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Cover

Red-spotted Royal Snake (*Spalerosophis arenarius*)

Non-venomous. Found in Thar Desert (northwest India and Pakistan). Nocturnal, sometimes seen by day. Grows to 4.5 ft. Feeds on lizards, mice and birds. Lays eggs. Also see page18 .

Photo: Satish Kumar Sharma

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AN INCIDENCE OF STRONGYLOSIS IN CAPTIVE MARSH CROCODILES (*CROCODYLUS PALUSTRIS*)

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Abstract

Free-ranging and captive reptiles are infected by a diversity of parasites are responsible for their illness and death. Strongyles occur in a wide range of hosts and are cosmopolitan in their distribution. They have a direct life cycle and hence co-habitation of host is the key factor in their development. Marsh crocodiles are also susceptible to almost all parasites that affect other reptiles. Fresh pooled fecal samples were collected from the enclosures of 33 marsh crocodiles at the Chennai Snake Park. Samples were processed for endoparasites as per the standard procedure in the laboratory and the samples collected from the crocodile enclosures revealed eggs of strongyles sp., Egg Per Gram (EPG) count was 300 and fenbendazole at the dose rate of 50-100 mg /kg body weight as a single oral dose was advised. Frequent cleansing of the crocodile enclosures and good sanitation measures were suggested to control parasitism.

Keywords: Chennai Snake Park Trust, fenbendazole, Marsh Crocodile, *Strongyle* spp.

Introduction

The mugger or marsh crocodile (*Crocodylus palustris*) inhabits freshwater streams, rivers, lakes and ponds of most of south Asia, and is categorised as vulnerable in the IUCN Red List (2008) (Britton 2003). Free-ranging and captive reptiles are infected by a diversity of parasites. Crocodiles in India and around the world face population declines and extinction mainly due to climatic change and habitat loss. Hence, adequate conservation measures have been taken to maintain crocodilian species in captivity. But in ex-situ conservation measures, the continued stress of surviving in a captive environment negatively affects their physiology and immunity, making them more susceptible to parasite infections due to factors

that alter the host-parasite relationships. *Strongyles* occur in a wide range of hosts and are cosmopolitan in their distribution. They have a direct life cycle and hence co-habitation of host is the key factor in their development. The present study revealed evidence of *Strongyles* in marsh crocodiles and Siamese crocodiles reared in captivity at the Chennai Snake Park, Chennai, and suitable clinical approaches to fecal *Strongyles* in this species are discussed.

Materials and methods

Five fresh pooled fecal samples collected from the three enclosures having a total 33 marsh crocodiles–two enclosures consisting of both subadults and adults, and males and females and one enclosure of Siamese crocodiles having four adults. The collected fecal samples were subjected to routine parasitological examination by both sedimentation and floatation techniques and quantitative examination by Mc Master technique (Soulsby, 1982).

Results and Discussion

The samples collected from the marsh crocodiles revealed eggs of *Strongyles* sp. The Egg Per Gram (EPG) count was 300. Fenbendazole at the dose rate of 50-100 mg/kg body weight (Mader, 2006) as a single oral dose was advised. Frequent cleansing of crocodile enclosures and good sanitation measures were suggested to control parasitism. Junker *et al.,* (2006) also reported gastric nematodes in Nile crocodiles, *Crocodylus niloticus* (Laurenti, 1768), from the Okavango river, Botswana. Literature regarding the prevalence and intensity of gastric nematode infections in crocodiles and alligators is scanty and variable (Ladds and Sims 1990; Goldberg *et al.,* 1991).

Mader (2006) stated that *Dujardinascaris* and *Paratrichosoma* were two genera that appeared to be of significance in crocodilians and also stated that *Capillaria* spp. is the only known trichurid to infest squamates and crocodilians. Ladds and Sims (1990) also encountered eggs of *Dujardinascaris* sp. in 41% crocodiles examined and Goldberg *et al.,* (1991), opined that crocodilians could become infected at an early age. Wilson and Carpenter (1996) stated that susceptibility to disease caused by parasitism is related to the stress of captivity, environmental temperatures, cleanliness, concurrent disease, the number of parasites, availability of intermediate hosts, and the nutritional status and age of the host.

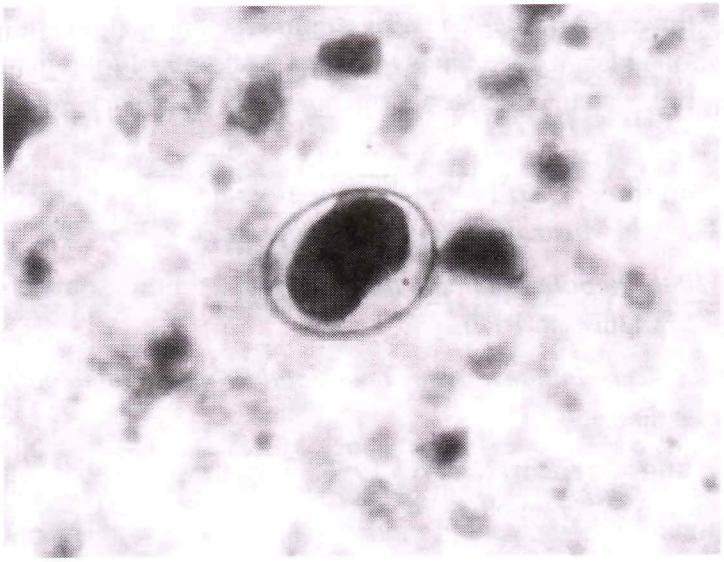

Fig. Slide of captive mugger fecal sample showing the egg of *Strongyles* sp. (encircled)

Conclusion

Strongyles sp. were detected in the captive marsh crocodile at Chennai Snake Park and therapeutic management with fenbendazole and frequent cleansing of crocodile enclosures with enrichment of good sanitation measures were suggested to control parasitism.

Acknowledgements

The authors are thankful to the Dean, Faculty of Basic Sciences, MVC, Chennai, the Executive Chairman and the Director, Chennai Snake Park Trust, Chennai for facilities offered and Department of Science and Technology for financial assistance during the study.

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COMPARISON OF SPATIO-THERMAL PROFILES OF TWO SPECIES OF INDIAN CROCODILIANS: MUGGER (*CROCODYLUS PALUSTRIS*) AND GHARIAL (*GAVIALIS GANGETICUS*) IN CAPTIVITY

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Introduction

Crocodiles, being the top predator of the threatened fresh water habitats are ideal flagship species for conservation. In India three species namely mugger (*Crocodylus palustris*), widespread throughout India, gharial (*Gavialis gangeticus*) restricted to the Gangetic river basin, and the salt water crocodile (*Crocodylus porosus*) found in mangrove forests occur (Daniel, 2002; Das, 2002; Pyrzakowski, 1989).

In some areas of northern India, more than one species occur. Particularly the two freshwater species muggers and gharials occur sympatrically, in the major north Indian rivers. Here they compete for basking and nesting sites. Gharials belong to a separate family Gavialidae and is unique for their narrow snout, almost exclusive fish-eating habits and more aquatic adaptations and lifestyle (Hvass, 1964). The mugger crocodile on the other hand has a broader snout, prefers a wider prey spectrum and is more terrestrial.

A fruitful approach to understanding patterns of species diversity is through analysis of the ways in which the component species actually subdivide the environment or partition available resource among themselves. The different ways in which the ecologies of the component species differ are the number of niche dimensions, and this is therefore an important determinant of species diversity (Burton, 1984).

Although several scientists have worked on Indian crocodilians (Kazi et al., 2012; Nair, 2010; Lang & Whitaker, 2010; Lang & Kumar, 2013; Patil et al., 2012; Chang et al., 2012; Bayani et al., 2011; Jayson & Padmanabhan, 2002; Joshi et al., 2011; Bhatnagar & Mahur, 2010), not much work has been focused on understanding the means by which crocodilian species coexist and partition the

resources. The present paper deals with the comparison of microhabitat selection between captive muggers and gharials housed in separate enclosures.

Materials and Methods

We conducted this study at Chennai Snake Park (13.00°N 80.14°E) during the cold season from November 2013 to December 2013. We compared microhabitat selection between two ecomorphologically divergent, sympatric species of crocodilians—mugger or marsh crocodile (*Crocodylus palustris*) and the gharials (*Gavialis gangeticus*) in captivity. We categorized the substrates in the enclosure of these crocodiles into three major microhabitats namely, Land, Water and Interface. These microhabitats were further categorized based on exposure to sunlight as, Sun, Shade and Both. A combination of both the substrate and sun-exposure based classifications were used for allocating every sighting. Direct observations were made for 20 hrs on each species. No binoculars were used. The temperature and the humidity of the enclosures were measured using a digital thermohygrometer. The ambient temperature of the mugger and the gharial enclosure ranged from 26.1°C to 29.3°C (mean=27.7°C). The no. of crocodile sightings at different microhabitats were noted and tabulated for each species separately. The time period, part of the day, humidity and the temperature were also noted. Then the average number of crocodile sightings (both the species) obtained in various spatio-thermal regimes were tabulated and the percentage sighting of each species in various spatio-thermal regimes was calculated and pictorially represented.

Study Species

Gharial (*Gavialis gangeticus*): A fish-eating crocodile, of the family Gavialidae. It is found in the Indo-gangetic river system. The family contains only one species and is characterized by a very long, narrow snout, with a knob-like structure which is more strongly developed in the males. Gharials are the only crocodilians with visible sexual dimorphism. They feed largely on fish and are much more aquatic than other crocodilians, for they only come on to the land during breeding season (Hvass,1964). One of the longest of living crocodilians, this species measures up to 6.25 m (20.5ft). They inhabit large rivers with high sand banks that they use for basking and building nests. Young ones eat insects, tadpoles, small fish, and frogs. Adults feed mainly on fish and sometimes small crustaceans. Courtship starts in December and mating takes place in January and February. The young ones hatch before the onset of the monsoon (Daniel, 2002; Das,2002; Pyrzakowski, 1989).

Mugger (*Crocodylus palustris*): India's commonest freshwater crocodile and lives in streams, rivers, lakes and ponds almost throughout the country. It is a rough skinned reptile that grows over 4 metres (13 feet) in length and weigh over 300 kilograms. Males of the species may grow 4 m (13 ft) to 4.5 m (15 ft) in length, but rarely exceed 3.7 m (12 ft). They are ambush hunters and wait for their prey to come close. They mostly prey on fish, reptiles, birds and mammals. The mammalian prey are usually small to medium sized, such as monkeys, chital and otters. Reproduction takes place in winter months (Bellairs, 1966; Daniel, 2002; Das et al.,1993; Das, 2002).

Enclosure details

Mugger enclosure: the enclosure consists of land and water areas. The enclosure consists of water body which is about (18x15x1) ft (length x breadth x depth). They also come up to the land area for basking. Soil is used as a substrate in the land area.. The Mugger enclosure has a perimeter of about 145 ft . Concrete fence is constructed around the enclosure. The enclosure consists of plants and trees to ensure proper vegetation and also helps to maintain an appropriate temperature for the crocodiles. The enclosure houses 23 adult Mugger crocodiles. Muggers are not sexually dimorphic and, therefore, the number of female and male crocodiles are not provided.

Gharial enclosure: The enclosure houses six adult gharials, of which one is male and the remaining are females. Gharials are the only crocodilians that are sexually dimorphic. Similar to Mugger enclosure, this enclosure also has land areas and water bodies. The perimeter of the land area is 130 ft. The measurements of the water body is (25x15x5) feet (length x breadth x depth). Soil is used as the substrate. Concrete wall has been constructed around the enclosure. Trees are planted so that they provide a proper shady area for the gharials a protect them from getting hot above the optimal levels.

Results

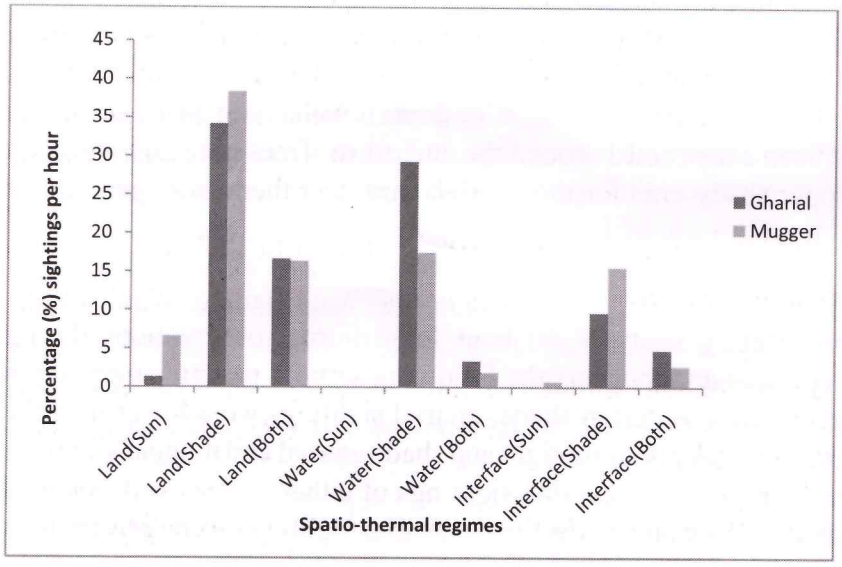
From a preliminary study of 40 hour long diurnal observations during winter on captive gharials and muggers the following activity pattern emerges. On land under sunlight as well as that in shade, gharial sightings were lower than the muggers by 4%. On land under both sunlight and shade gharial and mugger sightings were more or less the same. No crocodile sightings of either species was obtained in water under sunlight. In water under shade gharial sightings were greater than

mugger by 11%, the highest difference in any spatio-thermal regime. In water under both sun and shade, gharial sighting was just 1% higher than that of the muggers. In interface the gharial sightings were greater than the mugger by 1%. In interface under shade the gharial sightings were lower than the mugger by 6%. In interface under both sun and shade the gharial sightings were greater than the mugger by 2%.

Table 1. Percentage difference between captive gharials and muggers occupying various spatio-themal regimes.

Spatio-thermal regime	Species	Scale	Species	% difference
Land (Sun)	Gharial	<	Mugger	4
Land (Shade)	Gharial	<	Mugger	4
Land (Both)	Gharial	≥	Mugger	Nil
Water (Sun)	Gharial	Nil	Mugger	Nil
Water (Shade)	Gharial	>	Mugger	11
Water (Both)	Gharial	>	Mugger	1
Interface (Sun)	Gharial	<	Mugger	1
Interface (Shade)	Gharial	<	Mugger	6
Interface (Both)	Gharial	>	Mugger	2

Fig.1. Percentage sightings per hour of captive gharials and muggers across various spatio-themal regimes.



Discussion

Our preliminary diurnal winter observations indicate that gharials used water body more frequently than muggers. This pattern is similar to their behaviours in the wild (Daniel, 2002; Das et al.,1993; Das, 2002). Even though our sample of observed muggers (n=23) outnumbers that of gharials (n=6), it should be noted that the enclosures were correspondingly sized. As our sampling period coincided with the breeding season of the crocodiles, some in-fighting incidents were observed. But our observations suggest that they did not apparently fight for a place in the water body.

It is known that crocodiles perform well around 30°C (Bellairs, 1969). The observed air temperature values measured around the enclosures ranged from 26.1°C to 29.3°C (mean=27.7°C) consistent with the preferred range. This again suggests that in addition to the water bodies, shade providing trees present in the enclosure do offer optimal thermal conditions for the crocodiles during the daytime. Water temperature values and individual recognition-based further observations would throw more light on habitat preferences of these captive crocodiles.

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RECENT RECORDS OF KING COBRA (*OPHIOPHAGUS HANNAH*) FROM DRY EASTERN SLOPES OF SOUTHERN WESTERN GHATS, TAMIL NADU

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The king cobra is a large venomous snake distributed in many south and southeast Asian countries. Because of its elusive habits, despite its size this species has remained rather under-studied in terms of its natural history. Only recently has this species' biology been studied in India and aspects including its diet (Bhaisare et al., 2010), population dynamics (Gowrishankar et al., 2013a), habitat use (Rao et al., 2013), movement patterns (Barve et al. 2013), cannibalism (Gowrishankar & Whitaker, 2013), encounters with humans (Gowrishankar et al., 2013b) and nesting ecology (Whitaker et al., 2013). This recent influx of new fieldwork and surveys in the forest revealed new insights into the king cobra's natural history, that was previously largely built upon observations of captive animals.

The king cobra, despite its apparently widespread distribution, has always been considered rare throughout its range in India (and elsewhere), except in some places like Arunachal Pradesh, Karnataka and Andaman Islands (Whitaker & Captain, 2004). In particular it has been widely reported to live in the vicinity of dense, wet evergreen forests and stable water bodies (Das, 2002; Daniel, 2002; Whitaker, 1976). Daniel (2002) remarks on Narayan & Rosalind (1990) finding of king cobra in grasslands of the Manas, Assam in northeast India as unusual.

Since precise published records of king cobras from drier landscapes are rare, I present my sighting records of wild king cobras, from dry deciduous forest tracts in the eastern slopes of the Southern Western Ghats in Tamil Nadu. During observations, both the snakes studied were photographed and basic scalation and morphomteric details (after Whitaker & Captain, 2004) were collected. The one live snake was gently restrained for data collection.

Two adult king cobras were sighted in September 2012, the post monsoon season in two nearby sites abutting forest buffer zones. The first snake was seen dead

in a plantation site consisting of coconuts and tamarind in Rajapalayam (9°26'N 77°32'E; 125 m asl), a town in Viridunagar ditrict at the foothills of Srivilliputhur Sanctuary. The second snake was sighted alive in a dry deciduous forest area in Kadayam (8°49'N 77°21'E; 105 m asl) in Tiruneveli district abutting the Kalakkad-Mundanthurai Tiger Reserve. Rajapalayam and Kadayam are approximately 90 km apart, north and south of the Sencotta Gap. Both the localities are situated along the eastern foothills rain-shadow area on the leeward slopes of the Southern Western Ghats and are thus covered by drier forests than would occur in the much higher and wetter, Western Ghats proper (Champion & Seth, 1968).

Table. Details of the two adult king cobras studied. Measurements in cm.

Characters	**Individual 1(dead)**	**Individual 2 (live)**
Maturity & sex	Adult male	Adult female
Snout-vent length	305	295
Tail length	67	59
Total length	372	345
Head length	9.5	8.7
Head width	8	5.8
Mid body width	9	8.3
Width at neck level	6.5	7.2
Width at tail base	5	4.4
Width at mid-tail	1.8	1.3
Dorsal body colour	Yellowish brown	Yellowish brown
No. of bands	35 on body, none on tail	30 on body, none on tail
No. of coastal scales	19:15:15	19:15:15
No. of ventral scales	245	242
No. of subcaudal scales	89 (15 single, 74 paired)	80 (40 single, 40 paired)

Gowrishankar et al. (2013a) report adult males from Agumbe region to be dark olive to grayish black with mild yellow cross bars. However, both the snakes reported herein were dull brownish yellow in colour, with the hind body and tail being slaty grey. Considering the fact that dark body colouration is an adaptation to absorb heat from the environment, it is understandable that the overall dorsal body colouration of these snakes was much lighter than those from the wet and densely forested Agumbe (Gowrishankar et al., 2013a).

As for the occurrence of king cobras in the present landscape, previous workers who surveyed Southern Western Ghats have recorded king cobras mostly in the hill forests. In the case of Rajapalayam that is near Srivilliputhur Sanctuary, Malhotra & Davis (1991) and Chandramouli & Ganesh (2010) surveyed the region but did not record king cobra. In the case of Kadayam, which is near Kalakkad-Mundanthurai Tiger Reserve, Ishwar et al. (2001) who surveyed evergreen forests from 700-1300 m asl recorded king cobra but Vijayakumar et al. (2006) who surveyed the lower Mundanthurai plateau did not. However, it must be noted that king cobras are essentially rare in this landscape and published field sightings have been very few even within its known range (Hutton & David, 2009; Bhupathy et al., 2013).

Figure 1. Dead adult male king cobra observed in Rajapalayam

Figure 2. Live adult female king cobra sighted in Kadayam

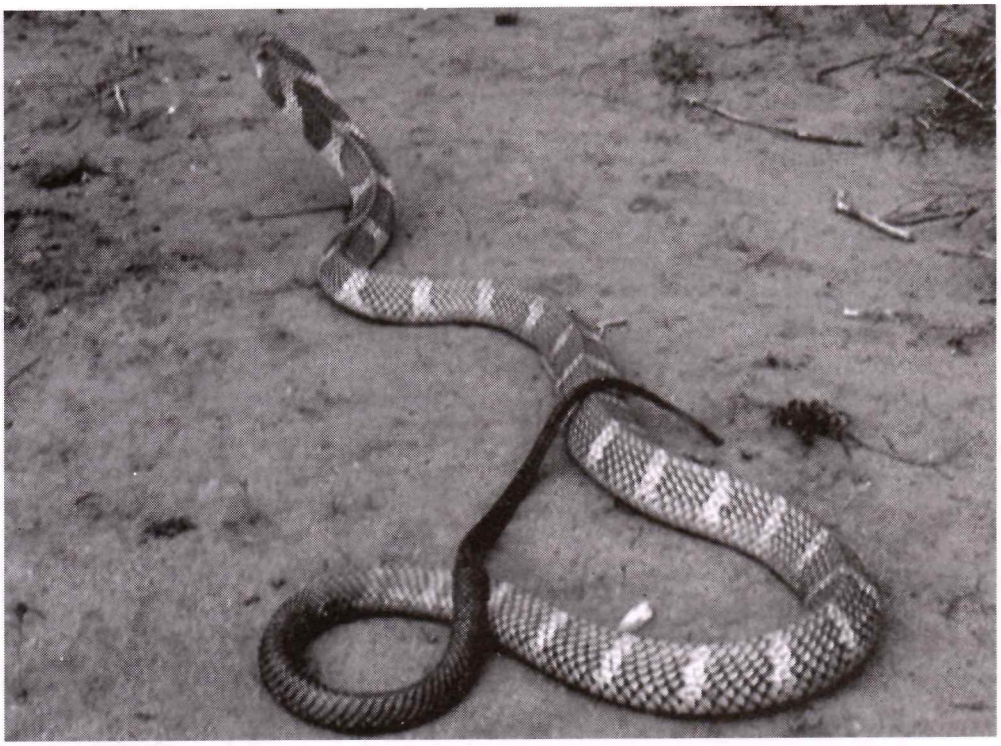
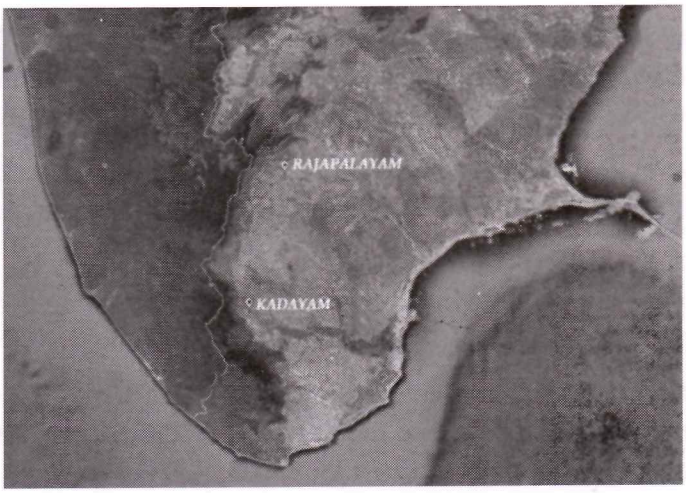


Figure 3. Map showing the sighting localities Rajapalayam and Kadayam



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OCCURRENCE OF RED-SPOTTED ROYAL SNAKE *SPALEROSOPHIS ARENARIUS* (BULENGER, 1890) IN JALORE DISTRICT, RAJASTHAN

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Red-spotted Royal Snake *Spalerosophis arenarius* (Boulenger, 1890) is a rare, non-venomous, colubrid snake inhabiting the Thar desert in northwestern India and the adjacent parts of Pakistan (Bhide, 2004; Mathur, 1975; Minton, 1966; Khan, 1985; Whitaker & Captain, 2004). Being a rare snake, precise distribution records are scarce, and exact reports are from parts in Sikar district of Rajasthan in India (Whitaker & Captain, 2004). In Rajsthan, this species is locally called *Lal Gurav* (Dr. Dharmendra Khandal, pers.com., 2013).

On 22nd June 2013 at about 10:00 hrs, a full grown red-spotted royal snake was seen near Sanchor (or Sanchore) in Jalore district in South-West Rajasthan. Sanchor (24°6'N 72°00'E; 52 m asl) is situated in the southwestern corner of Rajasthan and borders the northern parts of Gujarat state. This area falls under arid zone tract of the state and is a part of Thar desert. The landscape of the area is sandy with sparse shrubby vegetation, scattered with Khejri trees (*Prosopis spicigera*) that is predominant here.

The snake observed in Sanchore had the following diagnostic morphological characters: three short stripes on neck (one dorsal and two dorsolateral), the first curved band was present on head and continued as an oblique streak from eye to behind mouth; dorsum had red spots and venter was glossy white; dorsal spots were larger in size while dorso-lateral and lateral spots were smaller. The snake was present in the proximity of bushes and it escaped into the thickets.

Another individual of this species was seen and captured on 23rd October, 2013 at about 11:30 hrs in Hemguda village in Sanchor tehsil by the forest officials of Jalore Forest Division. Three persons were bitten by the snake. Being a non-venomous one, all survived. The snake was euthanized, preserved and submitted as

a voucher specimen by the Forest Dept. officials to the Zoological Survey of India, Jodhpur, for records.

Sikar district, the known site of occurrence of this species, is situated towards northeastern end of the State while present record is from Jalore district, which is situated towards the southwest end. Distance between two district headquarters is around 375 km. It indicates that, though this species is rare, it is distributed widely in the State, West of Aravallis in arid sandy tracts. More sightings are needed to better document the precise range of this species in Rajasthan. This is important since the snake is described as rare and confined to Rajasthan in India.

Acknowledgements

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A CASE OF OPEN TRAUMATIC WOUND TREATMENT IN COMMON SAND BOA (*GONGYLOPHIS CONICUS*)

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An injured adult common sand boa (*Gongylophis conicus*) measuring about 75 cm that was beaten by people, was rescued by members of Wildlife Association of Rajapalayam and Forest deportment staff on 9th JAN 2014 was referred to me for treatment. The snake had a bulge in its stomach suggesting a recent feeding. The snake was not in ecdysis.

On preliminary inspection, the snake was observed having an open wound on left side midportion of the abdominal region (see figure). The wound measured approximately an inch in size. Bleeding from the wound was noticed. The wound was still covered with muscle and no ribs were visible. The snake had restricted movement and, overall, appeared rather dull and sluggish. No spine injury could be detected from its movement.

The snake was then medically examined. The snake's behaviour when handling was placid. Otherwise its body conditions appeared normal. Skin and coat were damaged in some portions. Respiration was normal. Around the wounded region, a marked bilateral swelling was noticed. Protrusion of intestinal portion through the open wound was noticed. There was no intestinal damage. Other tests did not reveal any major clinical complications, particularly in its musculoskeletal system.

Hence the case was diagnosed as deep open traumatic injury on left side midportion of the abdomen. The snake was then treated as follows. The wound was washed with 2% povidone solution and the dirt and debris were removed. To arrest the bleeding forceps was applied on to the blood vessel passing through the wound. Further, stay suture (3-0 polyglycolic acid synthetic absorbable suture) was applied. Adrenalin was also topically applied. Then the protruding intestinal portion was restored.

Topical application viz. Povidone Iodine and Vetbacin were applied over the wound. Bandage was then applied around the wound. Injection Enrofloxication (antibiotic) 0.3ml was administered intramuscularly. Melonex (anti-inflammatory analgesic) 0.5 ml was administered intramuscularly. Then the snake was left undisturbed.

The snake was housed in a clean, dry, airy bird-cage-sized terrarium and was provided with a water trough and a small heat-lamp for temperature regulation. The next day, i.e., on 10th, the snake had regurgitated the prey. It was a large rat. Then further treatment was continued. After the regurgitation, the abdominal swelling near the wound also appeared to be reduced. The snake appeared active and alert.

From 10th onwards, in addition to the above treatments, Topicure spray was also applied. Wound dressing was also continued. Electrolyte powder and dextrose were given in liquid medium (dissolved in water) to the snake. A live mouse was given to the snake but considering the wound, we did not force-feed it. The snake did not eat the mouse. However the snake was observed taking the water treated with medicines periodically and appeared normal.

On 30th, upon observation the snake's wound showed signs of healing. Some mild skin growth at the wound was noticed. The snake was later safely released. Considering the general lack of published information in Indian snake trauma and treatment the present observation is noteworthy.

Fig. Treatment of open traumatic wound of common sand boa.

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I thank the Wildlife Association of Rajapalayam (WAR) for referring the case to me and for facilities provided. I am grateful to Dr. Senthil Kumar, Asst. Prof., Dept. of Surgery, VC & RI, Namakkal for his advice.

A NOTE ON PREYING OF ROCK GECKO (*HEMIDACTYLUS MACULATUS* DUMÉRIL & BIBRON, 1936) ON BROOK'S GECKO (*HEMIDACTYLUS* cf. *BROOKII* GRAY, 1845)

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Hemidactylus maculatus Duméril & Bibron, 1936 is a nocturnal, rock-dwelling gecko, one of the largest geckos in the Indian subcontinent, and is endemic to the Northern Western Ghats in Gujarat, Maharashtra states (Agarwal et al., 2011). Only meager information is available in literature regarding its behaviour, ecology and natural history. Recently, we recorded a rare event in which a *Hemidactylus maculatus* was actively preying on a *Hemidactylus* cf. *brookii.*

On 28 May 2013, at 22:30 hrs while searching for amphibians and reptiles, we observed a few juvenile and adult specimens of *Hemidactylus maculatus, H.* cf. *brookii* and *H. flaviviridis* on pillars of a bridge on Khapari River, connecting Vaghai and Ahwa, Dang District, Gujarat, India. After a few minutes, an adult *H. maculatus,* measuring approximately 260 mm was observed lunging at an adult *H.*cf. *brookii,* measuring approximately 90 mm and swallowing it in rapid succession using a sideways head jerk. After this action the *H. maculatus* retreated to a fracture in to the pillar. Like many other geckos, *H. maculatus* feeds mainly on arthropods. However, *H. maculatus* actively preys on small vertebrates such as geckos, skinks,

agamid lizards, small birds and small mammals (Daniel 2002). Predation of rodent by *H. hunae* has also observed in Sri Lanka (Karunarathna & Amarasinghe 2011).

Hemidactylus is the most species-rich Indian gekkonid genus with at least 25 described species from India (Agarwal *et al.* 2011). All species of genus *Hemidactylus* are nocturnal and active predators, feeding mainly on insects with the exception of *H.*cf. *brookii* (Mirza & Ahmed 2010), *H. flaviviridis, H. leschenaultii, H. maculatus* and *H. frenatus* which are known to be cannibalistic and/or to devour sympatric species of the same kind (Daniel, 2002). Though dominant across the subcontinent, *Hemidactylus* geckos remain poorly known, especially in terms of natural history and behavior. Further studies on the feeding habits may reveal additional information on the prey-predator relationships among the *Hemidactylus* geckos species.

Acknowledgement

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Figure: *Hemidactylus maculatus* preying on a *Hemidactylus* cf. *brookii.* (Picture Credit: Bhargav Parmar)

RANDOM HARVEST

The 'Tanjore Pill'

In discussions on native antidotes to snake venom, reference is often made to the so-called 'Tanjore pill'. A paper on the 'Tanjore pill', entitled "The arsenic and mercury-containing Tanjore pills used in treating snakebites in the 18th century Madras Presidency" authored by Raman et al. has appeared in the journal *Current Science* vol. 106, no. 12 in June 2014. The article traces the history of the Tanjore pill including how it was named. It was a native medical practitioner hailing from Tanjore (now Thanjavur) who first made out its claim as a cure for snake envenomation. The authors highlight the controversies concerning the pill's antidotal properties in which figured many scientists such as Johann Reinhold Forster from Halle, Germany, Christoph(er) Samuel John, a Lutheran missionary in Tanjore, James Anderson, Surgeon-General in Madras, William Duffin, a surgeon in Vellore and also Patrick Russell (the 'Father of Indian Ophiology'), to name a few. The safety of the pills had been questioned because their active ingredients were found to be toxic and potentially lethal chemicals like arsenic and mercury. The authors go on further to state that, however, based on some agreement in principle on the therapeutic uses of arsenic against several human aliments, benefit from the pills need not be dismissed out of hand. The authors provide supportive evidence on the therapeutic uses of these 'toxins' not only from ancient herbal remedies sourced from many native Indian plants but also from modern allopathic drugs. They allude to parallel dictums such as *like cures like* as occurs in Hippocrates (5th to 4th Century BC), Aryadeva (3rd Century AD) and Hahnemann (18th to 19th Century AD). The authors conclude that the question whether the Tanjore pill has remedial or only placebo effect stands unresolved.

* * * * *

New frogs from Western Ghats

A recent article by S.D. Biju et al. that has appeared in the *Ceylon Journal of Science* vol. 43, issue 1 describes 14 new species of 'Indian dancing frogs' (*Micrixalus*) that are endemic to the Western Ghats. The study is based largely on DNA barcoding – a recent advancement in molecular taxonomy. The study resolved some longstanding problems in a few previously known frogs and rediscovered some 'lost' species. The regions inhabited by the new frogs fall in many southern states viz. Tamilnadu, Kerala, Karnataka, and also in Maharashtra–where the team first documented the presence of *Micrixalus* frogs. The scientists remark on the conservation status of some of the known and new species by providing information of their very restricted distribution, that often fall outside the current Protected Area Network. They explain that this situation demands refining of protected areas along the Western Ghats, particularly targeting at some hill ranges that are not even partially protected. The article also describes the skeletal structure of these frogs for the first time, using clear staining method. Another important finding is the 'foot-flagging' or 'dancing' behavior in some of these frogs based on field observations. The paper concludes by highlighting the dearth of knowledge on Indian amphibians and recommend further studies.

Another paper by K.V. Gururaja et al. in *Zootaxa* vol. 3796, issue 1, describes a new type of parental care behavior in a new species of night frog (*Nyctibatrachus kumbara*). The authors observed the new species in Sharavathi River Valley in Karnataka. The authors record its unique 'mud-packing' behaviour wherein the male, after breeding and egg-release by the female, packs the laid egg clutches with mud. The male scoops up mud from the ground in its forelimbs and carefully spreads it over the eggs. The authors remark that the purpose of the mud layer should be to protect the vulnerable eggs from desiccation and, perhaps, predators. Most appropriately, this new species of frog has been named *kumbara* which in kannada, and some other Indian languages, means potter.

In a paper published in vol. 83 of *Contributions to Zoology*, authored by S.D. Biju et al. from the Univ. of Delhi, India, Univ. College Dublin, Ireland and Univ. of Peradeniya, Srilanka, a molecular taxonomic study of the golden-backed frogs in the Western Ghats-Sri Lanka biodiversity hotspot is presented. These frogs belonging to the genus *Hylarana*, in the family Ranidae, is one of the widespread groups of stream-dwelling frogs of the old world, extending from Africa, through Asia onto tropical Australia. The golden-backed frog taxonomy is challenging due

to lack of clear-cut morphological features to distinguish species, and this, the authors say, has resulted in many misidentifications during the past 150 years. The authors conducted extensive field surveys throughout the Western Ghats-Sri Lanka biodiversity hotspot and performed multiple gene barcoding using 103 samples collected from cultivated land and natural habitats. These revealed the presence of 14 candidate species in the region, as against the previously known 4 species. They have not only described seven new species, but also revalidated some species that were previously considered invalid, from both the countries, thus doubling the number of known golden-backed frog species in the region. The authors emphasise that there are no species of golden-backed frog shared between the Western Ghats and Sri Lanka.

* * * * *

New lizards from Western Ghats

A paper by Zeeshan Mirza et al. in the journal *Zootaxa* vol. 3815, issue 4, describes a new species of gecko named *Cnemaspis girii* from the Kaas plateau in western Maharashtra. The new species is named after the well-known Indian herpetologist Dr.Varad Giri of the BNHS. Incidentally, a few years ago Dr. Giri and his team described a new *Cnemaspis* gecko from Maharasthra named *Cnemaspis kolhapurensis.* The authors remark that their study illustrates the need for dedicated herpetofaunal explorations in the northern Western Ghats.

Another paper by Zeeshan A. Mirza and Rajesh V. Sanap in the journal *Taprobanica* vol. 6, issue 1 describes a new species of gecko *Hemidactylus acanthopholis* from dry rocky hillocks in the Tirunelveli district of Tamilnadu. Its name alludes to its spiny scales. This long-known 'new' species has in the past been mistaken for another closely-resembling rock gecko from Maharashtra, *Hemidactylus maculates.* In fact, the new gecko was collected as early as the 19th century by Col. R.H. Beddome in the 1860s. Beddome's specimens housed in the Natural History Museum, London were studied by the authors, who found the gecko to be distinct from *H. maculatus*, contrary to what was considered earlier. The study highlights the importance of geographical distribution and also examination of very old but yet valuable historical museum specimens.

A new species of day gecko named *Cnemaspis kottiyoorensis* was described by V.P. Cyriac and P.K. Umesh in vol. 21, no.3 of *Russian Journal of Herpetology*. The new lizard was named after its locality – Kottiyoor. This region comprises

of tropical rain forest on hills raising more than 1000 m, forms part of a recently proposed wildlife sanctuary covering the Kannur and Wayanad districts of Kerala. The species is usually found under rocks in evergreen forests, particularly adjoining streams. The authors remark that the new species lays pairs of round eggs under fallen logs on the ground, mainly during February. When disturbed, it will escape into the surrounding leaf litter and remain still, making it hard to detect. The authors remark that their description of a new gecko resembling another species *C. wynadensis* indicates a largely hidden diversity of south Indian herpetofauna.

* * * * *

Studies on evolution of India's bent-toed geckoes

In a series of papers by Ishan Agarwal and colleagues from the Centre for Ecological Sciences, Indian Inst. of Science, India, and the Villanova University of USA, the evolutionary histories of three groups of Indian 'bent-toed geckoes' (in contrast to the expanded toes in house geckoes like *Hemidactylus*) have been studied in detail. In all the three papers in general, the authors based on extensive genetic data, explain the evolutionary patterns of these lizards in light of the synchronous geological changes that happened in the Indian subcontinent. The authors also remark on the dominant presence of undescribed species in many of the studied groups and say that the gecko diversity has been grossly under-estimated for want of robust taxonomy and geographic sampling.

The first paper titled "A phylogeny of the Palaearctic naked-toed geckos (Reptilia, Squamata, Gekkonidae) reveals a radiation of cryptic species and Miocene diversification of geckos in the Indian dry zone" published in vol. 43 of *Zoologica Scripta* details about the impact of geological changes in the Thar Desert and the north-western frontier of Indian subcontinent on the diversification and evolutionary radiation of many poorly-known genera, mainly focusing on *Cyrtopodion* rather confined to dry-zone of the northwest and parts of central India.

In the second paper titled "Insights into Himalayan biogeography from geckos: A molecular phylogeny of *Cyrtodactylus* (Squamata: Gekkonidae)" published in vol. 80 of *Molecular Phylogenetics & Evolution*, the authors deal with lizards of the genus *Cyrtodactylus*. In this paper, the focus was on Himalayas and northeast hill-states, with samples included from adjacent East-Asian countries as well as from the Andaman and Nicobar Islands. An important finding in the paper

deals with the trans-oceanic than trans-continental dispersal mechanism followed by the lizards to reach peninsular India where the species had later diversified.

In the third paper titled "A phylogeny of the only ground-dwelling radiation of *Cyrtodactylus* (Squamata, Gekkonidae): diversification of *Geckoella* across peninsular India and Sri Lanka" appearing in *Molecular Phylogenetics et Evolution*, the authors deal with peninsular Indian Srilankan species. One of the major conclusions is about *Geckoella*, which previously believed to be a genus by some scientists, which was found to be well nested within a larger group of *Cyrtodactylus* lizards. Also, the authors compare and contrast the evolutionary pattern of the bent-toed geckoes with that of the *Hemidcatylus* geckoes inhabiting the same area at the same time. An interesting outcome of the study is that ground-dwelling and rock-dwelling habits evolved in these lizards mainly in relation to their evolutionary time of origin and their body size.

These three papers together make fundamental contributions to studies on Indian geckoes.

- B. Vijayaraghavan

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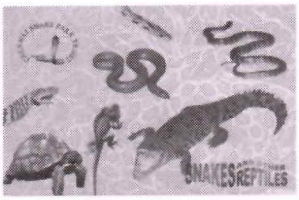

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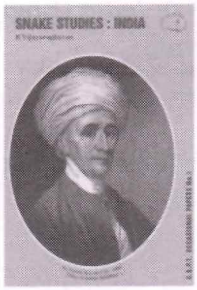

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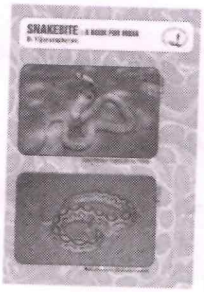

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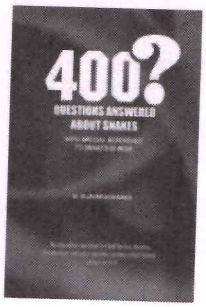

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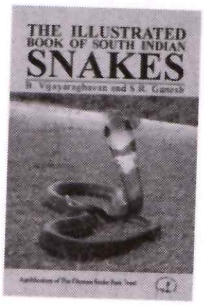

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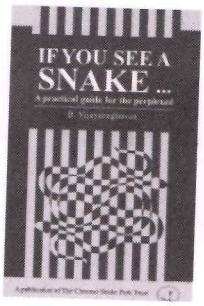

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