Filarial infections in semi-wild cattle of Northeast India: first record of *Setaria digitata* (von Linstow 1906) in *Bos frontalis* (Lambert 1804)

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Abstract The occurrence of adult *Setaria digitata*, a filarial nematode of bovine host is reported for the first time from mithun (*Bos frontalis*) of Arunachal Pradesh, India. During December 2011 to March 2012, a thorough survey was undertaken to evaluate the incidence and intensity of helminth infections among semi-wild cattle in Northeast India. During the course of investigation, the relatively uncommon species of *Setaria* was encountered among two out of eleven mithun examined. Through light and scanning electron microscopy, the nematode is identified as *S. digitata*.

Keywords *Bos frontalis* · Arunachal Pradesh · *Setaria digitata* · Scanning electron microscope

Introduction

Setaria digitata (Onchocercidae: Setariinae) is a well-known filarial nematode which is mainly found in the peritoneal cavity of cattle (Yadav and Tandon 1989). It has been reported that the adult worm of this genus does not show any apparent pathogenic effect to the host (Nakano et al. 2006), however, sheep, goat and horse serve as intermediate host and the infective larvae are transmitted to these hosts by mosquito vectors. In the intermediate hosts,

the larvae can migrate to the central nervous system and cause severe clinical manifestations such as myelopathy and encephalopathy (Subhachalat and Adachi 1997; Jaysinghe and Wijesundera 2003). Different species of *Setaria* such as *S. cervi*, *S. labiatopapillosa* and *S. marshalli* were reported in domestic cattle and it is difficult to differentiate different species when multispecies infection occurs. Light microscope is generally used for differentiation and identification of different species; however, due to low resolution it is hard to reveal proper identifying characters under light microscope and leads to wrong identification of parasites. Therefore, the present communication deals with detailed stereoscan features of *S. digitata*, to give an authentic surface fine characters of the species with the help of scanning electron microscope.

Materials and methods

The adult nematodes were collected from the peritoneal cavity of mithun (*Bos frontalis*) slaughtered at Ganga market (27.10°N–93.62°E) and Nirjuli (27.12°N–93.59°E) in Itanagar (Arunachal Pradesh). Soon after collection, six parasites (three males and three females) were washed thoroughly in 0.9 % phosphate buffered saline (pH 7.4) and fixed in 70 % alcohol for whole mount preparation and another six specimens (three males and three females) were fixed in 10 % neutral buffered formalin for scanning electron microscopic observation. Alcohol fixed specimens were cleared in glycerin-alcohol solution while formalin fixed specimens were dehydrated through ascending grades of acetone and dried using tetra-methyl silane (Dey et al. 1989). The specimens were then metal coated with gold and viewed under a JSM 35CF (Jeol) scanning electron microscope operated at 20 kv.

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Results

Light microscopy

The female worm of *S. digitata* revealed to be 80 mm in length and 0.70 mm in width whereas the male was found to be 54 mm in length and 0.39 mm in width. Light microscopic observations of the anterior most part of both the male and female *S. digitata* found to possess a round-shaped mouth opening with some minute small rounded papillae arranged just below the lateral lips in the head region (Fig. 1a, arrow and arrowhead). Unlike anterior end, marked structural differences were observed at the posterior region of male and female *S. digitata*. In female, the posterior most part of the tail posses a knob like structure (Fig. 1b, arrow) whereas, in male no such structure was visible. Papillary arrangement was observed at the posterior region of male parasite (Fig. 1c, arrow and arrowhead).

Scanning electron microscopy

Surface micro topographical observations revealed round shaped mouth opening at the anterior most end of both the male and female *S. digitata* with a pair of finger-like projection situated on either side (Fig. 2a). On the other hand the spirally coiled posterior ends of female *S. digitata* posses one pair of lateral appendages near the tail tip (Fig. 2b). The female worm bears a knob like structure on the tip of the tail (Fig. 2c). The general arrangements of the precloacal and post cloacal papillae of the male were distinctly visible under SEM (Fig. 2d). Male *S. digitata* showed clear papillary arrangement: three pairs of

precloacal, one pair of adcloacal, three pairs of post cloacal (of which one pair was longitudinally arranged) and a central papilla has been found just in front of the cloaca (Fig. 2d, e). In males, the cuticular ornamentation was observed in ventral side of the parasite (Fig. 2f).

Discussion

The present report is the first record of *S. digitata* from mithun, a semi-wild indigenous cattle of Northeast India. Except for minor variation in body size, measurement of different body organs, shape and size of lateral lips, the present observations tally with the earlier description of the species (Yadav and Tandon 1991). On the basis of coprological observations, several genus of nematodes were reported from mithun (*B. frontalis*), like *Trichuris*, *Capilaria*, *Strongyloides*, *Toxocara*, *Ascaris*, *Oesophagostomum*, *Bunostomum*, *Mesistocirus*, *Coperia*, *Ostertagia*, *Thelazia* and *Dictyocaulus* etc. (Rajkhowa et al. 2005; Tandon et al. 2005; Chamuah et al. 2009).

Several species of *Setaria* were reported from domestic cattle (*Bos indicus*), buffalo (*Bos taurus*), goat (*Capra hircus*), and pigs (*Sus scrofa domestica*) in Northeast India, however, *S. digitata* was reported only from *B. indicus* and *B. taurus* in the region (Yadav et al. 1988; Yadav and Tandon 1989, 1991). Although Yadav and Tandon (1991) recovered the adult *S. digitata* from slaughtered cattle and buffaloes in Shillong, the origin of the host is doubtful, since most of the cattle and buffaloes slaughtered in Shillong brought from Uttar Pradesh and Bihar. Thus the present observation confirms the prevalence of these

Fig. 1 Light microscopic photographs of *S. digitata*. **a** Anterior portion showing the lateral lips (arrow) and some minute papillae in the head portion of the worm (arrowhead), **b** posterior portion of

female showing the knob (arrow) and **c** posterior portion of male showing arrangement of precloacal (arrow) and post cloacal papillae (arrowhead)

Fig. 2 Stereoscan photographs of *S. digitata*. **a** Anterior portion of the body showing lateral lips (arrow) and some minute papillary arrangement in the head portion of the worm (arrow heads), **b** posterior portion of female showing lateral appendage (arrow head), **c** enlarged view of posterior portion of female showing a knob like structure on the tip of the tail (arrow), **d** posterior portion of male showing the arrangement of three pairs of precloacal papillae (arrow) and three pairs of post cloacal papillae (arrow heads), **e** posterior

portion of male worm showing arrangement of a central papilla (long arrow), situated in front of the cloaca (small arrow), a pair of longitudinally arranged post cloacal papillae (arrow head) and **f** posterior region of the male worm, anterior to the cloaca showing clearly well arranged ventral bands, where the transversely (arrow-head) running cuticle alternated with those of having longitudinal (arrow) arrange cuticle

economically important parasites among indigenous cattle of Northeast India. The report seems to be of veterinary significance since apart from normal host, like cow and buffalo, whenever other herbivores hosts like sheep, goats or horse are infected; serious pathogenic manifestations like cerebrospinal nematodiasis and lumbar paralysis are known to occur an account of erratic migration of the juveniles of *Setaria* species (Innes and Shoho 1953). The life cycle of most of the species of *Setaria* is unknown; however, different species of mosquitoes such as *Aedes aegypti*, *A. pembaensis*, *Culex* species and *Anopheles* species are implicated as vectors of microfilariae which transmit the infective form to different hosts (Soulsby 1982). In the area under study there is a close proximity between mithun and wild animals since the mithun are released for grazing in the jungle, thus there is proximity to transmit the infection between wild and semi-wild animals through *Anopheles* vector, of which as many as 17 species are reported to occur in the region (Dutta et al. 1992). Therefore, further investigation on the seasonal prevalence and intensity of filarial infections among domestic as well as semi-wild and wild animals in this region, together with an intensive study on the biology and ecology of its vectors are prerequisite for implementation of successful management program of this indigenous cattle.

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