***Camallanides prashadi* Baylis and Daubney, 1922 (Nematoda, Camallanidae) in *Xenchropis piscator* (Schneider, 1799) (Reptilia, Squamata) and discussion on the synonymy of *Camallanides piscatori* Khera, 1954 from West Bengal, India**

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Abstract *Camallanides prashadi* Baylis and Daubney, 1922, recovered from the intestine of Asiatic water snake, *Xenchropis piscator* (Schneider, 1799), collected from the Bolpur town, Birbhum district of West Bengal, India, is redescribed. This species is characterised by presence of buccal capsule which is reddish-brown in colour and consists of two lateral buccal valves. Each buccal valve bears five complete and four incomplete longitudinal ridges, presence of similar, non-alate, unequal spicules and fourteen pairs of pedunculated caudal papillae. Of these papillae, seven pairs are preanal, two pairs are adanal and five pairs are postanal in position. *Camallanides piscatori* Khera, 1954 is proposed as a synonym for *Camallanides prashadi* Baylis and Daubney, 1922. Birbhum district is recorded as new geographical locality for this parasite.

Keywords *Camallanides prashadi* · *C. piscatori* · *Xenchropis piscator* · West Bengal · India

Introduction

The Asiatic water snake, *Xenchropis piscator* (Schneider, 1799), is found in or near fresh water lakes, ponds and rivers. It feeds mainly on small fishes and water frogs. It is a com-mon species of non-venomus snake found in

Birbhum district, West Bengal. Nematodes are one of the most important groups of animals that are free living in water and soil and an impressive number of species are parasitic in plants and animals. With respect to the knowledge of nematode parasites in India, studies on this group in West Bengal are rather satisfactory. In spite of contribution by several authors, perhaps there is absence of detail survey of reptilian hosts for nematode parasites of all areas of West Bengal. Of the host groups, works on reptilian nematodes are rare. De (1998), reported some reptilian nematodes from elapid snake in West Bengal. Sou and Nandi (2011) reported some reptilian nematodes from Birbhum district, West Bengal.

During a routine survey for reptilian nematodes, 3 male and 3 female nematodes were recovered from the intestine of one, *X. piscator* collected from Bolpur town (23.6687° N, 87.6828° E) in Birbhum district, West Bengal, India. After light microscopic study, the recovered nematodes were found to be *Camallanides prashadi* Baylis and Daubney, 1922. But the original description of these species is inadequate. The purpose of this paper is to provide a detailed description of *C. prashadi* from the material recovered from *X. piscator*.

Materials and methods

One Asiatic water snake, *Xenchropis piscator* (Schneider, 1799), collected by net from a pond of Bolpur town (23.6687°N, 87.6828°E), Birbhum district, West Bengal, India was killed through proper anaesthesia with solvent ether and examined for parasitic infection. 3 male and 3 female nematodes were recovered from the intestine of the host. Recovered nematodes were freed from debris by shaking them in 0.67% NaCl solution, killed and fixed in

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steaming 4% formaldehyde solution and mounted in 5% glycerine for light microscopic examination. The glycerine treated specimens after observation were directly transferred to 4% formalin and could be stored satisfactorily. All specimens have been deposited in the Helminthological collection, Parasitology Laboratory, Burdwan University, Purba Bardhaman, West Bengal, India (Registration No. BUPL-162). All measurements are given in millimetres unless otherwise indicated.

Results

Camallanides prashadi Baylis and Daubney, 1922 (Fig. 1–8)

General morphology

Small and slender worms. Body cuticle thin and bears fine striations. Mouth dorsoventrally elongated and lips absent (Figs. 1 and 2). Two pairs of submedian cephalic papillae present just behind the mouth opening (Fig. 2). Buccal capsule reddish-brown in colour and consists of two lateral buccal valves. Each buccal valve bears five complete and four incomplete longitudinal ridges (Fig. 2). Dorsal and ventral monodents attached to the buccal capsule. Oesophagus long and divided into an anterior muscular and a posterior glandular part (Fig. 1).

Male

Males smaller than the females. Body length 5.93–6.17, maximum width 0.17–0.18. Buccal capsule 0.10–0.11 long and 0.11–0.12 wide. Length of muscular oesophagus 0.33–0.34 and 0.07–0.08 wide, of glandular oesophagus 0.31–0.32 long and 0.07–0.08 wide. Distance of nerve ring 0.17–0.18, of excretory pore 0.20–0.22, of cervical papillae 0.43–0.44 from anterior end. Tail 0.62–0.67 long, conical curved ventrally and bears a pair of narrow caudal alae (Fig. 3). Fourteen pairs of pedunculated caudal papillae present. Of these, seven pairs preanal, two pairs adanal and five pairs postanal in position (Fig. 3). Spicules non-alate, similar and unequal (Figs. 4 and 5). Right spicule 0.22–0.23 long, stout and gradually narrowed down to a bluntly rounded distal end. Left spicule feebly developed, 0.10–0.11 long and could not be made out in situ but isolated on rupturing the posterior end of one male. Gubernaculum could not be made out.

Female

Body length 15.46–16.28 and maximum width 0.46–0.50. Buccal capsule 0.12–0.13 long and 0.14–0.14 wide. Length of muscular oesophagus 0.42–0.43 and 0.16–0.169 wide, of

glandular oesophagus 0.63–0.64 long and 0.13–0.14 wide. Distance of nerve ring 0.20–0.21, of excretory pore 0.25–0.26, of cervical papillae 0.51–0.52 from anterior end. Tail 0.49–0.50 long, tapers distally ending in a bluntly rounded tip (Fig. 6). Vulva 6.45–6.78 from anterior end and more or less equatorial and situated at the tip of a tubular appendage facing posteriorly (Fig. 7). Vagina runs anteriorly along the vulvar appendage and then turns posteriorly to join the uteri. Uterine branches opposed. Posterior uterine branch without an ovary. Eggs oval and thin-shelled (Fig. 8).

Taxonomic summary

Family	Camallanidae Railliet and Henry, 1915
Subfamily	Camallaninae Yeh, 1957
Genus	<i>Camallanides</i> Baylis and Daubney, 1922
Species	<i>Camallanides prashadi</i> Baylis and Daubney, 1922
Host	<i>Xenchropis piscator</i> (Schneider, 1799)
Location	Intestine
Locality	Bolpur, Birbhum, West Bengal, India (23.6687°N, 87.6828°E)

Discussion

According to Anderson et al. (2009), the genus *Camallanides* can be identified by presence of buccal cavity which is reduced or absent behind valves; buccal valves with longitudinal lateral band; presence of trident; dorsal and ventral tridents replaced by sclerotized rods and parasites of alimentary canal of snakes.

The present parasites agree with *C. prashadi* in metrical range (Table 1) and having dorsoventrally elongated mouth opening; buccal capsule with two lateral valves with longitudinal ridges; equal dorsal and ventral monodents; bipartite oesophagus; male tail with caudal alae; seven pairs preanal; two pairs adanal and five pairs postanal papillae; unequal spicules; equatorial vulva situated at the tip of a tubular appendage; posteriorly directed vagina; opposed uteri and single ovary.

Baylis and Daubney (1922) established the genus *Camallanides* with *Camallanides prashadi* Baylis and Daubney, 1922 as the type species recovered from *Bungarus faciatus* (Schneider, 1801). Khera (1954) divided the genus *Camallanides* into two subgenera, *Camallanides* (*Camallanides*) and *Camallanides* (*Procamallanides*) and also described *Camallanides* (*Procamallanides*) *piscatori* and *Camallanides* (*Procamallanides*) *ptyas*. Deshmukh (1968) however, suppressed these subgenera. Present account agrees with Deshmukh (1968).

Fig. 1–8 *Camallanides prashadi* Baylis and Daubney, 1922 **1** Anterior end of female, lateral view. **2** Enlarged view of anterior end of female, lateral view. **3** Posterior end of male (single spicule shown), lateral view. **4** Left spicule (Isolated). **5** Right spicule

(Isolated). **6** Posterior end of female, ventral view. **7** Vulvar region of female, lateral view, arrow points towards cephalic end. **8** Egg, morulate stage

Khera (1954) described *Camallanides ptyas* from *Ptyas mucosus* (Linnaeus, 1758) in Lucknow, India and Deshmukh (1968) described *Camallanides dhamini* also from *P.*

mucosus in Aurangabad, India. Gupta and Nayier (1992) synonymised this two species with *C. prashadi*. The present account accepts Gupta and Nayier's opinion. Khera

Table 1 Morpho-metrical variation of forms placed in synonymy under *Camallanides prashadi* Baylis and Daubney, 1922

Description	<i>Camallanides prashadi</i> (after Baylis and Daubney 1922)		<i>C. prashadi</i> (after Agarwal 1967)		<i>C. prashadi</i> (after Bliques and Rehena 1975)		<i>C. prashadi</i> (= <i>Camallanides pyus</i> Khara, 1954)	
	Calcutta, West Bengal	Female	Lucknow, India	Female	Sind, Pakistan	Lucknow, India	Lucknow, India	
Host	<i>Bongarus fasciatus</i>		<i>Ptyas mucosus</i>		<i>Cerberus rhynchos</i>		<i>P. mucosus</i>	
	Male	Female	Male	Female	Female	Male	Male	Female
Body length	5.80–6.60	14.20–17.70	6.74–7.29	13.56–19.88	11.68–17.90	8.50–8.80	23.0–25.00	
Maximum body width	0.21–0.25	0.40–0.47	0.24–0.28	0.40–0.48	0.36–0.48	0.25–0.29	0.42–0.46	
Length of buccal capsule	0.06	0.09–0.10	0.06–0.065	0.08–0.115	0.08–0.09	0.028	0.045	
Width of buccal capsule	0.075	0.10	0.08–0.085	0.11–0.14	0.09–0.11			
Length of muscular oesophagus	0.38	0.47–0.50	0.29–0.30	0.31–0.40	0.35–0.39	0.25–0.27	0.36–0.39	
Width of muscular oesophagus			0.075–0.08	0.10–0.15	0.06–0.08			
Length of glandular oesophagus			0.42	0.51–0.63	0.45–0.46	0.47–0.49	0.70–0.76	
Width of glandular oesophagus			0.09–0.095	0.10–0.15				
Nerve ring from anterior end	0.15	0.19	0.14	0.18–0.26				
Cervical papillae from anterior end	0.28	0.35		0.52–0.86		0.13–0.15	0.16–0.17	
Excretory pore from anterior end	0.25	0.31	0.19–0.22	0.32–0.56		0.24	0.40	
Vulva from anterior end		5.90–6.10		6.10–8.60	5.40–7.30	0.30	0.42	11.00
Anus from posterior end	0.06	0.40–0.60	0.06–0.09	0.29–0.36	0.40–0.59	0.48–0.50	0.46–0.50	
Length of right spicules	0.24		0.29–0.36			0.19–0.21		
Length of left spicules	0.14		0.175–0.19			0.09–0.10		
Length of Gubernaculum	0.025		0.028–0.029			0.028		
Width of Gubernaculum								
Ridges on buccal capsule	14		10–12			10–12	12	
Caudal papillae (pre-ad-postanal) in pairs	7:2:5		7:2:5			5:0:5		
Description	<i>C. prashadi</i> (= <i>Camallanides dhamini</i> Deshmukh, 1968)		<i>C. prashadi</i> (= <i>C. dhamini</i>) (after Subbarao et al. 1985)		<i>Camallanides piscator</i> Khara, 1954		<i>C. piscator</i> (= <i>Camallanides venae</i>) Gupta and Duggal, 1984	
	Aurangabad, India	Female	Andhra Pradesh, India	Female	Lucknow, India	Uttar Pradesh, India		
Host	<i>P. mucosus</i>		<i>P. mucosus</i>		<i>Natrix piscator</i> (= <i>Xenochrophis piscator</i>)		<i>N. piscator</i> (= <i>X. piscator</i>)	
	Male	Female	Male	Female	Male	Female	Male	Female
Body length	5.50	11.30–14.76	5.00–9.00	6.00–20.00	5.70	15.00–17.10	6.975	21.40–21.80
Maximum body width	0.22	0.30–0.39	0.25–0.37	0.24–0.33	0.18	0.50–0.55	0.285	0.515
Length of buccal capsule	0.086	0.105	0.07–0.12	0.09–0.12	0.07	0.10–0.11	0.075	0.10
Width of buccal capsule	0.071	0.09	0.09–0.11	0.10–0.15	0.093	0.135–0.142	0.095	0.13–0.135
Length of muscular oesophagus	0.29	0.28–0.31	0.33–0.41	0.31–0.39	0.31	0.36–0.39	0.365	0.415–0.445
Width of muscular oesophagus			0.07–0.12	0.09–0.18				
Length of glandular oesophagus	0.37	0.43–0.46	0.60–0.68	0.57–0.60	0.04	0.58–0.62	0.515	0.65–0.80

Table 1 continued

Description	<i>C. prashadi</i> (= <i>Camallanides dhumini</i> Deshmukh, 1968)		<i>C. prashadi</i> (= <i>C. dhumini</i>) (after Subbarao et al. 1985)		<i>Camallanides piscator</i> Khara, 1954		<i>C. piscator</i> (= <i>Camallanides venae</i>) Gupta and Duggal, 1984	
	Aurangabad, India		Andhra Pradesh, India		Lucknow, India		Uttar Pradesh, India	
Locality								
Host	<i>P. mucosus</i>		<i>P. mucosus</i>		<i>Natrix piscator</i> (= <i>Xenochropis piscator</i>)		<i>N. piscator</i> (= <i>X. piscator</i>)	
Description	Male	Female	Male	Female	Male	Female	Male	Female
Width of glandular oesophagus			0.09-0.40	0.09-0.13				
Nerve ring from anterior end	0.15	0.15-0.17	0.15-0.20	0.21-0.22	0.115	0.245	0.155	0.225-0.240
Cervical papillae from anterior end					0.28	0.35		
Excretory pore from anterior end			0.26-0.29	0.28-0.30	0.30	0.38	0.35	0.434
Vulva from anterior end		4.93-5.74		6.00-7.57 ^a				8.20-8.70
Anus from posterior end	0.13		0.15-0.18	0.18-0.49	0.12	0.42-0.48	0.10	1.80-1.84
Length of right spicules	0.31		0.24-0.27		0.32		0.275	
Length of left spicules	0.26		0.12-0.19		0.22		0.1476	
Length of gubernaculum	0.017		0.031-0.37 ^a		0.25			
Width of gubernaculum	0.006							
Ridges on buccal capsule	14	16	14-16		12		8-9	
Caudal papillae (pre-ad-postanal)	7:0.8		7:0.8		9:0.5		7:2.7	
Description	<i>C. prashadi</i> (after Soota and Chaturvedi 1972)				<i>C. prashadi</i> (Present material)			
Locality	24- Parganas, West Bengal				Birbhum district, West Bengal			
Host	<i>N. piscator</i> (= <i>X. piscator</i>), <i>N. stoltus</i> , <i>Enhydris</i> sp, <i>P. mucosus</i>				<i>X. piscator</i>			
Description	Male	Female	Male	Female	Male	Female	Male	Female
Body length	3.70-6.60	5.00-18.30			5.93-6.17	15.46-16.28	3.70-9.00	5.00-25.00
Maximum body width	0.088-0.18	0.19-0.50			0.17-0.18	0.46-0.50	0.088-0.37	0.19-0.55
Length of buccal capsule	0.055-0.066	0.066-0.088			0.10-0.11	0.12-0.13	0.028-0.12	0.045-0.13
Width of buccal capsule	0.066-0.077	0.088-0.11			0.11-0.12	0.14-0.145	0.066-0.12	0.088-0.15
Length of muscular oesophagus	0.21-0.27	0.31-0.36			0.33-0.34	0.42-0.43	0.21-0.41	0.28-0.50
Width of muscular oesophagus					0.07-0.08	0.16-0.169	0.07-0.12	0.06-0.169
Length of glandular oesophagus	0.27-0.40	0.38-0.55			0.31-0.32	0.63-0.64	0.04-0.68	0.38-0.80
Width of glandular oesophagus					0.07-0.08	0.13-0.138	0.07-0.40	0.09-0.15
Nerve ring from anterior end	0.11-0.12	0.14-0.20			0.17-0.18	0.20-0.209	0.11-0.20	0.14-0.26
Cervical papillae from anterior end					0.43-0.44	0.51-0.52	0.24-0.44	0.35-0.86
Excretory pore from anterior end					0.20-0.22	0.25-0.26	0.19-0.35	0.25-0.434
Vulva from anterior end		2.30-7.00				6.45-6.78		2.30-11.00
Anus from posterior end	0.088-0.12	0.30-0.55			0.62-0.67	0.49-0.50	0.06-0.67	0.18-1.84

Table 1 continued

Description	<i>C. prashadi</i> (after Soota and Chaturvedi 1972)		<i>C. prashadi</i> (Present material)		Range of variation	
	24- Parganas, West Bengal		Birbhum district, West Bengal			
Host	<i>N. piscator</i> (= <i>X. piscator</i>), <i>N. stolanus</i> , <i>Enhydryis</i> sp., <i>P. mucosus</i>		<i>X. piscator</i>			
Description	Male	Female	Male	Female	Male	Female
Length of right spicules	0.16–0.24		0.22–0.23		0.16–0.36	
Length of left spicules	0.11–0.16		0.10–0.11		0.09–0.26	
Length of gubernaculum	0.022–0.033				0.022–0.25	
Width of gubernaculum					0.006	
Ridges on buccal capsule			9		8–16	
Caudal papillae (pre-:ad-:postanal) in pairs	5–8;0.5–9		7.2:5		5–9; 2:5–9	

*Erroneous data since the minimum distance of vulva from anterior end is equal to minimum length of female

**Probably an error for 0.037

(1954) established the species *Camallanides piscatori*, on the specimens recovered from *Natrix piscator* (= *X. piscator*) and included it under the subgenus *C.* (*Procamallanides*), mainly based on the absence of dorsal and ventral chitinous bodies in the buccal capsule and this character was considered as specific character for *C. piscatori*. Lakshmi et al. (1985) redescribed *C. piscatori* from *Atrium schistosum* (Daudin, 1803) and *N. piscator* (= *X. piscator*) in Andhra Pradesh, India. Gupta and Duggal (1984) described *Camallanides veenae* Gupta and Duggal, 1984 from *N. piscator* (= *X. piscator*) in Uttar Pradesh, India. Sood (1999), however synonymised *C. veenae* with *C. piscatori*. Deshmukh (1968) though suppressed the subgenera of *Camallanides* retained *C. prashadi* and *C. piscatori* as separate species. It is not clear whether dorsal and ventral chitinous bodies as described by Khera (1954) are different from monodents. Moreover *C. prashadi* has also been reported from *N. piscator* (= *X. piscator*) in India (Sinha and Sahay 1967; Soota and Chaturvedi 1972). Present parasites have also been reported from *X. piscator*.

C. piscatori and the present worms approach *C. prashadi* in general body measurements (Table- I) and other morphological features. *C. piscatori* bears twelve complete and incomplete longitudinal ridges, simple pointed chitinous rod like tridents (= monodent), fourteen pairs of pedunculated caudal papillae. Number of longitudinal ridges on the buccal capsule in *C. piscatori* comes within the range of longitudinal ridges in *C. prashadi* and the number of caudal papillae in *C. piscatori* is also similar to that of *C. prashadi*. Though the monodents are pointed chitinous rods in *C. piscatori* and simple rods in *C. prashadi*, other morphological features of *C. piscatori* are not markedly different from those of *C. prashadi*. From the above discussion and metrical evaluation it is apparent that the points of similarity between *C. prashadi* and *C. piscatori* are of more taxonomical importance than the points of departure and thus *C. piscatori* is considered as a synonym of *C. prashadi*. The variations of the present worms from both *C. prashadi* and *C. piscatori* are thought to be intraspecific in nature and the present worms are, therefore, assigned to *C. prashadi*. Birbhum district is recorded as new geographical record for this parasite.

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Compliance with ethical standards Though there is no ethics committee in our Institutions, snake has been sacrificed 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.

Conflict of interest Authors declared that there is no conflict of interest.

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