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ORIGINAL ARTICLE

Meteterakis asansolensis sp. nov. (Nematoda: Heterakidae) in *Duttaphrynus melanostictus* (Schneider, 1899) (Amphibia: Anura: Bufonidae) from Asansol coalfield area, Paschim Bardhaman, West Bengal, India

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Abstract *Meteterakis asansolensis* sp. nov. (Nematoda: Heterakidae) recovered from the rectum of Asian common toad, *Duttaphrynus melanostictus* (Schneider, 1899), collected from Asansol coalfield area in Paschim Bardhaman district of West Bengal, India, is described and illustrated. This species is characterised by the presence of a precloacal sucker, a gubernaculum and two equal and similar spicules (0.31–0.32 mm in length). This species differs from other reported species of the Oriental region by morphometrical ranges of measurements of males (3.09–3.54 mm) and females (4.60–4.72 mm) and the number and the distribution pattern of caudal papillae in males which includes 5 pairs precloacal, 1 pair adcloacal and 5 pairs postcloacal in position.

Keywords *Meteterakis asansolensis* sp. nov. · Nematoda · *Duttaphrynus melanostictus* · Amphibia · Asansol · India

Introduction

Duttaphrynus melanostictus (Schneider, 1899) is commonly known as Asian common toad or Asian black-spined toad. It is a widespread species occurring throughout Southeast Asia and southern China and Pakistan (Daniels 2005). It should be noted that bufonid toads have been reported from all zoogeographical region only excluding Australo-Papuan realm (Duellman 1999). The species of the genus *Meteterakis* Karve, 1930 are the common parasites of the alimentary canal of amphibians and reptiles (Inglis 1958). Bursey et al. (2017) have given an updated list of 27 species of the genus *Meteterakis* from different biogeographical regions. After that, Sata (2018) described two other new species of the genus, viz. *Meteterakis formosensis* Sata, 2018 in *Plestiodon chinensis* from Taiwan and *M. occidentalis* Sata, 2018 in *P. japonicus* from Japan. So, the genus *Meteterakis* currently comprises 29 species, of which 20 species have been reported from the Oriental region. It should be noted that Sou et al. (2014) described *Aplectana duttaphryni* Sou, Sow and Nandi, 2014 from the rectum of *D. melanostictus* from Kulti, Asansol coalfield area. Few years later, Sou and Bursey (2017) reported the presence of *Seuratascaris numidica* Seurat, 1917 in *Hoplobatrachus tigerinus* (Daudin, 1803) also from the same region. Recently, Sou and Sow (2018) have reported the presence of *A. macintoshii* (Stewart, 1914) Travassos, 1931 in *Euphlyctis cyanophlyctis* (Schneider, 1799) from the Raniganj town, Asansol coalfield region.

During an ongoing survey for amphibian nematode from West Bengal, India, 3 male and 4 female nematodes were recovered from the rectum of 1 *D. melanostictus*, collected from the Asansol coalfield area, Paschim Bardhaman, West Bengal. In the present study, nematodes recovered from the rectum of *D. melanostictus* are described and assigned to a new species of the genus *Meteterakis* and the name *Meteterakis asansolensis* sp. nov. is proposed for them. *Meteterakis asansolensis* sp. nov. represents the 30th species assigned to the genus and 10th species from India and 21st from the Oriental region.

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Materials and methods

One *D. melanostictus* was collected by hand from Asansol coalfield area of Paschim Bardhaman district, West Bengal, during March 2018. The collected toad was killed after doing proper anaesthesia. Removal of digestive tract was done by an incision of the mid-ventral region of the toad. A longitudinal slit of the oesophagus, stomach and intestine helped in the examination of contents for nematode parasites. Three male and 4 female nematodes were recovered from the rectum of the host. The collected nematodes were cleared from ingesta by shaking them with 0.67% NaCl solution, killed and fixed in steaming 4% formaldehyde solution. 5% glycerine was used as mounting medium for light microscopic examination. After study, nematodes were transferred to fresh 4% formalin and could be stored satisfactorily. All measurements are given in millimetres as well as the range with holotype/allotype in parenthesis.

Results

Meteterakis asansolensis sp. nov. (Fig. 1a–j)

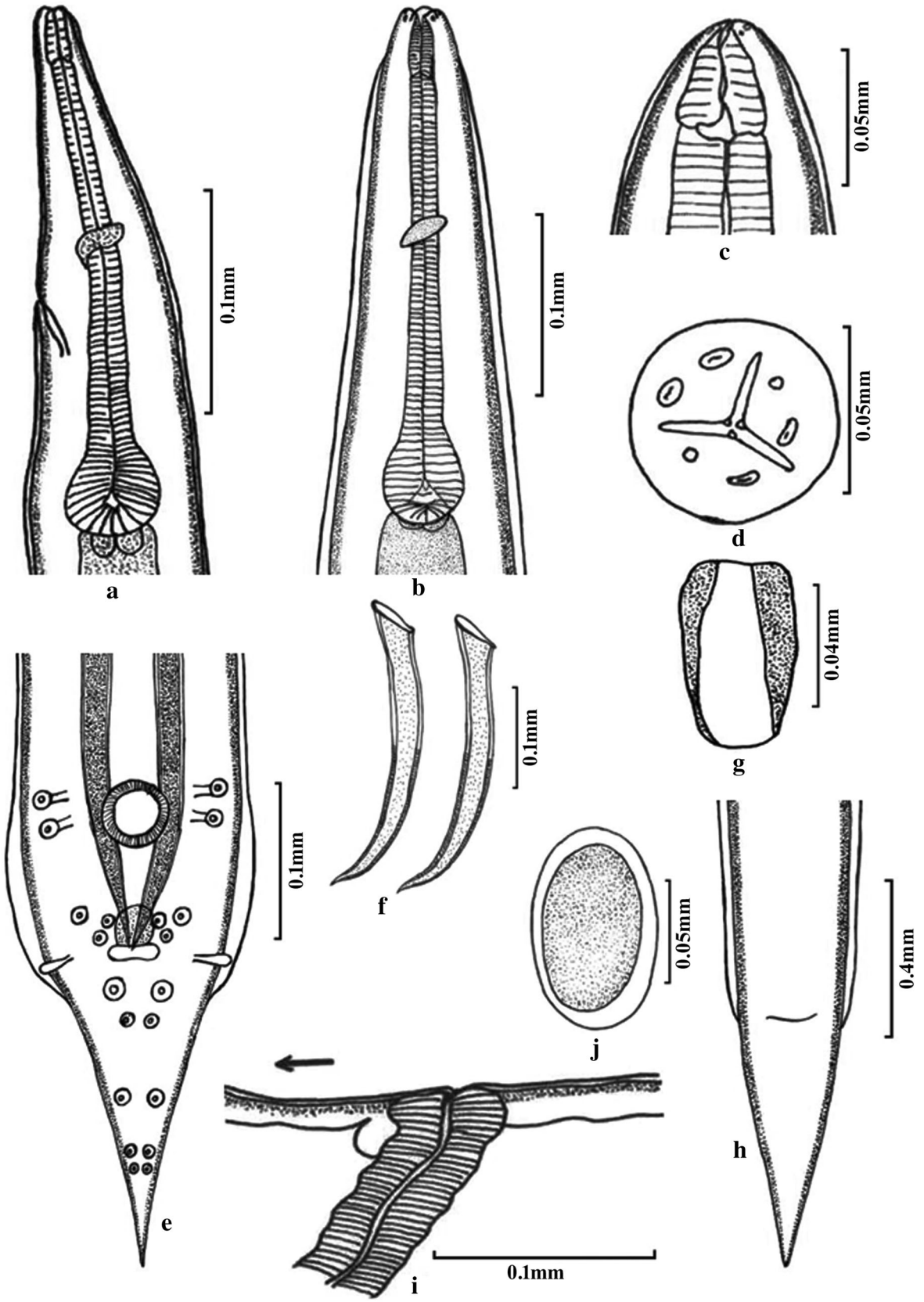
General morphology Small and cylindrical worms, tapering at both ends. Cuticle with fine transverse striation. Lateral alae (Fig. 1b, e, h) narrow starting at the level of pharynx to caudal region in males and at the level of anus in females. Mouth surrounded by three lips (Fig. 1d) and no interlabia found. Dorsal lip with 2 sessile papillae and each ventrolateral lip with 1 papilla and 1 lateral amphid (Fig. 1d). Each three lips with cuticular flange at inner edge (Fig. 1e). Oesophagus (Fig. 1a, b) divided into a short pharynx, a long cylindrical corpus and a valved oesophageal bulb. Excretory pore (Fig. 1a) situated in between nerve ring and oesophageal bulb. Nerve ring (Fig. 1a, b) located just anterior to the excretory pore. Posterior end of male with a cuticular sucker and a narrow caudal alae (Fig.1e).

Male (based on holotype and two paratypes; measurement of holotype in parenthesis): Body length 3.09–3.54 (3.50) and maximum body width at mid body region 0.18–0.22 (0.22). Total length of oesophagus, including pharynx, cylindrical corpus and oesophageal bulb, 0.72–0.78 (0.77), of pharynx 0.03–0.037 (0.037) long and 0.02–0.023 (0.02) wide, of cylindrical corpus 0.55–0.90 (0.88) long and 0.05–0.07 (0.06) wide, of oesophageal bulb 0.09–0.10 (0.095) long and 0.10–0.104 (0.10) wide. Nerve ring, 0.45–0.46 (0.46) and excretory pore, 0.58–0.60 (0.59) from anterior end. Caudal alae narrow. Caudal papillae (Fig. 1e) 11 pairs, of which 5 pairs precloacal, 1 pair adcloacal and 5 pairs postcloacal in position. Of the precloacal papillae, 3 pairs situated around the upper lip of cloaca. 2 pairs large pedunculated caudal papillae situated at the level of ventral sucker. 1 pair pedunculated papillae, also ventral in position at level of cloaca which supports the narrow caudal ala. Of the postcloacal papillae, 1 pair larger and 1 pair smaller in size, situated just posterior to the cloaca and rest of 3 pairs postcloacal papillae smaller in size on the tail, also ventral in position. Spicules (Fig. 1f) similar, equal, 0.31–0.32 (0.32) in length, slightly curved and non-alate. Distal end of spicule pointed but proximal end expanded into a well-developed manubrium and well cuticularised. Gubernaculum (Fig. 1g) present, 0.04–0.042 (0.041) long, flat but lateral part well sclerotised. Tail conical (Fig. 1e), 0.22–0.23 (0.23) long, bent ventrally.

Female (based on allotype and three paratypes; measurement of allotype in parenthesis): Body length, 4.60–4.72 (4.70) and maximum width at mid body, 0.23–0.24 (0.23). Total length of oesophagus including pharynx, cylindrical corpus and oesophageal bulb, 0.91–0.94 (0.93), of pharynx 0.08–0.09 (0.09) long and 0.04–0.05 (0.05) wide, of cylindrical corpus 0.69–0.71 (0.71) long and 0.06–0.07 (0.07) wide, of oesophageal bulb 0.14–0.15 (0.15) long and 0.15–0.16 (0.16) wide. Nerve ring, 0.48–0.51 (0.51) and of excretory pore 0.62–0.61 (0.62) from anterior end. Vulva transverse (Fig. 1i) slit without any flap, 2.10–2.14 (2.11) from anterior end. Vagina directed anteriorly and then posteriorly directed giving rise to two uteri. Uterus filled with numerous eggs. Eggs (Fig. 1j) oval, thick shelled and unembryonated in uterus. Tail conical (Fig. 1h), slightly bent in lateral view, 0.25–0.27 (0.26) in length.

Taxonomic summary

Family: Heterakidae Railliet and Henry, 1912.
Subfamily: Meteterakinae Inglis, 1967.
Genus: *Meteterakis* Karve, 1930.
Species: *Meteterakis asansolensis* sp. nov.
Host: *Duttaphrynus melanostictus* (Schneider, 1899).
Location of parasites: Rectum.
Locality: Asansol town, Paschim Bardhaman, West Bengal, India (23.6739°N, 86.9524°E).
Holotype: One male; Regn. No: BUPL-153A.
Allotype: One female; Regn. No: BUPL-153B.
Paratypes: Two males and three females; Regn. No: BUPL-153C.
Type Specimens: Type specimens (Holotype: one male; Regn. No: BUPL-153A; Allotype: one female; Regn. No: BUPL-153B and Paratypes: two males and three females; Regn. No: BUPL-153C) have been deposited in the Helminthological collection, Parasitology Laboratory, Burdwan University, Purba Bardhaman, West Bengal, India.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◀**Fig. 1** **a–j** *Meteterakis asansolensis* sp. nov. **a** Anterior end of female, lateral view. **b** Anterior end of male, dorsal view. **c** Enlarged view of pharyngeal region of female, lateral view. **d** Enface view of head of female. **e** Posterior region of male, ventral view. **f** Spicules (isolated). **g** Gubernaculum (isolated). **h** Posterior region of female, ventral view. **i** Vulvar region, lateral view, arrow points towards cephalic end. **j** Egg, morulate stage

Etymology: The new species is named after the locality of collection, Asansol, West Bengal, India.

Discussion

Twenty-one species of the genus *Meteterakis* have been reported from the Oriental region; among them, only nine species of *Meteterakis* have been reported from India (see Bursey et al. 2017). The reported species of *Meteterakis* from the India are: *M. andamanensis* Soota and Chaturvedi, 1972 in *Bufo* sp (= *Duttaphrynus* sp) from Andaman and Nicobar; *M. aurangabadenis* Desmukh and Choudhari, 1980 in *Bufo melanostictus* (= *D. melanostictus*) from Aurangabad; *M. bufonis* (Biswas and Chakravarty, 1963) Baker, 1984 in *B. melanostictus* (= *D. melanostictus*) from Barasat, West Bengal; *M. gambhiri* Zhang and Zhang, 2011 in *D. melanostictus* from Manipur; *M. govindi* Karve, 1930 in *B. melanostictus* (= *D. melanostictus*) from Zoological Garden, Calcutta; *M. guptai* Gupta and Naiyer, 1993 in *Calotes versicolor* from Lucknow; *M. karvei* Naidu and Thakare, 1981 in *B. melanostictus* (= *D. melanostictus*) from Nagpur; *M. louisi* Inglis, 1958 in a tree lizard from Calcutta, West Bengal and *M. mabuyi* (Chakravarty, 1944) Inglis, 1958 in *Mabuya carinata* from Calcutta, West Bengal.

Following Bursey et al. (2017), selected morphological features of the species of *Meteterakis* having characteristics of Group IV of Junker et al. (2015), including the newly described nematodes, are presented in Table 1. It should be noted that Junker et al. (2015) classified the species of

Table 1 Diagnostic features of *Meteterakis* spp., belonging to Group IV, reported from India including the presently described new species (after Bursey et al. 2017, Junker et al. 2015)

Meteterakis spp.	Male				Female		References
	Body length (mm)	Spicule length (mm)	Gubernaculum length (mm)	Caudal papillae pattern in pairs (Pre-: ad-: postcloacal)	Body length (mm)	Vulva from anterior end (mm)	
M. andamanensis Soota and Chaturvedi, 1972	3.85–5.0	0.4–0.5	Absent	4:3:3	4.12–5.5	1.6–1.8	Soota and Chaturvedi (1972)
M. aurangabadensis Desmukh and Choudhari, 1980	2.80–4.86	0.62–0.72	Absent	10:0:6	5.3–6.0	2.06–2.46	Desmukh and Choudhari (1980)
M. bufonis (Biswas and Chakravarty, 1963) Baker, 1984	4.25	Right, 0.27–left, 0.31	Absent	6:1:5	5.59–5.85	2.83–2.96	Biswas and Chakravarty (1963)
M. gambhiri Zhang and Zhang, 2011	3.73–4.83	0.22–0.27	Absent	5:2:3 + 3 unpaired preanal	4.18–5.79	1.99–2.76	Gambhir et al. (2006) and Zhang and Zhang (2011)
M. govindi Karve, 1930	4.0–5.4	0.18–0.27	Present, 0.11	7:0:13	4.6–7.2	2.2–3.2	Inglis (1958)
M. guptai Gupta and Naiyer, 1993	7.8	0.49	Present, 0.06	6:1:6	9.99	4.9	Gupta and Naiyer (1993)
M. hurawensis Bursey, Goldberg, Siler and Brown, 2017	3.20–4.48	0.31–0.391	Present, 0.068-0.093	6:0:4 + 1 single	3.89–5.44	2.24–2.62	Bursey et al. (2017)
M. karvei Naidu and Thakare, 1981	3.04–4.41	0.66–0.84	Present, 0.045	11:1:5	3.64–4.90	1.72–1.98	Naidu and Thakare (1981)
M. louisi Inglis, 1958	5.0–7.4	0.97–1.10	Present, indistinct	3:1:14–15	6.5–7.6	2.3–2.9	Inglis (1958)
M. mabuyi (Chakravarty, 1944) Inglis, 1958	4.7	0.30	Absent	12:0:8	7.025	2.6	Chakravarty (1944) and Inglis (1958)
M. triaculeata (Kreis, 1933)	9.4	0.38	Absent	10:2:5	8.2–9.8	4.1–4.8	Inglis (1958)
M. asansolensis sp.nov.	3.09–3.54	0.31–0.32, equal	Present, 0.04	5:1:5	4.60–4.72	2.10–2.14	Present study

Meteterakis into 4 groups (i.e. Groups I–IV) on the basis of length of spicules whether they were equal or unequal. *Meteterakis asansolensis* sp. nov. belongs to the Group IV (spicule length ranging from 0.18–0.38 mm), because it has also short and equal spicules (see Junker et al. 2015). The species under the Group IV includes *M. gambhiri*; *M. govindi*; *M. hurawensis* Bursey, Goldberg, Siler and Brown, 2017; *M. mabuyi*; *M. triaculeata* (Kreis, 1933) and *M. asansolensis* sp. nov.

The present parasites differ from *M. gambhiri* by the presence of gubernaculum and distribution pattern of caudal papillae in males. Moreover, males of the present parasites are smaller than the males of *M. gambhiri*. The males of the present parasites are smaller than the males of *M. govindi,* and caudal papillae pattern is also different from that of *M. govindi*. The present parasites differ from *M. hurawensis* by the pattern of distribution of caudal papillae in males. The vulva of *M. hurawensis* is covered by a lateral flap, but flap is absent in the case of present parasites. The newly described nematodes also differ from *M. mabuyi* and *M. triaculeata* by the distribution pattern of caudal papillae in males. The males and females of the present parasites are smaller than the males and females of *M. mabuyi* and *M. triaculeata*.

The present nematodes, thus, appear to be new in the field of science, and the name *Meteterakis asansolensis* sp. nov. is proposed. The new species is named in reference to the locality from where it was collected. *Meteterakis asansolensis* sp. nov. represents the 30th species assigned to the genus and the 10th species described from India and 21st from the Oriental realm.

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Compliance with ethical standards

Human and animal rights Though there is no ethics committee in our Institutions, toad has been killed for the present study following guidelines of The Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA) formed by the Act of the Indian Parliament.

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