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NEW SPECIES OF NYGOLAIMOIDEA, *NYGELLUS SHAMIMI* SP. NOV. (NEMATODA: DORYLAIMIDA) WITH A FIRST RECORD OF *AETHOLAIMUS INDICUS* FROM WEST BENGAL, INDIA

Debabrata Sen

Zoological Survey of India, M–Block, New Alipore, Kolkata–700 053, West Bengal, India

E-mail of corresponding author: debabrata.zsi@gmail.com

INTRODUCTION

Thorne (1939) established the genus *Nygellus* with a single species *clavatus* having a combination of features of both Nygolaimidae and Belondiridae. Inspite of the nygolaimoid pharynx and mural tooth, he placed the genus under Belondiridae due to the presence of sheath of spiral muscles surrounding the basal expanded part of pharynx. Later Williams (1958) and Jairajpuri (1964) included two didelphic species *Nygellus symmetricus* and *N. caudatus* respectively in the genus because of the presence of spiral muscles around the basal part of pharynx. Clark (1961) transferred the genus *Nygellus* Thorne, 1939 to Nygolaimidae considering the nygolaimoid characters to be more fundamental and important than belondiroid characters. Moreover, Heyns (1967) observed that all Nygolaimidae species have a sheath surrounding the basal expanded part of pharynx, being quite conspicuous in some and he could not confirm the presence of spiral sheath in three of the *Nygellus* species he examined. Although, in the original description of *Nygellus clavatus*, Thorne (1939) observed that the basal expanded part of pharynx enveloped by a conspicuous sheath and was said to consist of spiral muscles, but this could not be confirmed by Heyns (1967) in his study. Since *Nygellus* could not be separated from *Nygolaimus* on the basis of the spiral sheath, its description was emended and the emphasis was placed on the possession of a single posterior reproductive branch in *Nygellus*. Jarajpuri (1964) removed *Nygellus* with the species having single posterior gonad from Nygolaimidae and placed the genus in the sub family Nygellinae under the new family Nygellidae which was accepted by Thorne (1964). At present four species, i.e. *Nygellus clavatus* Thorne, 1939, *N. subclavatus* Timm and Ameen, 1960, *N. mozammili* Jairajpuri, 1965 and *N. zingli* Dhanam, Jairajpuri and Sreedharan, 2002 are considered to be the valid species with mono-opisthodelphic reproductive system under this genus.

A few nematode specimens were collected from soil around the roots of guava (*Psidium guajava* L.) and litchi (*Litchi chinensis* Sonn.) at South 24-Parganas district, West Bengal, India. Examination of nematodes, collected from the soil samples, revealed a previously undescribed species of *Nygellus* Thorne, 1939 and *Aetholaimus indicus* Jairajpuri, 1965 being recorded for the first time from West Bengal. The new species is described as *Nygellus shamimi* sp. nov.

MATERIALS AND METHODS

The collected soil samples were processed by Cobb's sieving and decantation technique (Cobb, 1918) followed by modified Baermann funnel technique (Christie and Perry, 1951) for extraction of nematodes. The nematode specimens were fixed and preserved in their characteristic body posture in hot FA (formalin-acetic acid 4:1) solution and

were mounted in anhydrous glycerin, sealed by paraffin wax (De Maeseneer & d'Herde, 1963). Then they were observed under a compound microscope (Olympus BX 41), drawings were made with the help of a drawing tube attached to the microscope, and specimens were measured (curved structures were measured through its median axis). The latitude and longitude of collection areas were recorded from Google Earth. The formulae, to locate the positions of pharyngeal gland nuclei and the terms to denote them, were used as given by Andrássy (1998).

SYSTEMATIC POSITION

Order DORYLAIMIDA Pearse, 1942

Sub order NYGOLAIMINA Ahmad and Jairajpuri, 1979

Super family NYGOLAIMOIDEA Thorne, 1935

Family NYGELLIDAE Andrassy, 1958

Sub family NYGELLINAE Andrassy, 1958

Genus ***Nygellus*** Thorne, 1939

Nygellus shamimi sp. n.

DESCRIPTION

Nygellus shamimi sp. n.
(Figure 1)

Material examined: 02 females and 01 juvenile.

Measurements: Shown in Table 1

Female: Body almost straight on fixation, slender, tapering gradually towards anterior end from the base of pharynx. Cuticle very thin without striation all over the body, its thickness 1–1.5 µm at the level of mural tooth, 1.5 µm at mid body and 1–1.5 µm on tail. Body pores indistinct. Lip region continuous with body, almost rounded and gradually narrower than adjoining body, 4µm high, 10–11 µm or about half of the neck base-width wide, labial papillae not elevated. Amphid at 5µm from anterior end, cup-shaped, more than half of the lip region width wide. Tooth linear, 0.8–1 lip region width long. Nerve ring at 127–128 µm from anterior end surrounding the anterior slender part of pharynx. Expanded part of pharynx 56.4–57.6% of its total length. Spiral muscles at the basal expanded part of pharynx obscure. Cardiac glands small, inconspicuous, almost rounded, measuring 3–4 µm in diameter. Cardia small, 5–6 µm long, rounded. Dorsal pharyngeal gland located very near to the beginning of expanded part of pharynx. First pair of sub ventral glands (AS_1 & AS_2) very prominent. Location of pharyngeal gland nuclei are: D = 48.7–49%; AS_1= 17.2–20.1%; AS_2 = 23.4–25.7%; PS_1 = 56.2–59.2%; PS_2 = 62.3–62.6%. Vulva transverse, distinctly pre-equatorial. Vagina about half of the corresponding body width long, slightly posteriorly inclined or at right angle to the body, vaginal wall sclerotized. The length of vagina 11–12 µm. The length of *pars proximalis* vagina 2–2.5 µm, *pars refringens* 3 µm, combined width of *pars refringens* 5–6 µm and *pars distalis* 6–6.5µm). Female reproductive system mono-opisthodelphic. Anterior reproductive branch completely absent, even without any uterine sac. Posterior branch of gonad well developed. Ovary reflexed, 56–108 µm long with numerous oocytes. Oocytes arranged in a single row except at the tip. A well-developed sphincter present at uterus-oviduct junction. Prerectum 3–3.6 and rectum 1.9–2 anal body-widths long. Body slightly narrowing just before the anus or at the level of anus. Tail clavate, 2.8 anal body-widths long, 1.2 anal body widths wide near its end. Caudal pores indistinct.

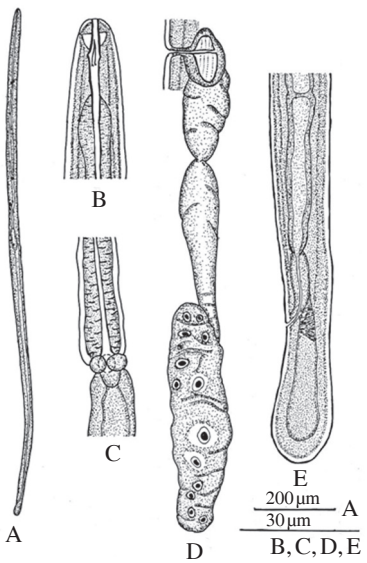

Fig. 1. ***Nygellus shamimi*** n. sp. Female: A. Entire body, B. Anterior end, C. Pharyngo-intestinal junction showing glands & cardia, D. Mono-opisthodelphic reproductive system, E. Posterior end showing pre-rectum, rectum & tail.

Male: Not found

Juvenile: General body shape and morphology similar to those of females except for some differences in measurements and body ratios. Expanded portion of pharynx 55.9% of its total length. Nerve ring at 118µm from anterior end surrounding the anterior slender part of pharynx. Cardia 5µm long, cardiac glands rounded measuring 4µm in diameter. Tooth slender and weak, smaller than adult, 0.6 lip region width long. Prerectum 3.2, rectum 1.6 and tail 2.6 anal body-width long. Tail clavate with rounded terminus.

Type specimens: Holotype registration No. WN 996 along with one female paratype and one juvenile on same slide. Deposited in National Zoological Collection, Zoological Survey of India, Kolkata, India.

Etymology: The new species has been designated after the name of eminent nematologist Prof. Md. Shamim Jairajpuri.

Type habitat & Locality: Collected from soil around the roots of guava at Natunpara, Dhapdhapi of Baruipur block (22.36^0 North and 88.43^0 East) of South 24-Parganas district, West Bengal, India on 27. 07. 2005.

Distribution: South 24-Parganas, West Bengal, India

Differential diagnosis and Relationship: *Nygellus shamimi* sp. n. is characterized by almost rounded small cardiac glands, sclerotized vaginal wall, mono-opisthodelphic female reproductive system with complete absence of anterior reproductive branch, even without any uterine sac and by clavate tail. It comes closer to *N. clavatus* Thorne, 1939, *N. subclavatus* Timm and Ameen, 1960, *N. mozammili* Jairajpuri, 1965 and *N. zingli* Dhanam *et al.*, 2002. But it differs from all known species of *Nygellus* excepted *N. zingli* and *N. suclavatus* by the complete absence of an anterior uterine sac, although rudimentary anterior uterine branch may or may not be present in *N. suclavatus*. The new species differs from *N. clavatus* in having a slightly longer tooth, longer pharynx without any spiral muscle in the basal expanded part of pharynx, small cardia, cardiac glands rounded, distinctly shorter tail with lesser *c´* value (tooth = 5.6 – 6.4µm; pharynx = 326 – 344µm and basal expanded part of pharynx may be enveloped by a conspicuous sheath of spiral muscles; cardia absent, cardiac glands flattened; tail length 96 - 98µm with *c´* = 7.7 in the type specimens of *N. clavatus*). *Nygellus shamimi* sp. n. can be differentiated from *N. subclavatus* in possessing slightly longer tooth, inconspicuous and smaller cardiac glands, shorter tail and in having a cardia (tooth = 7 – 7.2µm; cardiac gland 3.5 – 5 × 6.7 – 7µm; tail = 35 – 41µm and cardia absent in *N. subclavatus*). The new species differs from *N. mozammili* in having a distinctly longer tooth and tail and in having cardia (tooth = 5µm; *c* = 50 – 67; *c´* < 1.5 anal body-width and cardia absent in *N. mozammili*). *N. shamimi* sp. n. shows closest resemblance with *N. zingli* but it differs in having slightly shorter body, continuous and symmetrical lip, greater *a* value, sclerotized vaginal wall (L = 1.3 – 1.5mm; lip set off by depression and slightly asymmetrical at tip, *a* = 45 – 53; vaginal wall weakly sclerotized in *N. zingli*).

Remark: *Nygellus shamimi* sp. n. possesses mono-opisthodelphic reproductive system with complete absence of any anterior uterine sac, showing closeness to *Nygellus subclavatus* Timm and Ameen, 1960. For this reason it must be mentioned that in the type specimens of *Nygellus subclavatus*, the anterior uterine sac is completely absent as described by Timm and Ameen (1960) and the topotypes studied by Heyns (1967) from soil around the roots of pine apple (*Ananas sativus)* from Dhaka, Bangladesh, whereas Ahmad and Jairajpuri (1982) reported the presence of rudimentary anterior uterine sac in the specimens collected from soil around the roots of unidentified water plants from Orissa, India. Moreover, while establishing *N. zingli* as a new species, Dhanam *et al.* (2002) differentiated the species from *N. subclavatus* on the basis of anterior uterine branch and they stated that rudimentary anterior uterine branch present in *N. subclavatus*. So it is evident

that rudimentary anterior uterine sac may or may not be present in *Nygellus subclavatus* which can be considered as the intraspecific variation of this particular character. The only species, without any anterior uterine sac, beside the proposed new species, is therefore, *N. zingli*.

Key to the species of the genus ***Nygellus*** Thorne, 1939

(Modified after Jairajpuri, 1965 and Heyns, 1967)

1. Tail about eight anal body-diameter long; *c* = 10–13…….....***N. clavatus*** Thorne, 1939
– Tail not more than three anal body-width long; *c* = 29 or more……2
2. Tail 1.5–3 anal body-width long; anterior uterine sac distinctly present or rudimentary 3
– Length of tail at least 2 anal body diameter but less than 3 anal body diameter; anterior uterine sac completely absent..... 4
3. *c* = 50 – 67; mural tooth smaller (5µm); anterior uterine sac half vulval body width long .....*N. **mozammili*** Jairajpuri, 1965
– c = 32 – 37; mural tooth longer (8 – 10µm); anterior uterine sac, if present, rudimentary and 7 – 15µm long ....***N. subclavatus*** Timm and Ameen, 1960
4. L = 1.3–1.5mm; tail 2.0 – 2.5 anal body-widths long ..... ***N. zingli*** Dhanam *et al.,* 2002
– L = 1.28 – 1.29mm; tail at least 2.8 anal body widths long ..... ***N. shamimi*** sp. n.

Family AETHOLAIMIDAE Jairajpuri, 1965

Sub family AETHOLAIMINAE Jairajpuri, 1965

Genus ***Aetholaimus*** Williams, 1962

Aetholaimus indicus Jairajpuri, 1965

(Figure 2)

1965. *Aetholaimus indicus* Jairajpuri, M. S. *Proc. Helminth. Soc. Wash.*, **32**: 78–81.

Material Examined: 03 females.

Measurements: *Females*: L = 1.61–1.73mm; *a* = 32.1–36.7; *b* = 3.3–3.4; *c* = 64.3–73.5; *c'* = 0.9–1.1; V = 48.3–52%; G_1 = 10.3–11.1%; G_2 = 10.8–13.7%; Mural tooth = 7.5–11.5 µm; maximum body width = 44–54 µm; length of pharynx = 477– 509 µm; body width at neck base = 44–54 µm; body width at vulva = 44–54 µm; expanded part of pharynx = 272–291.5 µm; glandularium = 242–275 µm; distance of vulva from anterior end = 789–904 µm; length of anterior gonad = 166.5–193.5 µm; length of posterior gonad = 189–223 µm; prerectum = 29.5–51.5 µm; rectum = 19.5–29.5 µm; tail length = 22–27 µm; anal body diameter = 19.5–29.5 µm.

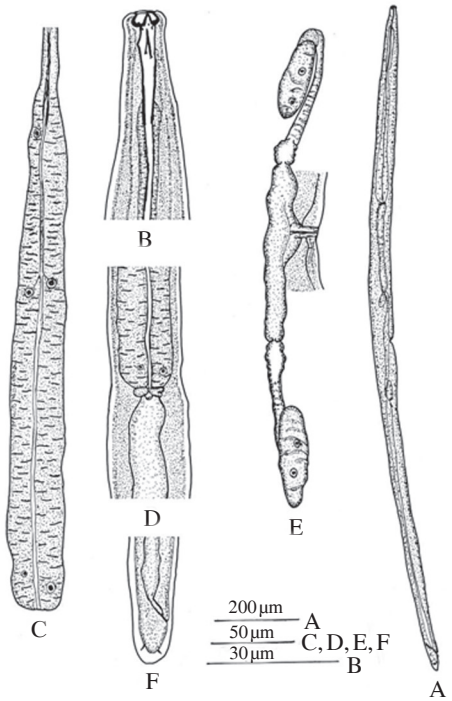

Fig. 2. ***Aetholaimus indicus.*** Female: A. Entire body, B. Anterior end showing buccal region, C. Expanded portion of pharynx with gland nucleei, D. Pharyngo-intestinal junction & glands, E. Reproductive system, F. Tail.

Diagnosis: *Female*: Body almost straight on fixation, gradually tapering towards anterior end. Cuticle and sub cuticle with fine striations. Body pores not visible. Lip region truncate, narrow, almost continuous with body contour, 10 µm wide, papillae not elevated. Amphids not visible. Tooth 0.8–1.2 lip region-width long. Stoma consisting of a bowl-shaped sclerotized vestibule. Sclerotized walls of pharyngeal cavity narrowing gradually towards pharyngeal lumen. Expanded portion of pharynx occupying 56–61.1% of the total pharyngeal length. Three obscure glandular bodies present at pharyngo-intestinal junction. Nerve ring

at 142–149 µm from anterior end. Locations of pharyngeal gland nuclei are: D = 42.1–54.4%; AS_1= 30.2–36.4%; AS_2= 32–40.4%; PS_1= 93.7%; PS_2 = 95.5%. Vulva transverse, slightly pre-equatorial to post equatorial. Reproductive system amphidelphic. Both ovaries reflexed with oocytes, anterior ovary 51.5–59 µm and posterior ovary 61.5 µm long. Distinct sphincter present at uterus-oviduct junction. Prerectum 1.5–1.7 and rectum one anal body-width long. Tail 0.9–0.2 anal body width long, rounded terminally with two caudal pores on each side.

Male: Not found.

Habitat and Locality: Collected from soil around the roots of litchi at Madhyam Kalyanpur, Baruipur block (22.36^0 North and 88.43^0 East) of South 24-Parganas district, West Bengal, India on 13. 12. 2004.

Table 1. Morphometric data on *Nygellus shamimi* sp. n. (All measurements are in µm except L and body ratios, L in mm. As only one paratype female was available, minimum-maximum range and mean calculated on the basis of holotype & single paratype)

Characters	Holotype Female	Paratype Female				
			Min	Max	Mean	Juvenile
L	1.28	1.29	1.28	1.29	1.28	1.25
a	58.4	52.8	52.8	58.4	55.6	57.2
b	3.1	3.2	3.1	3.2	3.1	3
c	37.8	38.1	37.8	38.1	37.9	39.3
c$'$	2.8	2.8	2.8	2.8	2.8	2.6
V %	38.4	36.6	36.6	38.4	37.5	--
G_2 %	13.7	19.4	13.7	19.4	16.6	--
Length of Mural tooth	8.5	9.5	8.5	9.5	9	7.5
Replacing mural tooth	--	--	--	--	--	7.5
Maximum body width	22	24.5	22	24.5	23.2	22
Body width below head	11	10	10	11	10.4	11
Body width at neck base	22	23	22	23	22.5	22
Body width at vulva	22	24.5	22	24.5	23.25	--
Pharyngeal length	404	404	404	404	404	416.5
Expanded part of pharynx	228	233	228	233	230.5	233
Length of Glandularium	205	209	205	209	207	--
Length of cardia	6	5	5	6	5.5	5
Cardiac glands (diameter)	3	4	3	4	3.5	4
Length of posterior gonad	177	252	177	252	214.5	--
Anterior end to vulva	495	475	475	495	485	--
Vaginal length	10	12	10	12	11	--
Tail length	34	34	34	34	34	32
Anal body width	12	12	12	12	12	12
Body width at tail end	14.5	14.5	14.5	14.5	14.5	14.5
Length of prerectum	37	44	37	44	40.5	39
Length of rectum	23.5	24.5	23.5	24.5	24	19.5

Registration Number: On slide, Registration No. WN 1462, three females on same slide, deposited in National Zoological Collection, Zoological Survey of India, Kolkata

Distribution: In India: Uttarakhand (formerly Uttar Pradesh), Himachal Pradesh and West Bengal.

Remark: Jairajpuri (1965) described *Aetholaimus indicus* from soil around the roots of grass from Nainital of Uttar Pradesh (presently in Uttarakhand state), India. Ahmad and Jairajpuri (1982) further reported it from soil around the roots of weeds and grasses at Manali and Kulu districts, Himachal Pradesh, India. The present female specimens agree well with both of the above, except the *a*-value (*a* = 45–51 in type specimens and 42–43 in the reported specimens). As the present specimens became slightly flattened during slide preparation, it is probable that a lower *a* value was obtained due to flattening of specimens. This is the first report of the species from West Bengal, India.

SUMMARY

A few specimens of *Nygelllus shamimi* sp. n. were collected from soil around the roots of guava (*Psidium guajava* L.) and that of *Aetholaimus indicus* Jairajpuri, 1965 were collected from soil around the roots of litchi (*Litchi chinensis* Sonn.) at South 24-Parganas district, West Bengal, India. *Nygellus shamimi* sp. n. is characterized by almost rounded small cardiac glands, sclerotized vaginal wall, mono-opisthodelphic female reproductive system having no anterior reproductive branch and by clavate tail. It comes closer to *N. clavatus* Thorne, 1939, *N. subclavatus* Timm and Ameen, 1960, *N. mozammili* Jairajpuri, 1965 and *N. zingli* Dhanam *et al.*, 2002. The present female specimens of *Aetholaimus indicus* agree well with type specimen except the *a*-value (*a* = 45 – 51 in type specimens).

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