A rare and little known lizard, *Otocryptis beddomi*, from the *Myristica* swamps of southern Kerala, India

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ABSTRACT – We present new data on the occurrence, behaviour, life history and ecology of the little known Indian kangaroo lizard, *Otocryptis beddomi* from the *Myristica* swamps of southern Kerala, a highly endangered, fragmented and restricted fresh water swamp forest in the Western Ghats.The result of our study conducted for two years from November 2004 to November 2006, also indicates that *Myristica* swamp forests provide an optimum habitat for this lizard which has disappeared from its earlier habitats, and calls for the conservation of these unique forests.

MYRISTICA swamps were first described by Krishnamoorty (1960) and classified by Champion & Seth (1968) in the sub-group of tropical fresh water forests (4c/FS1). These fresh water swamp forests are highly fragmented and restricted in distribution due to systematic destruction (Rodgers & Panwar, 1988), and also special abiotic conditions required for their survival. These swamps have been reported from the flat-bottomed, ill-drained valleys of Anchal and Kulathupuzha Forest Ranges and Shendureney Wildlife Sanctuary of Southern Kerala, and from Uttara Kannara in Karnataka and Satari regions in Goa. These swamps are usually surrounded by low elevation evergreen forests at altitudes ranging from 180–200 ASL. The dominant vegetation is trees belonging to *Myristicaceae* family which show adaptations such as (breathing roots) knee roots and stilt roots (for anchoring the tree in damp soil) (Varghese, 1992).

During our field trips for the ongoing research project, "Mapping Biodiversity of *Myristica* swamps in southern Kerala", we sighted *Otocryptis beddomi* in the drier regions of many *Myristica* swamps and from the forests adjacent to these swamps, both in Kulathupuzha Forest Range and Shendureney Wildlife Sanctuary. The IUCN Red list (2006) at the IUCN website does not list this lizard but the C.A.M.P Workshop for Reptiles (1998) reported this as endemic and vulnerable under IUCN criteria (B1, 2c; D2). Little is known about the life history or ecology of this species (Daniels, 1991). Till 2005, the only other species in the genus was *Otocryptis weigmanni* which is endemic to Sri Lanka. The presence of a new species, *Otocryptis nigristigma* also from Sri Lanka, was reported by Mohomed & Silva (2005).

STUDY AREA AND METHODOLOGY

The field study was conducted for two years from November 2004 to November 2006 in and around the *Myristica* swamps of Anchal and Kulathupuzha Forest range and Shendureney Wildlife Sanctuary. This area lies between 8°75'N and 9° N and 76°75' E and 77°25' E. Of the 60 individual swamp patches identified at present, most were less than 0.05 km^2. The cumulative area of all *Myristica* swamp patches in this area is less than 2 km^2 (Roby & Nair, 2006). All sightings of *Otocryptis beddomi* were recorded along with the date, time, location and microhabitat and the details were tabulated and analyzed. When a lizard was sighted, it was observed for 10 minutes without disturbing it. It was photographed using a JVC Handycam and a Canon EOS300 digital camera. The lizards were captured by hand, measured and released at the site of capture. Identification was done following Smith (1935).

The movements and behaviour of the lizards after release were also recorded. Enviromental parameters such as rainfall data, water level (above and below soil and inundation), canopy cover, temperature, humidity, altitude, slope, leaf litter depth, leaf litter cover, undergrowth and regeneration were recorded using standard methods. But only those enviromental parameters

Figure 1. *Otocryptis beddomi* (normal colour variant). © J. Jose.

which affected the number of sightings of *Otocryptis beddomi* have been mentioned in this report for the sake of brevity. Procedures involving animal killing or excessive handling and habitat destruction were avoided in the interests of conservation.

RESULTS

Morphology

All the lizards sighted by us confirmed to the description by Smith (1935) (Figure 1) with two exceptions. Colour variations were evident in two cases. In the first case the pale vertebral stripe was closer to grey than buff and the darker flanks were closer to black than brown. In the second case the pale vertebral stripe was not distinct and the general body colour was a darker shade of brown than usual. The snout to tail measurement of adults varied from 78–125 mm.

During the months of October and November we observed seventeen young ones of the species. The morphological characters differed slightly from that of the adult. The snout to tail length varied from 30 mm to 60 mm. Scales on the head and trunk were not clearly visible to the naked eye but those on the tail and limbs were quite clear. The head and body were dark brown. The tail, where it joined the body was cream coloured but the distal end of the tail was buff. The extremities of the limbs were also cream coloured. The pale vertebral region was indistinct but the series of brown transverse vertebral spots was visible.

Behaviour, Distribution and Ecology

Some of these lizards were observed feeding on ants, termites and on small dipterans. When disturbed they fled on hind legs with the prey clutched in the mouth. Of the approximately 920 minutes spent observing the 92 individuals of *Otocryptis beddomi*, the animals 19% of this time was spent for feeding while 40% and 41% of the time was spent for resting and moving respectively (Fig. 2).

The number of sightings across three seasonal units – premonsoon, monsoon and post monsoon and across the three forest ranges where *Myristica* swamps are found in southern Kerala is shown in Figures 3 and 4. During the rainy season the number of sightings in the swamps declined but increased in the forests adjacent to the swamps and vice versa for dry season. All sightings during rainy season were between 09:30 h and 15:30 h. During the dry season time of sighting varied between 08:30 h and 17:00 h. A single nocturnal sighting was made during the dry season inside a swamp at 20:30 h.

This lizard preferred the peripheral areas of completely inundated swamps whereas it was found in both core and peripheral areas in periodically

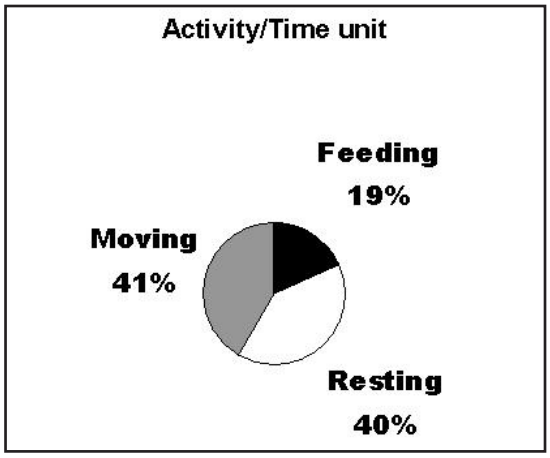

Figure 2. Activities/Time units spent.

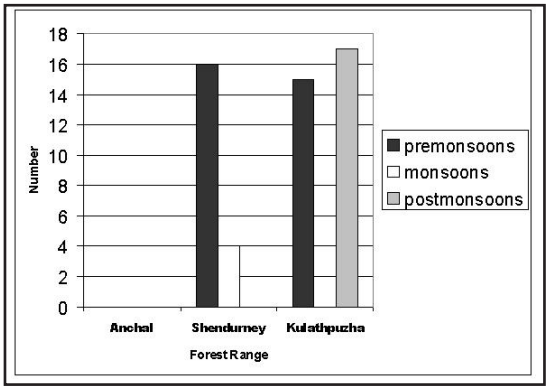

Figure 3. Sightings of *Otocryptis beddomi* inside *Myristica* swamps.

inundated swamps. The lizard was seen less in inundated areas, and areas where the forest floor litter had been washed away due to flooding (Fig. 5). Areas with high canopy cover were preferred over areas with low canopy cover. It is also evident from Figure 5 that litter cover and inundation were more decisive factors than canopy cover in determining the number of *Otocryptis beddomi* sightings.

Kulathupuzha and adjacent areas get heavy rain in the post monsoon period leading to high level of inundation in the swamps, but the number of sightings increased during the months of October and November due to the juveniles sighted in the peripheral areas of the swamp. Of the nineteen individuals sighted during these two months, seventeen were juveniles. The total number of juveniles sighted from all the other months combined is less than this figure. All the sightings during these two months were from the drier areas of the swamp, where the forest floor litter deposited by natural leaf fall was supplemented by litter deposited during rain water run off.

DISCUSSION

Mohomed & Silva (2005) quote Deraniyagala's study which reports the peak breeding season for *Otocryptis wiegmanni* as October–January, and observed egg laying in July–October from the wet zones of Sri Lanka. They also report egg laying by *O.weigmanni* during May 2004, with a clutch size of five eggs and *insitu* hatching period of forty nine days. There are no reports on the breeding habits of *Otocryptis beddomi*. The general assumption is that tropical lizards breed continuously. But increase in the number of juvenile sightings of *O. beddomi* by

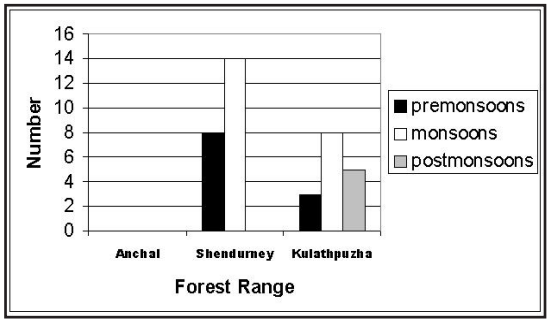

Figure 4. Sightings of *Otocryptis beddomi* in forests adjacent to *Myristica* swamps.

us during the months of October and November, suggest an egg laying peak in the immediately preceding months which is similar to its Sri Lankan counterpart. Further studies on the natural history of *O. beddomi* is needed to validate the assumption that as the egg-laying peak seems to be similar in the Indian and Sri Lankan species the breeding peak will also be similar.

Daniels (1991) has described *O. beddomi* as one of the least known lizards of the Western Ghats. He wrote that although he had seen this lizard many times in the 1960's in the forests of Balamore, Kanyakumari district, Tamil Nadu State, he had never seen this species elsewhere in the Western Ghats in spite of his intensive field work. As his last sighting of this species was in the early 1970's in Maramalai Hills south of Balamore he suggested that the species could be possibly extinct in its restricted range and hypothesized canopy cover destruction as a possible reason for this. Our perusal of literature make us conclude that there have been sporadic reports of this

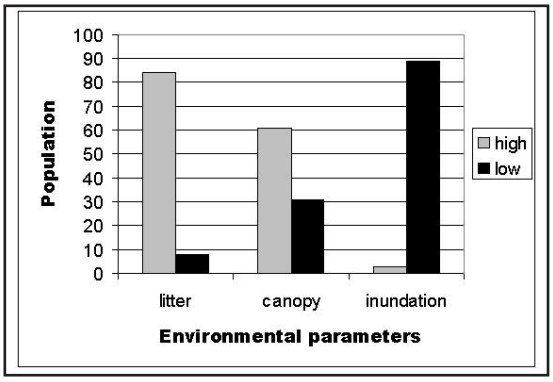

Figure 5. Comparison of number of sightings in littered and non littered, inundated and non -inundated, low and high canopy covered areas.

species after Daniel's paper and different authors (Easa *et al*., 2004; Ajith Kumar *et al*., 2002; Murthy, 1985; Inger *et al*., 1984) have included it in their list of lizards for Western Ghats. Ajith Kumar *et al*., (2002) reported it from Rosemala and Palaruvi forests of Thenmala division, Kerala and suggested that the absence of the same from Tamil Nadu could be due to destruction of low elevation rainforests in that state. Rosemala and Palaruvi are within the 25 km radius from our study area but at a higher altitude. The findings of our study concur with these opinions. We sighted *O. beddomi* in the *Myristica* swamps and in the forests near the swamps in Shendureney Wildlife Sanctuary and also in Kulathupuzha forest range but did not have even one sighting of the species from Anchal forest range. The swamps in Anchal range are highly degraded and the surrounding vegetation is almost always disturbed forests, man-made grasslands or plantations. The absence of leeches in the Anchal part of our study area is another indicator of the desiccation of this area. The non- perennial and degraded status of many *Myristica* swamps in Anchal could be due to the destruction of the surrounding evergreen forests which has reduced the year long water seepage into the swamps. This combined with anthropogenic disturbance are sounding the death knell for the swamps in Anchal range. Conversion of evergreen patches into moist deciduous forests, monotypic plantations and grasslands have led to reduced canopy and litter cover which in turn may have affected habitat specialists like *O. beddomi.* In Shendureney Wildlife Sanctuary there were no sightings of *O. beddomi* during the post monsoon period either in swamps or in the adjacent forests. The absence of *O. beddomi* in the swamps is due to high inundation caused by heavy rains but the adjacent forests are also devoid of *O. beddomi*. We attribute this to the clearing of fire-lines surrounding almost all the swamps in Shendureney Wildlife Sanctuary. The presence of fire-lines has drastically reduced the litter cover in the peripheral areas of the swamps which are contiguous to the adjacent forests.

Myristica swamp forests are low elevation evergreen forests, the existence of which depends on the presence of healthy evergreen forests in the vicinity. The presence of evergreen forests is a sure indicator for high canopy cover and high forest floor litter which are essential component of the *O. beddomi* microhabitat. Even though high levels of inundation inside the *Myristica* swamps may not be conducive for *Otocryptis beddomi* populations, the drier peripheral areas of the swamps and the adjoining evergreen forests provide a habitat for this rare and little known lizard. In this context our sightings of *O. beddomi* in and around of *Myristica* swamps assumes a two pronged importance. Firstly, the fact that at least a small population of this little known lizard is still intact is a matter of significance and all efforts should be taken to maintain this population. Secondly the importance of the *Myristica* swamps, an endangered, restricted and fragmented ecosystem, in Southern Kerala, as a habitat and home range for rare animals is highlighted.

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Bicephaly in *Salamandra salamandra* larvae

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ABNORMALITIES occur frequently in wild populations of amphibian and reptiles (e.g., Matz, 1998; Meyer-Rochow & Asahima, 1988; Worthington, 1974). Polymelia (presence of supernumerary limbs) or polydactyly (presence of supernumerary digits) are the most common alterations and have been reported frequently in the herpetological literature (e.g., Johnson *et al*., 2001; Recuero & Campos Asenjo, 2003; Sealander, 1944). Reports on bicephaly are, however, more scarce.

Bicephaly, in general terms, refers to the presence of two heads in a single individual. It has been documented occurring naturally in mammals, including humans (e.g., Wu, 2002), and reptiles (e.g., lizards [e.g., Pleticha, 1968], turtles [Diong *et al.,* 2003], geckos [Holfert, 1999]), being specially frequent in snakes (e.g., Belluomini, 1959; Da Cunha, 1968; De Lema, 1982, 1994; Hoser & Gibbons, 2003; Khaire & Khaire, 1984; Maryan, 2001; Mitchell & Fieg, 1996; Oros *et al*., 1997). Bicephaly, however, is not very common in amphibians. To our knowledge, it has only been documented in three anuran larvae (Dragoiu & Busnitza 1927; Lebedinsky, 1921; Loyez 1897) and in the Golden-striped salamander (Pereira & Rocha, 2004).

The term 'bicephaly' is used to describe a broad spectrum of developmental alterations. Different abnormalities, from the duplication of some structures of the head to the ocurrence of Siamese or co-joined twins, give rise to bicephalic individuals. Bicephaly may be the consequence of the incomplete separation of the zygote of identical twins (co-joined twins). Bicephalia may also occur by the terminal bifurcation of the axis of development of the embryo, the notochord, during the neurulation process. The notochord gets divided or forked, leading to two distinct axes and the formation of two neural plates and their neural