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Anomalous (?) Nocturnal Feeding by the Agamid Lizard *Calotes emma* in Northeastern Thailand

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Abstract. - I observed feeding by the Agamid lizard *Calotes emma* during the early part of the Thai monsoon season. During this period, one individual took advantage of swarming termite reproductives and fed nocturnally. Nocturnal activity has not been reported for this genus. The lizard's behavior may have resulted from conditions created by artificial lighting. Alternately, it may constitute a normal response to a rich annually-available food resource.

Key words. - *Calotes emma,* feeding, termites, nocturnal, atypical behavior.

Introduction

Agamid lizards belonging to the genus *Calotes* are widely distributed throughout South and Southeast Asia. They are characterized by semi-arboreal or arboreal behavior, strongly diurnal activity patterns, and insectivorous diets (Erdelen, 1988; Günther, 1864; Subba Rao 1970, 1975; and Subba Rao and Rajabai, 1972).

Calotes emma is a typical member of the genus. The species occurs from Assam through Yunnan in the north, and Peninsular Thailand in the south. It prefers moist forested habitat and is arboreal to semi-arboreal it its habits (Günther, 1864). Here I report observations of *C. emma* feeding at night in a manner apparently contrary to norms for the genus.

Methods

This study took place at the Sakaerat Environmental Research Station. Sakaerat is a scientific and educational facility located in Northeastern Thailand at 14° 30.46' N Latitude by 101° 55.92' E Longitude. The station grounds cover approximately 80 km^2.

Small and medium-sized wildlife is plentiful in the area. As of this writing, 70 species of mammals, 50 species of birds, and 25 species of amphibians have been recorded from Sakaerat. Reptile fauna is also abundant ~82 species are known to occur (Lawanyawatna and Schaedla, 2000). Of the reptiles, *C. emma* is among the most common because of the station's abundant forest cover.

Seasonal (monsoonal) and perennial dipterocarp forests comprise the bulk of Sakaerat's habitats. I worked specifically in an area of Dry Evergreen Forest, which is a Dipterocarp mosaic containing other floral components. It is a four storied forest. The upper story extends from 21 to 40 m in height and consists mostly of *Hopea ferrea*, *H. odorata*, *Shorea sericeiflora*, and *Irvingia malayana*. The middle story ranges from 15 to 20 m in height and contains *Hydrocarpus ilicifolius*, *Memocylon ovatum*, and *Walsura trichostemnon*. The lower story is between 4 and 24 m in height and is characterized by *Baccaurea sapida*, *Apodytes dimidiate*, and *Olea salicifolia*. Undergrowth is less than 4 m from the ground, leafy, and composed mainly of *Ardisia*, *Canthium*, and *Clausena*.

Average humidity at Sakaerat runs about 76% over the course of the year. Average annual precipitation is 1,222 millimeters, and average annual temperature is 26°C. March is the hottest month with a maximum recorded high of 37°C. January is the coolest with a minimum recorded low of 8°C. Sakaerat generally experiences a 3.5 month long rainy season that lasts from early June through mid September. Conversely, rainfall is rare from December through February (Tongyai, 1980).

I made behavioral observations of Sakaerat's *Calotes emma* on the evenings of 7, 10, and 12 June, 2001. These dates followed the onset of the local monsoon season, but were not monsoon days themselves. Weather conditions were overcast, but there was no heavy or sustained precipitation. Rainfall was light and intermittent, accompanied by occasional lightning. Ambient temperature was moderate, ranging from 27° to 30°C.

My observations took place from approximately 6:00 PM (dusk) to 9:00 PM. I watched from an area in a semi-secluded part of the research station. My vantage was the front porch of a bungalow near Sakaerat's station headquarters, but offset in the forest and away from the main complex of office, visitor's center, cafeteria, and general housing. This area is dimly lit by two overhead fluorescent lights attached to the sides of buildings. These lights attract large numbers of insects, especially during seasonal monsoon periods. In particular, termite alates (winged reproductives) were present in high num-

bers on the evenings I observed. Large swarms of *Odontotermes* sp. and *Macrotermes* sp. clouded the local area and eventually dropped to the ground.

When termites fell to the ground, I observed a single *C. emma* feeding them. The lizard was present all three rainless nights, and seemed unperturbed by my presence. It was there from dusk, or before, to nearly 9:00 PM on all three evenings. It was active, and its behavior was restricted to the terrestrial environment. It did not climb nearby trees or the sides of wooden buildings. All of its movements were directed; it displayed no signs of disorientation in the relative darkness of its surroundings. On the contrary, it focused on the termite alates and fed vigorously on them as they landed.

On June 10, I captured the lizard to verify its identity as *C. emma*. It had been correctly identified and was a mature female. Her stomach was distended from termite consumption, but she was not visibly gravid with eggs.

In addition to the lizard, other predators feeding on the termite alates included toads (*Bufo melanostictus*), geckoes (*Cyrtodactylus spp.*), and centipedes (*Scolopendramorpha*).

Discussion

Little is known about the exact feeding preferences of *C. emma*. However, some indication of its diet might be inferred from studies of a closely related arboreal species. Subba Rao (1972) found that *C. nemoricola* in India fed mostly on ants, while *Sitana ponticeriana*, an unrelated ground-dwelling lizard, fed on termites. In another study he found that *C. nemoricola* consumed a wide variety of invertebrates ranging from beetles, to gastropods, to earthworms. Analysis of gut contents showed a predominance of ants but no termites. He also noted a distinct absence of flying insects in the lizards' stomachs (Subba Rao, 1975). Hence, feeding on winged termites by *C. emma* may represent a departure from its normal dietary habits.

Likewise, nocturnal feeding has not been reported in the literature surrounding *Calotes*. In fact, members of the genus are usually active only during the day (Erdelen, 1988; Günther, 1864; Subba Rao 1970, 1975; and Subba Rao and Rajabai, 1972). *C. emma* at Sakaerat is decidedly diurnal in its habits. At night they tend to sleep on the ends of low-hanging tree branches. Spotlighting does not wake them and they can be captured easily by anyone walking through the forest with a headlamp. I have worked at Sakaerat for three years, and, with the exception of the observations reported herein, I have never seen them active at night.

Calotes is apparently physiologically predisposed towards diurnal activity. Light has a positive affect on both the pituitary and the hypothalmamo-neuro secretory systems of *C. versicolor* (Banerjee, 1972). However, Kar (1987) found that day length (photoperiod) played a less important role than ambient temperature in scale regeneration by *C. versicolor*. He speculated this happens because the lizards' thyroid activity is elevated by heat, rather than light.

Evening temperatures were warm on the nights I made my observations. The lizard I observed may have been able to extend her activity because of this. It is also possible that the lack of sunlight was mitigated by the presence of overhead florescent lights (albeit dim). My subject may simply have been disrupted from its normal circadian routine by the local environment. Some support for this possibility comes for another observational study. Subba Rao et al. (1984) noted that abrupt changes in light intensity, temperature, and relative humidity during a total solar eclipse actually stimulated activity in *C. versicolor*.

Of course, the feeding I observed may have been part of *C. emma*'s normal behavioral regime. Termite alates constitute a rich, but seasonally discrete food source, induced by the onset of the monsoons. They are available in great numbers at specific times of the year, and they attract a wide variety of predators, including retiles. It is therefore possible that *C. emma* takes advantage of the bonanza via seasonal changes in behavior. Whatever the case, nocturnal feeding by *C. emma* is unusual and unreported. Even if not anomalous it deserves future attention.

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