

**Nesting ecology of the King Cobra, *Ophiophagus hannah*, (Reptilia: Squamata: Elapidae) in Aizawl District, Mizoram, India**

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**Abstract**

This paper present the results of the nests survey of the King Cobra in the Aizawl District of Mizoram, India with data collected between the 2009 and 2012 during the nesting seasons. A number of eighteen (18) nests were monitored during this period. Collection on the data of location, elevation, vegetation, nesting materials, nest dimensions, clutch size, egg size, temperature and relative humidity inside and outside the nest, and incubation periods were recorded. During the survey period, all nests were sighted between the months of April and July, and documentations on the various stages of the embryological development within the egg shells and the duration of the female King Cobra sitting on the nest were recorded. The range of clutch size 14 - 35 in the wild is a new information on the biology of King cobra, where the existing literature reported the clutch size of between 20 – 43. All the nests were found in between the elevation of 161 m to 1170 m asl. This finding also provided the habitats, distribution and extension range of King cobra in Mizoram.

**Keywords:** Nesting ecology, King cobra, Aizawl District, Mizoram, India.

**Introduction**

The king cobra, *Ophiophagus hannah* (Cantor), belongs to the monotypic genus of the family Elapidae. Several distinct pattern and color morphs exist (Scott, 2008) and this monotypic genus of the family Elapidae is considered as a species complex (Das, 2002). It is considered to be the largest venomous snake in the world, capable of attaining a length of 4.8 m to 6 m (Campden-Main, 1970; Cox, 1991; Daniel, 1983; Schmidt and Inger, 1957; Zug, 1993; Whitaker and Captain, 2008).

Globally, the species is distributed in India, Bangladesh, Bhutan, Myanmar, Nepal, South China, Macao, Laos, Thailand, Malaysia, Indonesia, Hong Kong, Brunei Darussalam, Cambodia, the Philippines, Singapore and Vietnam, (David and Vogel, 1996; Scleich and Kestle, 2002). In India, the distribution range of the species is recorded as

Western Ghats, Uttar Pradesh (Terai), Bihar, Orissa, West Bengal, northeast India and also the Andaman Islands (Whitaker and Captain, 2008). It is regarded as widespread, but uncommon (David and Vogel, 1996). In its distributional range, the species is recorded from various habitat types such as lowland wet tropical forest, coastal rainforest, tropical and subtropical wet montane forest, dry forest, swamps and marshes, mesic open scrubland, plantation and cultivated areas, alluvial and terai grassland, mangrove swamps, open country and disturbed areas, and near human habitations (David and Vogel, 1996; Scleich and Kestle, 2002; Leviton *et. al.*, 2003; Narayan and Rosalind, 1989).

Being a large and conspicuous reptile, King cobra has received scientific attention from various perspectives since its first description (see Das and Whitaker, 1996). In

the wild, female King Cobra are reported to constructed a two-storey chambered nest from leaf litter and other plant materials, the eggs being deposited in the lower chamber while the female, at times, may reside in the upper chamber (Loveridge, 1946; Schmidt and Inger, 1957). Female king cobras are reported to guard the eggs from potential predators (Campden-Main, 1970; Cox, 1991; Daniel, 1983; Loveridge, 1946; Whitakers *et. al.*, 2013). Male king cobras have also been reported to participate in guarding the nest (Loveridge, 1946; Schmidt and Inger, 1957). The king cobra nesting season in India extends from April to July (Daniel, 1983). However, in comparison to the availability of literature concerning its systematics, diet, general biology, husbandry, venom and envenomation, there is a dearth of information regarding its regional distributional locality records, which is a serious concern when planning out conservation strategies for the species, and a very little is known about the nesting ecology of the king cobra population of North-Eastern India, especially in Mizoram.

**Materials and methods**

The primary data used in the present study on King Cobra nests between the years 2009-2012 was mainly depending upon the information provided by local people while collecting bamboo shoots and cultivation nearby the nesting sites. Apart from visiting, the local people were informed and requested to monitor the presence of the mother with minimum disturbance. The location of each nest was recorded with the help of the GPS Garmin etrex. Temperatures of the nests' chamber and the surrounding atmospheric air were recorded using a manual mercury thermometer and the humidity using hygrometer, and the flora around the nests were identified. The diameter, circumference and height of the nesting chamber and the nest were measured using a measuring tape (least count = 1 mm). The diameters of each nest were measured at two different positions (north to south and east to west) and the circumferences were also taken.

**Table 1: The years, date of sighting of the nest, locality, coordinates and elevations of the nests**

Sl. No.	Year	Date of sighting	Place	Location		Elevation (in meter)
				Latitude	Longitude	
1	2009	27/06/09	Keifang I	23° 40' 16"N	92° 57' 33"E	1022
2	2009	04/07/09	Keifang II	23° 39' 40"N	92° 59' 09"E	858
3	2009	20/07/09	Seling I	23° 42' 46"N	92° 52' 14"E	687
4	2009	07/08/09	Seling II	23° 42' 59"N	92° 52' 52"E	455
5	2010	28/05/09	Mualpui	23° 43' 16"N	92° 44' 18"E	749
6	2010	20/6/09	Dilkhan	23° 44' 56"N	92° 57' 37"E	1170
7	2010	20/06/10	Bolui	23° 42' 07"N	92° 45' 18"E	566
8	2010	25/06/10	Lawipu	23° 43' 25"N	92° 40' 15"E	558
9	2011	03/06/10	Reiek kai I	23° 42' 25"N	92° 40' 1"E	195
10	2011	21/06/11	Phunchawng	23° 45' 44"N	92° 40' 47"E	713
11	2011	05/07/11	Mibolui	23° 43' 35"N	92° 44' 47"E	773
12	2011	14/7 /11	Saitual	23° 41' 00"N	92° 59' 14"E	912
13	2011	15/7/11	Damdiai	23° 31' 15"N	92° 41' 57"E	673
14	2012	01/05/12	Reiek kai II	23° 42' 38"N	92° 40' 7"E	202
15	2012	15/05/12	Reiek kai III	23° 42' 59"N	92° 39' 3"E	161
16	2012	05/06/12	Sailam	23° 19' 21"N	92° 47' 40"E	677
17	2012	21/07/12	Mualzen I	23° 44' 46"N	92° 45' 29"E	532
18	2012	21/07/12	Mualzen II	23° 44' 45"N	92° 45' 29"E	542

The height of the nest chamber from the ground is abbreviated as c/h. The diameter of the nest and the diameter of the nest chamber are abbreviated as  $\varnothing_n$  and  $\varnothing_c$ , respectively. During the period of survey (2009-2012), 18 nests were monitored within the Aizawl district of Mizoram. Since the nests were located in a hilly slope, the height is taken at two places - the up-slope and the down-slope and abbreviated as u/s and d/s respectively.

**Results and discussion**

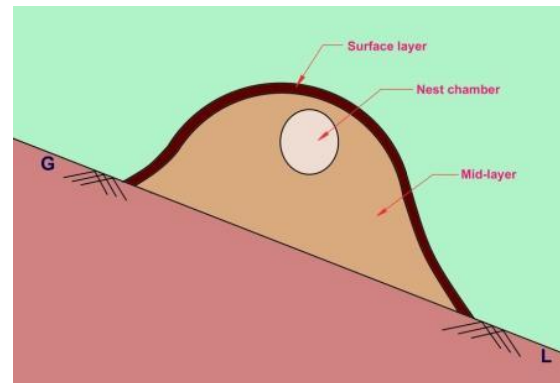
During the course of our herpetological field work (2009-2012) in different parts of Mizoram, we came across new distributional localities of King cobra. Eighteen (18) nests of King cobra were sighted and monitored from various parts of the Aizawl district (Table 1).

**Nesting habitats and ecology**

Moreover, the present study reveals that all the nests were constructed at the edge of bamboo forest areas adjacent to other forest communities. It was also noticed that King cobra occupy a wide variety of habitats. The landscape also contains an irregular mosaic of different type of bamboo forest with *Mikania micrantha*, *Chromolaena odorata*, *Erianthus longisetosus*, etc. All the nests are located on a well-drained slope in such a way that the flash flood cannot reach it. They are mainly located at the base of a bamboo thicket usually enclosing a bamboo tree or two, which seems to give extra anchorage giving more stability to the nest and any direct sunlight hardly reaches the nest at any given time of a day. The nests are all located near a source of fresh water, not more than 300 meters away from a stream or river. The sources of water may be perennial or non-perennial but, they all have regular flow throughout the nesting period.

The nesting materials consist primarily of dried bamboo leaves heaped up in a dome shape. It was found that among dry leaves of bamboos, though *Melocanna baccifera* and *Bambusa tulda* were found in

and around the nests, *Dendrocalamus longispathus* and *Bambusa longispiculata* are the most common utilised for nesting material (Table 2). The nest can be divided into three parts- i) Surface layer, ii) Mid-layer and iii) Nest chamber (as shown in Fig. 1)



**Fig.1: Layers of nest**

Surface layer is formed as nature force like rain acted upon the nest compacting and binding the dead leaves together forming a partially impervious layer. The thickness of this layer increases with time. Mid-layer is loosely compacted as compared to the outer layer and are partially pervious. Nest chamber is located on the upper part of the mid-layer having a well clearance from the ground and the eggs are placed and incubated in this chamber. The nesting season of the king cobra of the Aizawl district begins from late April and may extend up to July which agreed with the previously reported nesting season in India i.e. April to July (Daniel, 1983). The nesting seasons of king cobra may depend upon by the timing of rainfall in a year. In contrast to a female King Cobra reported to construct a two-storey chambered nest (Loveridge, 1946; Schmidt and Inger, 1957), all of the nest surveyed have only one chamber with the female king cobra coiling up above the nest, guarding the eggs from potential predators as previously reported (Campden-Main, 1970; Cox, 1991; Daniel, 1983; Loveridge, 1946; Whitaker *et. al.*, 2013). During the present investigation, no male king cobra is sighted on

Table 2: Main flora identified around the nests

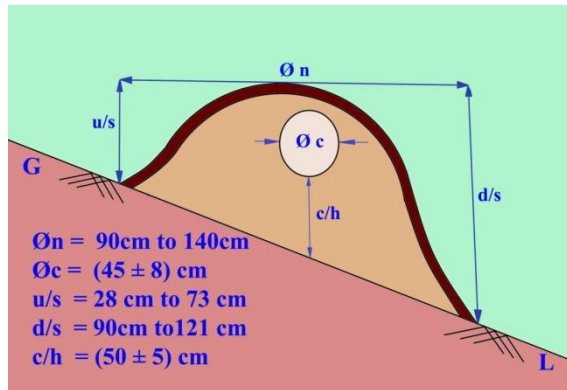
Sl. No.	Year	Place	Flora
1	2009	Keifang I	<i>Melocanna baccifera</i> , <i>Bambusa longispiculata</i> , <i>Toona ciliata</i> , <i>Mikania micrantha</i>
2	2009	Keifang II	<i>Dendrocalamus longispathus</i> , <i>Bambusa longispiculata</i> , <i>Toona ciliata</i> , <i>Mikania micrantha</i>
3	2009	Seling I	<i>Dendrocalamus longispathus</i> , <i>Musa paradiasica</i> , <i>Sida acuta</i>
4	2009	Seling II	<i>Bambusa longispiculata</i> , <i>Teridium sp.</i> , <i>Canna orientalis</i> , <i>Colocasia sp.</i>
5	2010	Mualpui	<i>Dendrocalamus longispathus</i> , <i>Bambusa longispiculata</i> , <i>Passiflora nepalensis</i> , <i>Saraca ascosa</i> .
6	2010	Dilkhan	<i>Bambusa tulda</i> , <i>Chromolaena odorata</i> , <i>Mikania micrantha</i> , <i>Bridelia monoica</i>
7	2010	Bolui	<i>Bambusa longispiculata</i> , <i>Dendrocalamus longispathus</i> , <i>Colocasia sp.</i>
8	2010	Lawipu	<i>Dendrocalamus longispathus</i> , <i>Bambusa longispiculata</i> , <i>Spondius pinnata</i> , <i>Engelhardtia spicata</i>
9	2011	Phunchawng	<i>Dendrocalamus longispathus</i> , <i>Erianthus longisetosus</i> , <i>Mikania micrantha</i> , <i>Chromolaena odorata</i> , <i>Albizia procera</i>
10	2011	Mibolui	<i>Bambusa longispiculata</i> , <i>Erianthus longisetosus</i> , <i>Chromolaena odorata</i> , <i>Colocasia esculenta</i>
11	2011	Saitual	<i>Dendrocalamus longispathus</i> , <i>D. hamiltoni</i> , <i>Erianthus longisetosus</i> , <i>Mikania micrantha</i> , <i>Cymbopogon hirtus</i> .
12	2011	Damdiai	<i>Bambusa longispiculata</i> , <i>Erianthus longisetosus</i> , <i>Betula alnoides</i> .
13	2011	Reiek kai I	<i>Bambusa longispiculata</i> , <i>Erianthus longisetosus</i> , <i>Blumea alata</i>
14	2012	Reiek kai II	<i>Melocanna baccifera</i> , <i>Bambusa longispiculata</i> , <i>Dendrocalamus longispathus</i> , <i>Colocasia sp.</i>
15	2012	Reiek kai III	<i>Bambusa longispiculata</i> , <i>Dendrocalamus longispathus</i> , <i>Betula alnoides</i>
16	2012	Sailam	<i>Melocanna baccifera</i> , <i>Bambusa longispiculata</i> , <i>Mikania Micrantha</i> , <i>Musa paradiasica</i>
17	2012	Mualzen I	<i>Dendrocalamus longispathus</i> , <i>Bambusa longispiculata</i> , <i>Arisaema specciosum</i> , <i>Colocasia sp.</i>
18	2012	Mualzen II	<i>Dendrocalamus longispathus</i> , <i>Bambusa longispiculata</i> , <i>Arisaema specciosum</i> , <i>Colocasia sp.</i>

and around the nest despite the report of male participating in guarding the nest (Loveridge, 1946; Schmidt and Inger, 1957).

The surface of typical king cobra nest (as shown in Fig.2) seems to prevent heat and water entering and escaping from the outside environment thus, maintaining the humidity and temperature of the nest. The mid-layer retains dampness and the decaying leaves of this layer seem to supply the required heat

thus, maintaining the humidity and temperature within the nest chamber. The nest chamber contain the eggs and and provide space for the hatchlings before they leave the nest. From the present observation, it was found that the clutch size in the wild ranges from 14 to 35 in numbers that falls not in between 20 - 43 eggs (Das, 2012), which might be the new information on the clutch size range for this species in the wild. A report

on captive breeding of *Ophiophagus hannah* at Brownsville Zoo yielded the largest clutch size known to date, 53 eggs, of which 39 hatchlings were produced (Burchfield 1977).



**Fig. 2: A typical king cobra nest**

The present altitudinal record of King cobra in the current surveyed area of Mizoram ranges from 161 m to 1170 m asl, while the lowest was recorded at 40 m at Bihara village, Cachar, Assam (Das *et. al.*, 2008) and the highest elevation 2,181 m was recorded by Waltner (1975) at Mussoorie, Uttarakhand in 1967. The highest nest observed was 1980 m a.s.l. at the Nainital nest site (Whitaker *et. al.*, 2013), where temperatures ranged from 18.3 to 31.1°C. During our observation the temperature of nests falls in between 26 °C and 29.5 °C with relative humidity of 80 % to 90 %.



**Fig.3: Eggs in the nest chamber.**

**Conservation Status**

The present investigation reveals the needs for further studies on the ecology of this King cobra and to conduct measures for its conservation, as it plays important roles in the food chain of the ecosystem. In India, King Cobras are placed under Schedule II of Wildlife Protection Act, 1972 (as amended) and a person guilty of killing the snake can be imprisoned for up to 6 years. As King cobra usually lives in dense highland forests (Mehrtens, 1987; Miller, 1970), preferring areas dotted with lakes and streams, their populations have dropped in some areas of its range because of the destruction of forests. Therefore, it is listed as an Appendix II Animal within CITES (2007). Das *et. al.* (2008) reported that although the exact status of the species in northeastern India is not known, it is certain that its numbers are dwindling rapidly due to large scale destruction of its habitat. The existing protected area network no doubt holds the key to maintaining safe and viable populations. But given the substantial areas of forested land under the direct control of local communities, any effective long term conservation strategy has to focus on intensive awareness campaigns and sensitization of local people towards the requirements of this magnificent reptile.

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**Fig.4: Female King cobra guarding the nest at Dilkhan (Dt. 20.6.2010)**

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