Prevalence of *Amblyomma gervaisi* ticks on captive snakes in Tamil Nadu

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Abstract Ticks are the important ectoparasites that occur on snakes and transmit rickettsiosis, anaplasmosis and ehrlichiosis. A total of 62 snakes (Reticulated python, Indian Rock Python, Rat snakes and Spectacled cobra) were examined for tick infestation at Chennai Snake Park Trust (Guindy), Arignar Anna Zoological Park (Vandalur) and Rescue centre (Velachery) in Tamil Nadu from September, 2015 to June, 2016. Ticks from infested snakes were collected and were identified as *Amblyomma gervaisi* (previously known as *Aponomma gervaisi*). Overall occurrence of tick infestation on snakes was 66.13%. Highest prevalence of tick infestation was observed more on Reticulated Python (*Python reticulatus*, 90.91%) followed by Indian Rock Python (*Python molurus*, 88.89%), Spectacled cobra (*Naja naja*, 33.33%) and Rat snake (*Ptyas mucosa*, 21.05%). Highest prevalence of ticks were observed on snakes reared at Chennai Snake Park Trust, Guindy (83.33%), followed by Arignar Anna Zoological Park, Vandalur (60.00%) and low

level prevalence of 37.50% on snakes at Rescue centre, Velachery. Among the system of management, the prevalence of ticks were more on captive snakes (70.37%) than the free ranging snakes (37.5%). The presences of ticks were more on the first quarter when compared to other three quarters and were highly significant ($P \leq 0.01$).

Keywords Snake · Tick · *Amblyomma gervaisi* · Prevalence · Tamil Nadu

Introduction

Ticks are the important ectoparasites which occurs on snakes and transmits rickettsiosis, anaplasmosis and ehrlichiosis (Kho et al. 2015). In India, the *Aponomma* spp. were reported on pythons, cobra and rat snakes (Patton and Cragg 1913; Sharif 1928; Alwar 1960; Soundararajan et al. 2013). *Amblyomma* (*Aponomma*) ticks are known to transmit *Coxiella burnetti* and *Rickettsia honei* in humans in India (Pandit et al. 2011), tick paralysis in *Coluber constrictor prius* (Southern black racer) (Hanson et al. 2007), the vectors for *Aeromonas hydrophilia* (bacterial stomatitis) and pneumonia on snakes (Marcus 1971) and causes blood borne parasitic infection such as *Aeromonas septicemia*, eventually leading to the death of the snakes (Rosenthal 1997). This study reports the prevalence of *A. gervaisi* on snakes in different places of Tamil Nadu.

Materials and method

A total of 62 snakes (22 Reticulated python, 18 Indian Rock Python, 19 Rat snakes and 3 Spectacled cobra) were examined for the presence of ticks at Chennai Snake Park

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Trust (Guindy), Arignar Anna Zoological Park (Vandalur) and Rescue centre (Velachery) of Tamil Nadu from September, 2015 to June, 2016. All serpentine were restrained using snake restraint gadgets and were visually examined for presence of ticks. The whole length of the snake's body (head to tail) was measured before proceeding with the examination and body length was divided into 4 quarters, namely, the 1st, 2nd, 3rd and 4th quarter. Collected ticks were processed and identified (Kaufman 1972; Mullen and Durden 2009).

Results and discussion

The ticks collected were identified as *Amblyomma gervaisi* (previously known as *Aponomma gervaisi*). In India, *Aponomma gervaisi* (Lucas 1847), *Aponomma leave* Neumann, *Aponomma lucasi* Warburton, and *Aponomma pattoni* (Neumann) have been recorded on reptilian hosts (Geevarghese and Dhanda 1995; Ghosh et al. 2007). *Amblyomma (Aponomma) gervaisi* was grossly identified based on their characteristic features like five creamy yellow spots, one was median and others were at periphery in the case of male ticks, whereas a heart shaped scutum with three creamy yellow spots were situated at angles in the case of female ticks. Identification of ticks was carried out by using the keys furnished by Kaufman (1972), Georgi et al. (1990) and Mullen and Durden (2009). Georgi et al. (1990) further quoted that this species of the tick might attack man, livestock, canids and felids. Microscopically, the tick was identified based on the ornamentation on the scutum and absence of eyes. It had long palps with longer second segments (twice the size) than the third segment. The hypostomal teeth were arranged in 3:3 dentition patterns. A comma shaped spiracular opening was present below the fourth Coxa in both male and female ticks. The scutum in male *A. gervaisi* was broader than the length and the scutum was dark coloured with creamy yellow patches which was spread over a larger area on the dorsum. The Coxa I had inconspicuous internal spur and visible external spur, whereas a single spur was seen on coxa II, III and IV (Figs. 1, 2, 7, 8). The female ticks had a heart shaped dark brown coloured scutum with three creamy yellow coloured oval shaped patches. The different views of ticks including identification related features are presented (Figs. 3, 4, 5, 6, 7, 8, 9).

The usage of snake hooks toward exercising of physical restraint measures throughout the course of this study was in agreement with the findings revealed by Fowler (1986) who stated that snake hooks were fundamental tools in order to effect the direction of the serpentine's twisting movements, lifting of snakes from containers and for a variety of other restraint procedures. Collections of ticks

Fig. 1 *Amblyomma (Aponomma)gervaisi*—male dorsal view

Fig. 2 *Amblyomma (Aponomma)gervaisi*—male ventral view

were carried out on serpentine, subsequent to swabbing of the ticks with alcohol. This was in agreement with the findings furnished by Rosenthal (1997).

Overall occurrence of tick infestation on snakes was 66.13% (Table 1). This is similar to that of Pandit et al. (2011) and Ingole et al. (2015) who reported 59.59 and 61.20% of tick infestation on snakes in Tamil Nadu and Western Ghats of India, respectively. Highest prevalence of tick infestation was observed, more on Reticulated Python (90.91%) followed by Indian Rock Python (88.89%), Spectacled cobra (33.33%) and Rat Snake (21.05%). Meanwhile, Pandit et al. (2011) had observed the *A. gervaisi* ticks only on the Indian rat snake (29.16%) and Spectacled cobra (30.0%) (Figs. 10, 11, 12, 13). Increased percentage of the prevalence with regard to tick infestation in Reticulated pythons as well as Indian Rock pythons was

Fig. 3 *Amblyomma (Aponomma)gervaisi*—engorged female dorsal view

Fig. 4 *Amblyomma (Aponomma)gervaisi*—engorged female ventral view

attributed to the factors like availability of increased surface area for attachment by the ticks on these pythons, when compared to the that of the surface areas available with regard to the Rat snakes and Spectacled cobra. Encountering the increased per cent of tick prevalence on pythons was further supported by the report presented by

Fig. 5 *Amblyomma (Aponomma)gervaisi*—semi engorged female dorsal view

Fig. 6 *Amblyomma (Aponomma)gervaisi*—semi engorged female ventral view

Rosenthal (1997) who quoted that ticks were the common ectoparasitic problems with pythons, in addition to Boas.

Highest prevalence of ticks were observed on snakes at Chennai Snake Park Trust, Guindy (83.33%) and Arignar Anna Zoological Park, Vandalur (60.00%), while a low level of incidence (37.50%) was reported on snakes kept at Rescue centre, Velachery. Mader (1996) who stated that ticks, both hard and soft types were found on reptiles and

Fig. 7 *Amblyomma (Aponomma)gervaisi*—male ventral view ($\times 10$)

Fig. 8 *Amblyomma (Aponomma)gervaisi*—male ventral view (Hypostomal teeth $\times 40$)

the hard ticks of genera *Ixodes*, *Hyalomma*, *Haemaphysalis*, *Amblyomma* and *Aponomma* were reported in a variety of reptiles, but many were host specific. Similarly, Fowler (1986) quoted on the occurrence of hard bodied ticks like *Amblyomma* spp. and *Hyalomma* spp. Corn et al. (2011) revealed the encountering of neotropical ticks *Amblyomma rotundatum* and *Amblyomma dissimile* from the wild caught Burmese pythons. In accordance to the finding of this study, Soundararajan et al. (2013) who had encountered ticks from Russell's viper and cobra, in addition to the monitor lizard and these ticks were reported to have ornate nature and were subsequently identified as *A. gervaisi*. Encountering the *Amblyomma latum* was reported by Nowak (2010) in *Python regius* and further, it was stated that the hosts for *Amblyomma latum* were

Fig. 9 *Amblyomma (Aponomma)gervaisi*—male ventral view (Anal plate $\times 40$)

reptiles and first to be listed were *Elapidae*, *Colubridae*, *Viperidae* and *Boidae* in particular *Pythonidae*.

Among the system of management, the prevalence of ticks were more on captive snakes (70.37%) than the free ranging snakes (37.5%). Among the captive snakes, 83.33% of ticks were found on the snakes at Chennai Snake Park Trust, Guindy and 60.00% of ticks were found on snakes at Arignar Anna Zoological Park, Vandalur (Table 2). The overall percentage of prevalence with regard to the serpentes that were reared in captive wild animal conservation places like, Chennai Snake Park Trust (CSPT), Guindy as well as in Arignar Anna Zoological Park (AAZP), Vandalur was revealed as 70.37, while it was 37.5 in case of serpentes caught from the free ranging areas (RC, Velachery). The reason for the encountering lesser per cent of prevalence, with regard to the ticks on snakes at Rescue centre might not be furnished in a concrete manner due to the lesser number of snakes encountered at the Rescue centre.

However, the difference in the variations pertaining to the prevalence of tick infestation in per cent between the snakes reared under captivity and the snakes in the free ranging condition might be attributed to factors like natural movements of the free ranging serpentes over vegetations which were found to be varying in nature, comprising of different types of vegetations like bushes, wooden logs, barks and roots of the tree etc. and changes in the movement pattern as well as the distance covered, quantity of available species coupled with nature and persistence period of substrate in the enclosures etc. The existence of variations related to the feeding based ecological niches might also be attributed as causal factors for the encountering of tick infestation in serpentes of the free-ranging snakes.

Table 1 Prevalence of tick infestation on snakes at different places

S. no.	Snake	CSPT, Guindy (%)	AAZP, Vandalur (%)	RC, Velachery (%)	Overall percentage
1.	Reticulated python (<i>python reticulatus</i>)	85.71 (12/14)	100 (8/8)	–	90.91 (20/22)
2.	Indian Rock Python (<i>Python molurus</i>)	100 (6/6)	83.33 (10/12)	–	88.89 (16/18)
3.	Rat snake (<i>Ptyas mucosa</i>)	50.00 (2/4)	0.00 (0/10)	40.00 (2/5)	21.05 (4/19)
4.	Spectacled cobra (<i>Naja naja</i>)	–	–	33.30 (1/3)	33.33 (1/3)
	Total	83.33 (20/24)	60.00 (18/30)	37.50 (3/8)	66.13 (41/62)

Fig. 10 Tick infestation on Indian Rock python **Fig. 11** Tick infestation on reticulated python

During the course of this study the prevalence of ticks were more on the first quarter when compared to the other quarters (2nd, 3rd and 4th quarter) (Table 3) and was highly significant ($P \leq 0.01$). The 4th quarter comprising the tail region had the less number of ticks, which might be

Fig. 12 Tick infestation on rat snake **Fig. 13** Tick infestation on Spectacled cobra

attributed to the factors like narrowing down of body in the tail region, increased movement of the tail region, when compared to the other quarter of the snake's body and lesser contact time with the substrate when compared to the other regions. Pandit et al. (2011) observed *A. gervaisi* ticks only on the dorsal surface of the body, while Ingole et al. (2015) observed mostly on lateral sides of the body, lesser numbers on around cloaca and eyes and very few ticks on dorsal aspect of body.

Table 2 Prevalence of tick infestation on different system of management

S. no.	Condition	Place	No. of snakes examined	No. of snakes infested with ticks	Percentage of tick infestation
1.	Captive condition	CSPT	24	20	70.37
		AAZP	30	18	
2.	Free ranging	Rescue centre	8	3	37.5
Total			62	41	66.13

Table 3 Prevalence of tick infestation on different location of snake

Location	No. of ticks	F value
First quarter	4.61 ^b ± 0.36	6.846**
Second quarter	3.69 ^b ± 0.23	
Third quarter	4.17 ^b ± 0.38	
Fourth quarter	2.64 ^a ± 0.40	

** Highly significantly ($P \leq 0.01$)

^{a, b} There is no significant groups with the same superscripts

During this study, the ticks were encountered beneath the scales as well as over the body. However, Rosenthal (1997) encountered ticks with blood swollen abdomens, protruding from under the scales of snakes. With regard to the location of the ticks on the body of the snakes Soundararajan et al. (2013) opined that the ticks were mostly found on Russell's viper as well as cobra and ticks were mostly found under the scale of both the dorsal and ventral aspects of the snakes.

The snakes infested with ticks revealed lumps, dermatitis and dysecdysis in general. This was in agreement with findings of Mader (2006) who reported that ticks caused anaemia, dermatitis, decreased food intake and even mortality during occurrence of heavy infestation. Throughout the course of this study, severe degree of tick infestation was not encountered among the serpentines. No other species of ticks except the *A. gervaisi* was encountered in this study with captive snakes. However, prevalence of *Rhipicephalus* (*Boophilus*) spp. was encountered in the serpentines that were reared under captive conditions, as reported by Ingole et al. (2015).

Conclusion

Amblyomma gervaisi was found to be the more predominant ectoparasitic species among the captive serpentines. Periodic examination of the different quarters of the body should be carried out to reveal the evidence of tick infested snakes. Maintenance of enhanced hygienic conditions, in addition to application of flame gun and enrichment of sanitary measures, together with periodic change of

substrates were emphasized in places where the snakes are kept under captive conditions.

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Compliance with ethical standards

Conflict of interest The authors declare that there are no conflicts of interest.

Ethical standard Since the trial was conducted only on clinical cases (tick infested snakes), and the herbal extracts used on the snakes were already proven to be non toxic on mammals. Hence, the necessity to seek permission from animal ethical care committee was resolved.

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