

Ecology of Vipers and a Case Study of Self-Envenomation in Russell's Viper

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Abstract: Family *Viperidae* is widely distributed in India, as well as in the Western Ghats, a global biodiversity hotspot; however their species ecology with respect to habitat or microhabitat use in Anaikatty hills is poorly studied and in addition here, a rare case of an accidental self-envenomation in Russell's viper was being observed, examined and reported.

Keywords Ecology, Self-envenomation, Russell's viper, Anaikatty Hills, Western Ghats

1. Introduction

Information on ecology of squamate reptiles in India are scanty, however efforts made by taxonomists are largely biased only to erect new taxa, without understanding species ecology and evolution, as a result many newly described species are facing a poor taxonomic future hence are vulnerable to extinction. The present study records the habitat use by various viperids, as compared to other taxa they may be more specialist with respect to spatio-temporal resource use and their adaptation in different elevation gradients are perhaps to reduce intra-specific resource competition; this is clearly observed in the field survey that various habitat types had distinct species assemblages with respect to changing elevation and associated vegetations. The article also deals with an unusual case of self-envenomation in Russell's viper *Daboia russelii* (SHAW & NODDER, 1797).

2. Materials and Methods

The ecosystem monitoring to access viper ecology was initiated from April 2021 to April 2022; visual encounter survey (VES) was primarily opted as sampling technique, two field persons carried out the survey during 06:00-09:00 and 16:00-19:00 hrs, morning and evening. Meaning a total six-man hours each, which resulted in 12 hours daily output. Additionally, the opportunistic encounters were also being recorded.

3. Results

In the scrublands (11° 4'21.20"N 76°49'34.20"E), where the elevation below ca. 650 m a.s.l., saw-scaled viper *Echis carinatus carinatus* the nominate subspecies has been observed in the tropical dry scrublands, this species camouflaged in the mosaics of exposed rocky outcrops. Above ca. 650 m a.s.l., the dry deciduous forest (11° 5'39.44"N 76°47'27.21"E), although an ideal habitat for Russell's viper *Daboia russelii* but not being encountered

initially, perhaps because of their restricted temporal activity like many other snake species.

In the dry seasonal hill stream beds, at mid altitude (11° 5'22.91"N 76°47'22.11"E), largely dominated by bamboos, Indian coral snake, an Elapid, *Calliophis nigrescens* being observed, the ventral coral red colour of this species advocates a warning display which indicates its venomous nature.

In elevation above ca. 1000-1500 m a.s.l. where forest type changed from dry deciduous to moist deciduous (11° 3'42.58"N 76°47'36.30"E), in forest floor covered with thick leaf litters, the Hump-nosed pit viper (*Hypnale hypnale*), a terrestrial or facultative semi arboreal Crotalinae was being encountered.

While in the highest peak (Perumalmudi), elevation around ca. 1600 m a.s.l. in the evergreen shola forest (11° 3'18.25"N 76°48'16.49"E), the Bamboo Pit Viper (*Craspedocephalus gramineus*) an arboreal Crotalinae was encountered in the branches. (Mukherjee 2012; Sharma et al. 2023; Mukherjee et al. 2023). Such observations may further anticipate that vipers might have been more specialized or habitat specific in niche utilization.

Later in another survey at around 11:30 inside dry deciduous forests (11° 5'45.26"N 76°47'29.81"E) a Russell's viper was encountered in an opportunistic inventory which confirmed its presence. However, the snake was found in an unusual condition. Its voluntary muscles were twitching with irregular rolling on both sides; buccal cavity/mouth part was wide open with visible rapid laboured breathing. This behaviour indicated similarity with clinical signs of snake venom toxicity. Similar, kind of signs such as ataxia and partial paralysis were reported in case of *Boiga irregularis* self-envenomation (Hill and McKillop 2017).

Critical investigation further revealed an impregnated fang in the lower buccal cavity. Interestingly, the main fangs were intact but its third right reserve fang was missing from

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maxilla (polyphyodont dentition) which might have caused self-venomation. It had seven reserve fangs on each side of maxilla.

The snake died in 6.5hrs at around 18:00, with persistent clinical signs of snake venom toxicity visible during this period.

It is not necessary that self-inflicted bites in venomous snakes may lead to self-venomation (Purkayastha et al. 2020) expect if there are signs of snake venom toxicity like in case of observed Russell's viper. In Viperids, the maxillary bone is shortened and flexibly kinetic to bear only fangs, which are hollow (solenoglyphous) like hypodermic needle, delivering chiefly haemotoxic venom, where production and ejaculation of venom is more but toxicity is comparatively less and dry bites are unlikely to happen and in general are slow moving and ambush predators. Whereas Elapids are largely known to deliver neurotoxic venom and are proteroglyphous having short grooved fangs fixed in maxilla with restricted mobility which often results in dry bites, here the production and ejaculation of venom is less but toxicity at a time is more potent and are more agile in comparison to vipers.

4. Discussions

The present study reveals that vipers are comparatively more specialist with respect to habitat use as compared to other ophidians and the incident regarding the accidental self-venomation concluded that venomous snakes may not be immune to their own venom. Russell's viper is among the most aggressive species in India, causing a large number of human fatalities and amputations. Their venom largely contains protein degrading enzymes, proteases that catalyse proteolysis (breakdown of proteins) and also responsible for haemotoxicity, cardio-cytotoxicity and myotoxicity (Debarati Mukherjee, Ph.D. pers. comm.). But a little awareness, precautions and understanding snake ecology and behaviour may finally bring positive results to deal snake bites in rural areas.

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