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Ethno-medicinal use of monitor lizard *Varanus bengalensis* (Daudin, 1802) by the 'Adi' tribe at East Siang, Arunachal Pradesh

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A recent visit to the remote villages of East Siang District, Arunachal Pradesh, revealed a unique medicinal approach practiced by the Adi tribe (earlier Abor tribe) using monitor lizard tails. Following reports of being a traditional medicine for humans, this case study emphasizes on the administration pattern to treat their livestock, veterinary purposes by the indigenous tribe of Arunachal Pradesh. The use of animal parts in traditional medicines negatively impacts and contributes to the overexploitation of wild animals for meat and remedial purposes. We raise our concerns of wildlife being harvested by the local communities for such unscientific use as a traditional medicine which harms species survival and a challenge for wildlife law enforcement.

Keywords: Conservation, Ethnomedicine, Indigenous tribes, Monitor lizard, Northeast India
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The genus *Varanus* includes large monitor lizards native to Africa, Asia and Oceania, termed non-native and invasive to America. Though being listed as Least Concern (LC), the species belonging to genus Varanidae are locally hunted for meat and fat and in illegal trade for the demand of their genitalia, popularized as Hatha Jodi. Further, there is concern over high levels of exploitation of these animals in the world through an organized network of criminals involved in animal trafficking. Globally, the prime quantities of *Varanus* specimens have been traded as skins and leather products with the trade being predominantly of wild sourced specimens[1]. Recent studies have also put forward the instances of *Varanus* hemipenial organ being sold online on various e-commerce sites and is a staid challenge for law enforcement agencies[2,3]. Further, the confiscated materials' geographical assignment is the key requirement to understand the poaching pressure and the local threats on species survival which is possible through stable isotope[4] and genetic analysis[5].

Information on the ecological function of venom of monitor lizards is not well documented. Further, the effects of the toxins from the venom in *Varanus* spp. have been ascribed to bacterial infections caused by virulent oral bacterial flora[6]. Whereas the rare instance of death subjected through monitor lizard bite-induced acute kidney injury was also noticed[7]. Nonetheless, cultural taboos and their relation with water monitors (*V. salvator*) are studied in threatened marshlands in West Bengal, India[8].

In several parts of Asia and Africa, wild animals are used as sources of medicines by the local communities. In Asia, a variety of body parts are included in traditional medicine pharmacopeia. In fact, there is always uncertainty between consumption of wildlife for food or medicine as some species are often eaten for their "tonic" properties[9]. Other than devouring monitor lizards meat as a delicacy in different parts of the country, the lizard's eggs are also often consumed[10-12]. However high taxonomic diversity observed among reptiles used in traditional medicine is not surprising as numerous workers have pointed out that reptiles are among the animals most frequently used in folk medicine since ancient times[13-15].

Hunting of wildlife is suggested as one of the major threats to the loss of wildlife in India, especially in the Northeastern states[16]. The state of Arunachal Pradesh, rather being linguistic, is considered ethnic state inhabited by the tribes of Paleo-Mongoloid origin, with the major dialect of Sino-Tibetan language. The tribes (26 tribal groups) have their unique culture, traditions, lifetime and bonding with the forests which they rely on for their basic needs. People do have strong cultural

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linkages with forests and wildlife that are closely intertwined with their local animistic religion[17]. The rugged topography and dense forests resulted in poor intercommunication between the tribes living in different river valleys of Arunachal. However, the traditional knowledge of these tribes is vital for wildlife conservation, as the people have the right to harness the bioresources of area[18]. In compliance, the sustainable use of forest and its products including wildlife should be in harmony for its conservation in the Northeastern states. Here, we document a practice by the Adi tribe at East Siang Arunachal Pradesh of using dried Monitor lizard tail as medicine which is largely based on the traditional knowledge and has not been tested on medical grounds.

Materials and Methods

During the questionnaire surveys being conducted to understand the dependency of locals on the forest and wildlife in East Siang, Arunachal Pradesh, we found a specimen of dried monitor lizard tail housed at one of the resident's house of the Adi tribe and collected a sub-sample of it for identification using molecular analysis. Along with the dried tail tissue, a fresh sample from roadkill of monitor lizard was also collected for generating species signature and cross-validation of the tail sample used in the traditional medicine in villages of Arunachal Pradesh.

Genomic DNA was isolated from 95% to 100% ethanol-preserved tissue sample using commercially available DNeasy Tissue kit (Qiagen Inc., Valencia, CA, USA) following the manufacturer's instructions. The present study is aided with the amplification of the partial segment of cytochrome c oxidase subunit 1 gene. PCR products were cleaned up using Exo-SAP treatment and Cycle sequencing was carried out independently for forward and reverse primer using Big Dye terminator cycle sequencing kit v 3.1 and the sequencing was performed using Genetic analyser 3730 (Applied Biosystems, Foster City, CA).

The sequences were compared using the Basic Local Alignment Search Tool (BLAST) algorithm within NCBI GenBank reference sequences for species identity. Most homologous sequences by a threshold similarity value of ≥93% were downloaded from NCBI (Table 1). Multiple Sequence Alignment (MSA) was carried out using Clustal W tool in MEGA X[19] with default gap penalties. Uncorrected pairwise distances were calculated using the in-inbuilt program in MEGA X. The molecular phylogenetic analysis was inferred using the maximum likelihood method and the tree was reconstructed with Hasegawa Kishino-Yano (HKY) Gamma distribution (*+G)* invariant sites (*+I*) model for COI gene, respectively, using MEGA X[19] run for 1000 non-parametric bootstrap replicates. The sequence generated for the Varanid has been deposited with GenBank accession number MN 148451 for the specimen and the sequence divergence uncorrected "p-distance" was calculated and the values are mentioned in Table 2.

Table 1 — List of species and their sequence accession numbers for the gene COI used in the present study

S. No	Species/ ID	Accession number
1	*Varanus bengalensis*	MN148451
2	*Varanus bengalensis*	KF766939
3	*Varanus bengalensis*	JN714165
4	*Varanus bengalensis*	EU621818
5	*Varanus bengalensis nebulosis*	AF407492
6	*Varanus salvator*	AB980995
7	*Varanus salvator*	KY354305
8	*Varanus salvator*	KY354301
9	*Varanus salvator*	EU621817
10	*Varanus salvator salvator*	AF407526
11	*Varanus nebulosus*	KY354299
12	*Varanus griseus griseus*	AF407503
13	*Varanus komodoensis*	AF407510

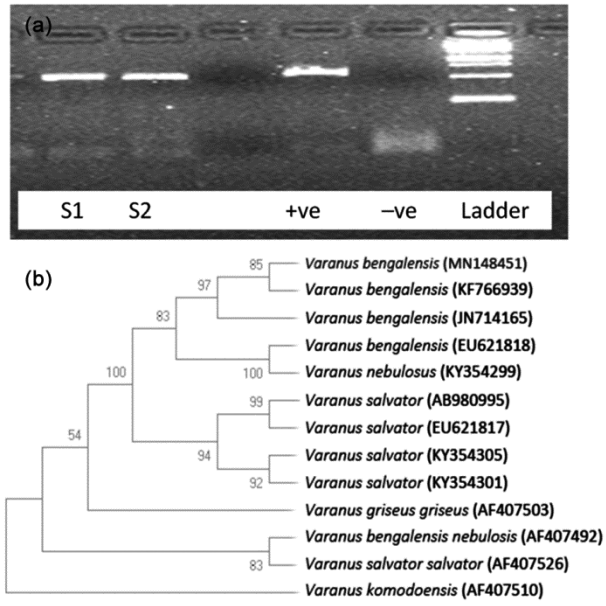

Fig. 1 — (a) The PCR amplification image of COI gene of the sample (From Left to Right: lane 1 (S1), 2 (S2) are the PCR products of *Varanus* samples, lane 3 is blank, lane 4 is amplified tissue DNA and lane 5 is negative and the lane 6 is 100bp Ladder, (b) ML tree constructed using COI gene representing the *Varanus* spp. along with the questioned Monitor Lizard sample. Bootstrap support values are mentioned in the nodes. Sample used for ethno medicine represented in blue text

Table 2 — Un-corrected pairwise sequence divergence between the selected species of the genus *Varanus* for the gene COI

Varanus bengalensis (MN148451) (Questioned sample)												
Varanus bengalensis (KF766939)	0.015											
Varanus bengalensis (JN714165)	0.025	0.025										
Varanus bengalensis (EU621818)	0.137	0.134	0.129									
Varanus bengalensis nebulosis (AF407492)	2.612	2.620	2.679	2.724								
Varanus nebulosus (KY354299)	0.137	0.134	0.129	0.000	2.724							
Varanus salvator (AB980995)	0.176	0.166	0.164	0.154	2.568	0.154						
Varanus salvator (EU621817)	0.179	0.169	0.171	0.150	2.491	0.150	0.021					
Varanus salvator (KY354301)	0.185	0.174	0.177	0.155	2.482	0.155	0.021	0.003				
Varanus salvator (EU621817)	0.179	0.169	0.166	0.156	2.563	0.156	0.001	0.023	0.023			
Varanus salvator salvator (AF407526)	2.582	2.574	2.649	2.683	0.173	2.683	2.655	2.577	2.568	2.650		
Varanus griseus griseus (AF407503)	2.486	2.477	2.513	2.597	0.228	2.597	2.513	2.444	2.444	2.508	0.226	
Varanus komodoensis (AF407510)	2.759	2.77	2.825	2.773	0.210	2.773	2.658	2.587	2.577	2.653	0.228	0.229

Fig. 2 — Dry tail piece of *Varanus bengalensis* (Daudin, 1802), sample collected from the residence of Adi tribe, Arunachal Pradesh

Results and Discussion

The questioned tail clip collected from the house of the Adi tribe in East Siang district, Arunachal Pradesh, is *Varanus bengalensis* (Daudin, 1802) (Bengal monitor or Common Indian Monitor Lizard), as identified using the DNA analysis (Fig. 1a,b).

The informal interaction with the tribesmen revealed that the monitor lizard's entire tail (*V. bengalensis*) (Fig. 2) is allowed to dry and later macerated to pieces followed by complete grinding to a fine powder. The fine powder is mixed in the fodder of the livestock and given to eat. The tribe believes that the feast mix helps their livestock recuperate and fight against aliments and in healing animal wounds. The process not only includes the dried tail but with the availability of the individual parts of the monitor lizard. This includes the use of the entire body, heads of monitor lizard for deworming and treating wound infection of domesticated animals, which involves the herbivores' food disguise.

Additionally, monitor lizard meat is also used for abdominal uneasiness like gastritis; tribe's women reported its success in pig bacterial infection by mixing a cocktail of snake ecdysis in the animal feed. Though there is not enough proof for this kind of treatment, the belief has put forward the practices in using monitor lizards and other reptiles for medical purposes. In physical injuries, such as bone dislocations and muscle cramps, the animal fat is used as a massaging balm. Products derived from the common Indian monitor (*V. bengalensis*), the skin and fat are used to treat hemorrhoids, rheumatism, body pain and burns, whereas the bile extracts are used in treating spider and snake bites[20,21]. The mode of administration involves cooking, eating and local application for burns. In case of spider and snake bites, the bile extracts are taken orally as an antidote[21]. However, the above study shows the use as a remedy by tribes but its use for treating cattle is rather rare and not well documented. Apart from the medicinal uses of the lizard, the tribes mainly hunt the species for bushmeat.

The current approach illustrates the ethno-zoological knowledge and practices concerning the relatively less known, rather heavily exploited reptile group from Northeast and the rest of our country. However, it is also important to note that behind the efficacy, the popularity of animal-based remedies is influenced by cultural aspects and the relations between humans and biodiversity in the form of zoo therapeutic practices and are conditioned by the social and economic relations between humans themselves[15]. Changing conditions like the gradual occupation of forest and wastelands, building new roads and improvements in rapidity of

transport accentuated with enormous increase of firearms in use continue to have a disastrous effect on the wildlife. Furthermore, the conservation of species and sustainable use of the natural resource is needed which indeed relies on the peoples (tribes) perspective on what resources are to be used and why. This includes the information on relevant socio-economic drivers and integral cultural practices (e.g., hunting), species hunted, structure and harvest levels help evolve sustainable hunting regulations[16]. Further studies to ascertain the magnitude and use of animals and their products in traditional medicine is yet to be documented in less explored Northeastern states.

Conclusions

We raise our concerns for using such wildlife parts and products in local healing or curing diseases that do not have any scientific basis and are not proven medically. However, it causes a severe decline in the free-ranging population of wildlife and poses a serious challenge to law enforcement agencies. However, *V. bengalensis* is not presently listed as being threatened with extinction, but the multiple uses attributed to these animals, associated with the social, cultural and economic factors will certainly contribute to increasing pressure on natural populations of this lizard. We interacted with the local people and made them aware of the violation of Indian Wildlife (Protection) Act, 1972, in illegally killing the animals. We advised the locals to undertake the benefits of the generic medicines issued by the Government of India.

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Conflict of interest

On behalf of all co-authors, it is certified that authors do not have any conflict of interest with respect to the publication of this manuscript and all co-authors approved the final manuscript.

Author(s) contribution

LKS and MT: conceptualized and designed the study; GCK, JDJ, GJ, LKS, MT and KC: participated in sample collection, data generation, quality check and primary data analysis; GCK, JDJ and GJ: wrote the primary draft of the manuscript; GCK, JDJ, GJ, LKS, MT and KC: finalized the manuscript; LKS: supervised the overall activities and KC raised funds for the study.

References

1 Crook V & Musing L, Monitoring Lizards. Part I – Trade data analysis - International trade in monitor lizards (*Varanus* spp.). Final report for BfN funded project. *TRAFFIC*, UK, (2016).

2 Rajpoot A, Kumar V P, Bahuguna A, Singh T, Joshi A & Kumar D, Wildlife forensics in battle against veneration fraud in Uttarakhand, India: identification of protected Indian monitor lizard in items available in the local market under the name of Hatha Jodi, *Mit DNA Part B*, 3 (2) (2018) 925-932.

3 Sharma C P, Ajit Kumar, Vipin V, Sharma V, Singh B, Chethan Kumar G & Gupta S, Online selling of wildlife part with spurious name: a serious challenge for wildlife crime enforcement, *Int J Legal Med*, 1331 (1) (2018) 65-69.

4 Ziegler S, Monitoring Lizards Part 2 – Pilot study testing the applicability of isotopic markers in scales to discriminate between captive and wild individuals. Final report for BfN funded project. *TRAFFIC*, UK (2016).

5 Mondol S, Moltke I, Hart J, Keigwin M, Brown L, Stephens M & Wasser S K, New evidence for hybrid zones of forest and savanna elephants in Central and West Africa, *Mol Ecol*, 24 (24) (2015) 6134-6147.

6 Arbuckle K, Ecological function of Venom in *Varanus*, with a compilation of dietary records from the literature. International Varanid interest group, *Biawak*, 3 (2) (2009) 46-56.

7 Vikrant S & Verma B S, Monitor lizard bite-induced acute kidney injury – a case report, *Ren Fail*, 36 (3) (2014) 444-446.

8 Bhattacharya S & Koch A, Effects of traditional beliefs leading to Conservation of water Monitor Lizards (*Varanus salvator*) and Threatened marshlands in West Bengal, India, *Herpetol Conserv Biol*, 13 (2) (2018) 408-414.

9 Shoukat A, Khan M F, Shah G M, Tabassam S, Sajid M, *et al*., Indigenous knowledge of zootherapeutic use among the people of Hazara division Khyber-Pakhtunkhwa, Pakistan, *Indian J Tradit Know*, 19 (3) (2020) 568-579.

10 Das I, Indian monitor lizards: A review of human utilisation patterns, *Hamadryad*, 14 (1989) 16–19.

11 Chandi M, The use and knowledge of herpetofauna on Little Nicobar Island, India, *Conserv Soc*, 4 (2006) 155-165.

12 Borah M P & Prasad S B, Ethnozoological remedial uses by the indigenous inhabitants in adjoining areas of the Pobitora wildlife sanctuary, Assam, India, *Int J Pharm Pharm Sci*, 8 (2016) 90–96.

13 Alves R R N & Rosa I L, Biodiversity, Traditional Medicine and Public Health: Where do They Meet?, *J Ethnobiol Ethnomed*, 3 (14) (2007a) 9.

14 Alves R R N & Rosa I L, Zootherapy goes to town: the use of animal-based remedies in urban areas of NE and N Brazil, *J Ethnopharmacol*, 113 (3) (2007) 541-555.

15 Alves R R N & Rosa I L, Use of Tucuxi Dolphin *Sotalia fluviatilis* for medicinal and magic/religious purposes in North of Brazil, *Hum Ecol*, 36 (2008) 443-447.

16 Naro E, Mero E L, Naro E, Kapfo K, Wezah K, *et al*., Project hunt: an assessment of wildlife hunting practices by local

community in Chizami, Nagaland, India, *J Threat Taxa*, 7 (11) (2015) 7729-7743.

17 Aiyadurai A, Traditional ecological knowledge of the IduMishmis: What do people say about wildlife? Report submitted for 2nd Rufford Small Grant for Nature Conservation, 2014, 38pp.

18 Sanyal D P & Gayen N C, Reptilia. Pp. 247-284. In: Alfred J.R.B, (Ed.): Fauna of Arunachal Pradesh, State Fauna Series, 13(Part-l), *Zoological Survey of India*, Kolkata. (2006) Pp. 396.

19 Kumar S, Stecher G, Li M, Knyaz C & Tamura K, MEGA X: Molecular evolutionary genetics analysis across computing platforms. *Mol Biol Evol*, 35 (6) (2018): 1547-1549.

20 Kakati L N & Doulo V, Indigenous knowledge system of zootherapeutic use by chakhesang tribe of Nagaland, India, *J Hum Ecol*, 13 (6) (2002) 419-423.

21 Kakati L N, Bendang A & Doulo V, Indigenous knowledge of zootherapeutic use of vertebrate origin by the Ao tribe of Nagaland, *J Hum Ecol*, 19 (3) (2006) 163-167.