Occurrence of the pentastomid *Porocephalus crotali* (Humboldt, 1811) in an Indian rat snake (*Ptyas mucosus*): a case report

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Abstract The occurrence of the pentastomid *Porocephalus crotali* in an Indian rat snake (*Ptyas mucosus*) at Chennai, India is reported. The worms were found in the lungs and they were identified as females. The worms were cylindrical and annulated with a centrally located mouth surrounded by four hooks. The worms were rounded in cross section with tapering ends. Eggs were composed of two shell membranes. This is one of the new reports from rat snakes in Southern India.

Keywords *Porocephalus crotali* · Indian rat snake · Pentastomid · Lungs

Introduction

Ptyas mucosus, commonly known as the oriental rat snake, Indian rat snake, or dhaman, is a common species of colubrid snake found in parts of South and Southeast Asia. Growing to nearly 2 m, they are large snakes and their colour varies from pale brown in dry regions to nearly black in moist forest areas. They are frequently found in urban areas where rodents thrive. They are diurnal and are active only at day time; remains hidden in dark and silent places like rat holes, termite mounds, wood caves, under rocks, etc. during night time. Habitats include gardens, agricultural lands, termite

mounds, under heavy rocks, caves, dense dry leaves, wood caves, dense forests, piles of brick, wood, rock, dump, scrap and grain storage etc. They are very fast and alert. They are very good climbers and can creep very fast even on trees and heights. On threatening can growl like an angry dog and inflates its forebody to look bigger. They feed on a variety of prey mostly on rodents and toads also feed upon birds, small mammals, other snakes and all kind of lizards.

Porocephalus crotali (Humboldt, 1811) is a pentastomid where adults are found in the lungs, trachea and nasal passages of snakes and nymphs occur in the viscera of various rodents including deer, mice and rats. Adults have a cylindrical, segmented body with hooks arranged in the form of an arc or a trapeze. The internal organs occupy the whole of the abdomen. The nymphs are cylindrical with a smooth annulated body about 8–14 mm in length. Two unequal pairs of hooks are located at the anterior ventral end around the mouth (Soulsby 1982). The eggs are fully developed and infective to the intermediate host when deposited by the female in the lung of the snake. They are subsequently are carried to the pharynx, swallowed, and passed out of the body in the faeces. The intact egg appears to be composed of two shell membranes of which the outer one is thin and the inner membrane is thick and is in contact with the fixed larva. Infection is without pathogenic effect generally, either in the snake or the intermediate host, but very heavy infections may lead to death of snakes. This paper reports the occurrence of *P. crotali* observed during necropsy of a rat snake in Chennai, India.

Case report

Necropsy was performed in an Indian rat snake at Madras Veterinary College, Chennai. Examination of lung revealed

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presence of long worms with a transparent cuticle. These worms were collected in normal saline for identification.

Gross description of the worms

On gross examination, the worms were found to cylindrical and annulated and were rounded in cross section with a bilateral symmetry (Fig. 1). The worms were identified to be females of *P. crotali*. The cuticle was transparent. The average length of the worms was 8 cm and width was 0.4 cm. The anterior end had the cephalothorax which was enlarged (Fig. 2) and the posterior end was tapering (Fig. 3). The internal organs were completely occupying the whole of the abdomen.

Microscopic description of the worms

The head and tail ends of the worms were placed in between two slides, pressed gently with even pressure and the morphological characters were studied in detail microscopically. The anterior end had four hooks arranged in the form of an arc or trapeze (Figs. 4, 5). This was found surrounding a keyhole shaped mouth (Fig. 6) and sensory papillae. The tail end was tapering and bifurcate (Fig. 7). The internal organs were fully occupying the whole of the abdomen. (Fig. 8, 9).

Microscopic description of the eggs

The saline in which the worms were collected contained the eggs shed by the worms. They were examined under the microscope. Eggs were composed of two shell membranes of which the outer one is thin and the inner membrane is thick. Between the two membranes is a fluid-filled space. The average diameter of the eggs measured $0.144\ \mu\text{m}$ (Fig. 10).

Fig. 2 Anterior end

Fig. 3 Posterior end

Fig. 1 Gross female worms

Fig. 4 Hooks—left side

Fig. 5 Hooks—*right side*

Fig. 8 Abdomen—gross

Fig. 6 Mouth

Fig. 9 Abdomen—microscopic

Fig. 7 Bifurcate tail

Fig. 10 Egg

Discussion

Porocephalus crotali are parasitic on snakes. Adults live inside the respiratory tract of snakes and larval nymphs live in the viscera of mammals. During their long evolutionary history, adult and larval nymphs have become very adapted to this internal habitat (Layne 1967; Riley and Henderson 1999). They are bilaterally symmetrical, rounded in cross section with tapered ends. They have an external, non-living cuticle and the body plan is characterized by a cephalothorax, abdomen, and terminal segment. On the cephalothorax, adults have four hooks surrounding a mouth and two pairs of ventral sensory papillae. They are annulated but not truly segmented. Both males and females average around 35–36 annuli over their entire body length. Eggs contain an inner and outer membranes and a fluid filled space in between. (Brookins et al. 2009; Esslinger 1962a, b; Penn 1942; Riley 1981; Self and Riley 1979). Detailed morphological characters of adults and eggs of *P. crotali* has been described by Rataj et al. 2011.

Worms encountered in the present observation were cylindrical and based on the length and other features, they were found to be females with length averaging 8 cm and width 0.4 cm. The anterior end had four hooks arranged in the form of an arc or trapeze with a keyhole shaped mouth in the middle. The tail end was tapering and bifurcate. The internal organs were fully occupying the whole of the abdomen. All these morphological characters were in accordance with the observations made by previous authors.

Considering the life cycle, eggs ingested by a mammal hatch in the small intestine, primary larva penetrates the gut wall and migrates to the liver and the lungs of the mammal, eventually encysting and becoming encapsulated in tissues, including the viscera, mesenteries, and walls of the thoracic and abdominal body cavities. Larvae then moult to become nymph. Snakes ingest the mammalian intermediate host containing seventh instar infective nymphs that excyst and penetrate the gut wall, migrating through the viscera and directly to the lungs. Within the lung cavities of the definitive host, the nymphs develop into adults. Adults with mature eggs are expelled from the trachea and eliminated from the definitive host by oral expulsion. The adults may also be swallowed, resulting in shed eggs in the feces in which another intermediate mammal host will ingest to begin the life cycle again.

The eggs obtained from the worms had two shell membranes of which the outer one is thin and the inner

membrane is thick. Between the two membranes is a fluid-filled space.

Porocephalus crotali also causes human visceral pentastomiasis. The majority of cases have been reported from Africa, Malaysia, and the Middle East. It is an unusual parasitic zoonosis, in which humans may accidentally serve as intermediate hosts. Infection occurs when eggs are ingested from respiratory secretions or feces of the parasite's definitive host. Larval nymphs hatch and penetrate the host gut where the adults become encapsulated in the viscera. Symptoms are highly dependent on affected organs and include abdominal pain, chronic cough, and night sweats. Heavy infections may cause death, however, most human infections are asymptomatic. Prevention of visceral pentastomiasis from *P. crotali* can be done by the avoidance of snake meat consumption and washing the hands (Tappe and Buttner 2009). Perusal of available literature did not show occurrence of this parasite in snakes from India.

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