellore district.

Table 3: Population Density of the Indian Golden Gecko *Calodactyldoes aureus* in the study locations of SPSR Nellore District

S. No.	Location	Area (m ²)	Number of Golden Geckos Present	Population Density (number of animals/km ²)	Standard Deviation
1	Vempallitoka	105.55	4	0.1429	0.378
2	Udayagiri	563.11	6	0.142	0.377
3	Somasila	211.1	4	0.1262	0.3552
4	Panchalingalakona	492.87	5	0.0892	0.2986
5	Mallemkonda	422.39	14	0.25	0.5
6	Penchalakona	1320.61	12	1.1713	1.0822
7	Bhairavakona	880.3	13	0.1711	0.4163
8	Akilavalasa	211.1	4	0.0759	0.2754
9	Sidduleswarakona	105.64	4	0.1428	0.3778
10	Dattanagaram	105.64	6	0.142	0.3768
11	Attalasiddavaram	140.89	4	0.1428	0.3776
12	Stambhalakona	105.64	3	0.1423	0.3772
13	Konamalleswaram	563.11	16	0.3788	0.6154
14	Varadanapalli	351.91	5	0.0892	0.2986
15	Paravolu	105.64	4	0.1138	0.3373

is less, expected population density is high in SPSR Nellore district in the observed study locations. Given the general observation that SPSR Nellore district experiences heavy down pour of rain due to frequent cyclones, average humidity and mean temperatures of the district is more. Due to this reason, forest cover may be thick, which in turn would affect population of insects, which is the main prey for Golden geckos. This would have an indirect positive effect on the reproductive capacity of individuals. Hence, the limited rocky terrain of SPSR Nellore district might support rich populations.

We calculated the estimated population density of Golden geckos in the entire district. The expected population density in SPSR Nellore district is 151.84/km². In the estimation of any population density, the parameter follows negative binomial distribution where the mean is always less than the variance (Table 3). This implies that the actual population density may be less, because entire rocky terrain cannot be

expected to be suitable habitat. As mentioned previously, many deeper pockets of forest areas are not accessible due to limitations of administrative restrictions imposed in view of red sanders smuggling and other illicit trade in forests. Keeping these findings in view, we suggest an intensive survey to be conducted in the rocky terrains of SPSR Nellore district, with the active help of all the stake holders to elucidate, protect and conserve Golden gecko habitat.

As the existence of Golden gecko has been largely unknown until its discovery by Beddome (1870), the Indian government has declared this animal as endangered and included it in Schedule I of the Wildlife Act, 1972. Issues like anthropogenic interference, loss and fragmentation of habitat, global warming etc., are threatening Golden geckos' existence (Chakrapani *et al.*, 2014). The reduction of gecko population would likely to have repercussions on the integrity of food chains, thereby affecting the food web. Golden geckos are prey animals for many reptiles and birds, while

Table 4: Seasonal variation in Golden gecko population at specified locations

S. No.	Location	No. of Golden Geckos observed		
		Rainy season	Winter	Summer
1	Mallemkonda	22	16	14
2	Penchalakona	18	16	12
3	Konamalleswaram	24	18	16

simultaneously being important predators of insects (Knowlton George, 1938). Many scientists have reported drastic decline and extinction of amphibian and reptiles around the globe. These extinctions are attributed mostly to the spread of fungal diseases, environmental change and climate change, especially the global warming (Sinervo *et al.*, 2010). The present study also emphasizes the importance of the temperature and humidity on the Golden gecko population. Many studies are emphasizing that the climate warming is the major cause of extinction of lizards (Sinervo *et al.*, 2010; Bharati *et al.*, 2017). We also observed greater number of golden geckos in rainy and winter seasons and less number during summer at three specified locations in SPSR Nellore district. We visited Golden gecko habitats three times successively every week in August, December and May. The mean number of animals noticed was observed, and we find less number of animals during summer (Table 4).

This finding corroborates with the results of many researchers. If temperature continues to raise as in the present scale, most of the geckos, existing right now, will become extinct by 2080 (Sinervo *et al.*, 2010). Hence, we suggest that there is an urgent need to initiate measures for conservation of this precious animal.

References

- Aaron MB and Das I. (2000) A review of the geckonid genus *Calodactylodes* (Reptilia: Squamata) from India and Srilanka. South Asian Nat Hist. 5(1): 25-35.
- Amarnath Reddy Y, Indira P, Pullaiah T, Sadasivaiah B, Raja Kullai Swamy K and Sandhya Rani S. (2013) Range extension of Indian golden Gecko *Calodactylodes aureus* in Andhra Pradesh, India. Reptile Rap. 15: 41-42.
- Amarnath Reddy Y, Sadasivaiah B, Indira P and Pullaiah T. (2012) Herpetofauna of Thummalapalle uranium mining area, Andhra Pradesh, India. Int J Biodiversity Conserv. 5(8): 515-522.
- Basundhara Chettri and Buhpathy S. (2010) Three little known reptiles from the Araku Valley, Eastern Ghats with notes on their distribution. J Threatened Taxa 2(8): 1109-1113.
- Beddome RH. (1870) Descriptions of some new lizards from the Madras Presidency. Madras Monthly J Med Sci. 1: 30-35.
- Bharati D, Hemavathi B and Sobharani A. (2017) Conservation of fauna of Seshachalam Biosphere Reserve. Int J Recent Innovative Trends Computers Communication 5(7): 361-368.
- Boulenger GA. (1885) Catalogue of the lizards in the British Museum (Natural History). British Museum (Natural History), London XII+463.
- Chakrapani IS, Chanikyudu B, Janardana Rao R and Rajasekhar M. (2014) Status Survey of the Indian Golden Gecko *Calodactylodes aureus* (Beddome, 1870) in YSR Kadapa and SPSR Nellore Districts of Andhra Pradesh, India. World J Zool. 9(1): 21-27.
- Daniel JC. (1983) The Text Book on Indian Reptiles. Oxford University Press, Oxford.
- Daniel JC, Bhushan B and Sekar AG. (1986) Rediscovery of the golden gecko *Calodactylodes aureus* (Beddome) in the Eastern Ghats of Andhra Pradesh. J Bombay Natural History Soc. 83: 15-16.
- De Silva A. (1994) An introduction to the herpetofauna of Srilanka. Lyriocephalus 1: 3-19.
- De Silva A. (1995) The reptiles of Srilanka, a checklist and common names, part 1: Testudines, Crocodilia and Lacertilia. Lyriocephalus 2: 25-33.
- Deraniyagala PEP. (1953) A new *Calodactylodes* gecko from Ceylon. J Roy Asiatic Soc(Ceylon) 1: 27-28.
- Dilip Venugopal P. (2010) An updated and annotated list of Indian lizards (Reptilia: Sauria) based on a review of distribution records and checklists of Indian reptiles. J Threatened Taxa 2(3): 725-738.

- Dutta SK, Mohanty B and Mohapatra PP. (2005) Niyamgiri unraveled. Sanctuary Asia Magazine 56-59.
- How RA, Dell J and Willington BD. (1986) Comparative biology of 8 species of *Diplodactylus* Gecko in Western Australia. J Herpetologica 42(4): 471-482.
- Indian Wildlife (Protection) Act (1972) Government of India, Chapter VII, Schedule II.
- IUCN. (2013) IUCN Red List of Threatened Species. www.iucnredlist.org.
- Javed SM, Mithun Raj and Kumar S. (2017) Predicting potential habitat suitability for an endemic gecko *Calodactylodes aureus* and its conservation implications in India. Tropical Ecol. 58(2): 271-282.
- Javed SM, Waran A and Tampal F. (2007) On the occurrence of golden gecko *Calodactylodes aureus* (Beddome, 1870) in Papikonda Hills, Eastern Ghats, Andhra Pradesh, India. J Threatened Taxa 2(1): 639-643.
- Kluge AG. (1993) Geckonid lizard taxonomy. Int Gecko Society San Diego, 245.
- Knowlton George F. (1938) Lizards in insect control. Ohio J Sci. 38(5): 235-238.
- Kotwal PC. (1982) Evaluation of Wildlife Habitats-Parameters and Procedures. Workshop on Wildlife Management, Kanha.
- Manamendra-Arachchi K. (1995) The geckos of Sri Lanka. Lyriocephalus 2(1-2): 8-10.
- Nandakumar NV, Vijayalakshmi KM, Rajasekhar M and Ameer Basha M. (2000) Survey of Golden Gecko habitat – Analysis and conservation in Tirumala Hills. Ecol Environ Conserv. 6(4): 435-439.
- Rajasekhar M and Chakrapani IS. (2012) Occurrence of *Calodactylodes aureus* in Chittoor district of Andhra Pradesh, India. Int J Comp Anim Physiol. 30: 116-124.
- Rajasekhar M and Nandakumar NV. (2007) A new finding on the occurrence of Golden Gecko (*Calodactylodes aureus*) in the rock boulders near Vellore town. Bioscan 2(1): 61-62.
- Rajasekhar M and Rajarami Reddy G. (2010) Occurrence and ecology of *Calodactylodes aureus* in Sri Venkateswara Sanctuary and Nallamalai Hills of Andhra Pradesh, India. Emerging Trends Modern Biol Centre Biotechnol Acharya Nagrjuna University Guntur 234-244.
- Sinervo B, Méndez-de-la-Cruz F, Miles DB, Heulin B, Bastiaans E, Villagrán-Santa Cruz M, Lara-Resendiz R, Martínez-Méndez N, Calderón-Espinosa ML, Meza-Lázaro RN, Gadsden H, Avila LJ, Morando M, De la Riva IJ, Victoriano Sepulveda P, Rocha CF, Ibargüengoytia N, Aguilar Puntriano C, Massot M, Lepetz V, Oksanen TA, Chapple DG, Bauer AM, Branch WR, Clobert J and Sites JW Jr. (2010) Erosion of lizard diversity by climate change and altered thermal niches. Science 328(5980): 894-899.
- Smith MA. (1935) The Fauna of British India, including Ceylon and Burma: Reptilia Amphibia Vol. II. Sauria. Taylor Francis, London, pp. 440.
- Sreekar R, Srinivasulu C, Seetharamaraju M and Aditya Srinivasulu C. (2010) Selection of egg attachment sites by the Indian golden Gecko *Calodactylodes aureus* (Beddome, 1870) (Reptilia: Geckonidae) in Andhra Pradesh, India. J Threatened Taxa 2(11): 1268-1272.
- Wermuth H. (1965) Liste der rezenten Amphibien und Reptilien: Geckonidae, Phrynosomatidae, Xantusiidae. Das Tierreich 80: 1-246.