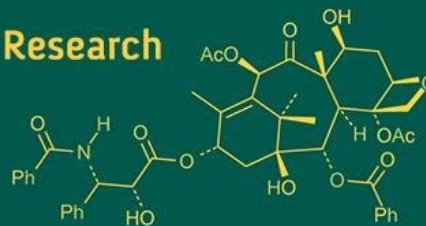


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Mixed endoparasitic infections in wild Indian rat snakes (*Ptyas mucosa*): A case report

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Abstract

Rat snakes are one of the most common non-venomous colubrids species found in India. They play a vital ecological role by regulating rodent population and thereby preventing losses to farmers and maintaining food security. However, like any other reptiles, they are susceptible to a variety of endoparasitic infection that can impact their health and survival. Between 2022 and 2025, at the request of Maharashtra Forest Department, four rats' snakes were submitted to the Wildlife Research and Training Centre, Gorewada, Nagpur for post mortem examination. Necropsy was conducted and parasitological examination revealed mixed endoparasitic infection including *Porocephalus crotali* (lung pentastomid), *Strongyloides* spp., *Capillaria* spp., and *Choleoeimeria* spp. Notably, *Porocephalus crotali* infection was identified in the lungs marking a rare occurrence in wild Indian snakes. Intestinal protozoan oocysts and nematode eggs were detected using zinc sulphate flotation technique and identified via microscopy. The findings demonstrate the diverse parasitic burden in wild snakes and underlying potential health consequences. The case report provides crucial insights into parasitic diversity, emphasising the need for regular monitoring and ecological health assessment associated with reptile parasites.

Keywords: *Ptyas mucosa*, parasitic infection, *Porocephalus crotali*, pentastomid, *Capillaria*, *Strongyloides*, *Choleoeimeria*

Introduction

Snakes play vital ecological role in the ecosystem as a prey and a predator. The snakes contain the population of various vermin's that pose a threat to agriculture and food security. There are a few snake species that are venomous while rest others are non-venomous. Rat snake is one of the most common snakes of the Indian subcontinent. A widespread, non-venomous colubrid species that is widely distributed in forests, agricultural fields, and peri-urban zones. The species often is identified by its distinct yellow tinge, fast movements, adults measure 2 to 2.5 meters in length, and juveniles often exhibit distinct markings compared to adults. When threatened, they may mimic cobras by inflating their neck region and hissing. They play an important role in maintaining ecological balance. They effectively predate upon rodents helping control population of rats and mice in agricultural fields, grain stores and around human settlements. The natural pest control has impact both on crop yield and public health by limiting the spread of rodent borne diseases. Also, they predate on birds, eggs, frogs and small reptiles contributing to regulation of various prey population. They also serve as prey for larger birds, mammals and even other snakes playing an important role in the food web.

Rat snakes play an important role in maintaining ecological balance. The effectively control the population of rodents like rats and mice around human settlements. The most important service rendered by the species involves the control of field rodent population, thus, preventing the crop damage and limiting rodent borne sicknesses. The food range includes small birds, reptiles and frogs, thus ensuring a natural population control. They also serve as a prey to larger snakes and birds, playing a vital role in the food web. As non-venomous, adaptable snakes, rat snakes are crucial indicators of ecosystem health and biodiversity.

A range of endoparasites are known to infect snakes like other reptiles. Most of the parasite infection is asymptomatic and does not result into a clinical disease.

However, some of the parasites invade vital organ systems like the lungs and liver leading to life threatening infection in snakes. The gastrointestinal parasites can further be classified as nematodes, trematodes and cestodes. All of them reside in the gastrointestinal tract of the host and lead to mild inflammation to severe enteritis; their migration at times leads to vital organ encroachment and damage leading to fatal consequences. Nematodes such as *Strongyloides* spp., *Ophidascaris* spp., and *Capillaria* spp. are among the most frequently encountered helminths causing enteritis, malnutrition and encroachment to vital organs. One of the most notable and unique reptilian parasites is *Porocephalus crotali* a pentastomid or tongue worm that infests the lung or coelomic cavity leading to fibrosis, pneumonia and potentially secondary bacterial infections. The impact of such parasites on snakes ranges from mild debilitation and weight loss to severe disease and death, particularly in young or immunocompromised individuals.

Case Presentation

Between 2022 to 2025, four rat snakes were presented to Wildlife Research & Training Centre, Gorewada, Nagpur for post-mortem examination. In all the cases the rat snakes were presented by local snake rescuers and the post-mortem examination was carried out on the request of Maharashtra Forest Department officials. The carcass was examined immediately and external morphological features were noted and recorded. During necropsy all the systems were critically examined and intestinal contents were aseptically collected for microbiology and parasitological examination. The samples were subjected to parasite screening by flotation technique using saturated salt solution and

saturated zinc sulphate (ZnSO_4) solution (specific gravity ~1.18). The flotation technique involved emulsification of the faecal sample in the saturated salt solution followed by transfer to glass tubes to fill the rim. The suspension was allowed to stand for 30 minutes after which a cover slip was gently placed on the solution and transferred to a slide.

Microscopic examination was performed under low (10×) and high (40×) magnification to detect and identify parasitic eggs, cysts, or oocysts. Photomicrographs of observed parasitic stages were taken using a digital microscope camera. Identification of parasitic forms was carried out based on morphological characteristics and standard identification keys. All findings were meticulously recorded, including the type of parasite, location within the GIT, and associated gross or microscopic lesions.

Post-mortem examination of the four rat snakes revealed the presence of multiple endoparasites, with varying degrees of infestation. Adult *Porocephalus crotali* (larval pentastomids) were observed embedded in the lung tissue, often associated with mild to moderate congestion and fibrotic lesions (Fig. 1 to 3). Examination of intestinal contents and mucosal scrapings confirmed the presence of *Capillaria* spp., identified by characteristic barrel-shaped eggs with bipolar plugs. *Strongyloides* spp. eggs were detected in the intestinal contents, indicating active intestinal infestation. Additionally, oocysts of *Choleoeimeria* spp., a coccidian parasite, were observed in the intestinal content, suggestive of hepatic or biliary involvement (Fig. 4, 5, and 6). The presence of multiple parasitic species in individual snakes highlights a diverse parasitic load and potential for systemic health impacts.

Table 1: Details of the finding of the post mortem examination of the rat snakes.

Parasites	Rat Snakes Examined			
	RS1	RS2	RS3	RS4
Nematodes	Negative	Negative	<i>Porocephalus crotali</i> , <i>Strongyloides</i> spp., <i>Capillaria</i> spp.	<i>Strongyloides</i> spp.
Trematodes	Negative	Negative	Negative	Negative
Cestodes	Negative	Negative	Negative	Negative
Protozoan	Negative	Negative	Negative	<i>Choleoeimeria</i> spp.,



Fig 1: *Porocephalus crotali* found in the lungs of a rat snake



Fig 2: *Porocephalus crotali* found in the lungs of a rat snake

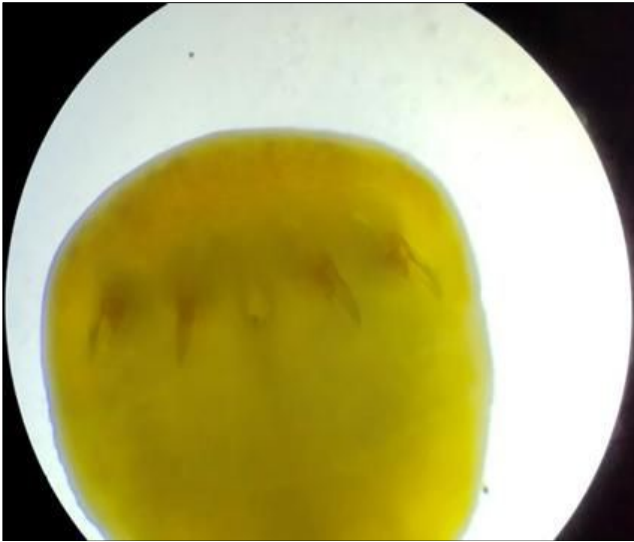


Fig 3: *Porocephalus crotali* exhibiting distinct row of hooks on the head (40X)



Fig 4: *Capillaria Spp* detected in intestinal content by flotation method

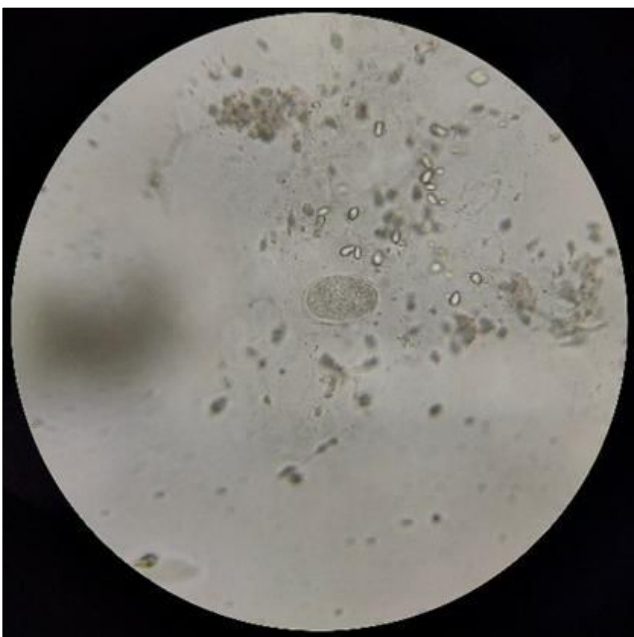


Fig 5: *Strongyloid spp.* eggs detected in intestinal content by flotation method

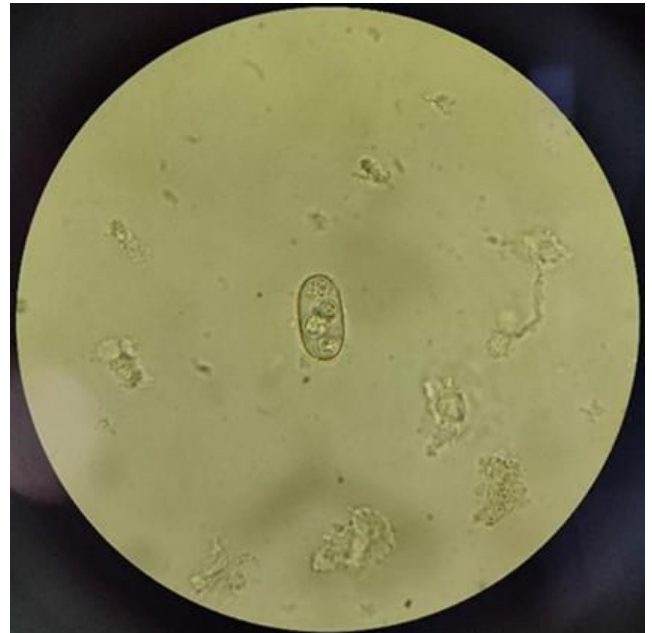


Fig 6: *Choleoeimeria spp* detected in intestinal content by flotation method

Discussion

Reptiles, especially snakes, host many endoparasites like nematodes, cestodes, protozoans, and pentastomids. They often get these infections by eating infected prey or coming into contact with contaminated surfaces in their habitats. It's common to find multiple parasitic infections together, which can work together to harm the host's health significantly (Jacobson, 2007; Telford, 2009) ^[3, 8]. In this study, several types of parasites were found in *Ptyas mucosa*, such as *Porocephalus crotali*, *Choleoeimeria spp.*, *Strongyloides spp.*, and *Capillaria spp.* This shows the variety of parasitic loads wild snakes can face.

Chronic parasitic infections can produce a range of health outcomes in snakes, from mild symptoms to severe weakness. Common health issues include loss of appetite, anemia, reduced mobility, poor body condition, and a higher chance of secondary bacterial or fungal infections (Walden *et al.*, 2020) ^[9]. In this case, the rat snake showed significant weight loss, indicating the impact of long-term parasitism. The combined effect of intestinal, liver, and lung parasites likely affected digestion and nutrient absorption, leading to the animal's death.

Among the parasites found, *Choleoeimeria spp.* is a protozoan that mainly affects the liver and bile ducts. Light infections are often asymptomatic, but heavy loads can cause liver cell death, bile duct overgrowth, and reduced liver function (Paperna, 2006) ^[5]. *Strongyloides spp.*, which is intestinal nematodes with a direct life cycle, may cause damage to the intestinal lining, diarrhoea, and systemic inflammation, especially in young or weak hosts (Telford, 2009) ^[8]. *Capillaria spp.*, recognizable by their bipolar-plugged eggs in intestinal samples, are usually mildly harmful. However, chronic infections can result in damage to the intestinal lining, local inflammation, and nutritional stress (Jacobson, 2007) ^[3].

Finding *Porocephalus crotali* in the lungs of the examined rat snake is significant. *P. crotali* is a type of pentastomid parasite in the Porocephalidae family, commonly seen in rattlesnakes and other vipers in North and Central America. However, there are occasional reports from tropical and

subtropical areas, including Asia, suggesting it may be found in a wider range of environments (Tappe & Büttner, 2009) [7]. Pentastomids are unique because, despite looking like arthropods with exoskeletons and segmentation, they are strict endoparasites that rely on vertebrates. While infections in snakes are often incidental, large numbers of larvae can lead to serious issues, including lung scarring and difficulty breathing (Jacobson, 2007) [3].

The potential for *P. crotali* and similar pentastomids to affect humans is concerning. Humans can accidentally become intermediate hosts by consuming contaminated water or undercooked meat from infected reptiles, which can lead to visceral pentastomiasis with granulomatous lesions in organs such as the liver, lungs, or mesentery (Tappe & Büttner, 2009) [7]. There is limited documentation of *P. crotali* in India. Acharjyo (2004) [1] reported pentastomid infections in captive snakes in Odisha, while unpublished reports from wildlife rescue centers suggest occasional findings in wild snakes. This discovery of *P. crotali* in a wild *Ptyas mucosa* from Central India significantly enhances our understanding of the distribution of pentastomids and their possible impact on snake health and zoonotic transmission.

Extensive research exists on parasitic infections in snakes worldwide. Studies from the United States, Africa, and Southeast Asia have described various parasite groups in both captive and wild snakes (Goldberg & Bursey, 2000; Jacobson, 2007) [2, 3]. However, literature in India is scarce and mostly focuses on captive populations. Acharjyo (2004) [1] and Mohanty *et al.* (2016) [4] documented helminths in snakes kept in zoos in Eastern India, while Parikh *et al.* (2013) [6] identified *Eimeria* and *Isospora* spp. in elapid snakes. This case study stands out as one of the few reports of mixed parasitic infections in a wild *Ptyas mucosa*, confirming the presence of *Choleoeimeria* spp. and *Porocephalus crotali* in Central India.

From an ecological and conservation perspective, parasitic infections in snakes are important indicators of ecosystem health. As mesopredators, snakes reflect the environmental conditions of their habitat. Heavy parasitic loads can reduce hunting efficiency, decrease reproductive success, and increase risk from predation or human activities like habitat destruction and road accidents (Wright & Whitaker, 2001; Wellehan & Gunkel, 2004) [11, 10]. Additionally, finding parasites with zoonotic potential, such as *Porocephalus crotali*, raises concerns for wildlife handlers, forestry workers, veterinarians, and communities involved in snake rescue or illegal reptile trade. These findings highlight the need to incorporate reptile parasitology into broader wildlife health monitoring, especially in biodiversity-rich areas where humans and wildlife interact, such as Central India. In conclusion, this case adds important field evidence to the limited knowledge about parasitic infections in wild Indian snakes. It emphasizes the need for post-mortem checks, targeted parasite studies, and ecological health assessments for herpetofaunal conservation and reducing zoonotic risks.

Declarations

Ethics approval and consent to participate: The study is a post mortem examination and the samples were drawn for diagnosis; hence, does not draw the ethical committee approval. However, as per the existing Wildlife Protection Act, 1972 permission from Principal Chief Conservator of Forest (Wildlife), Maharashtra State was sought to vide no.

Desk-22(8)/Res/CR-59(19-20)/2471/2025-26, Nagpur, date 30 September 2025 for the study and publication of scientific findings.

Consent for publication: Not Applicable.

- **Competing interests:** The authors declare that they have no competing interests.
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