

NEW AND KNOWN SPECIES OF BELONDIRIDAE FROM COSTA RICA

A. Shaheen and W. Ahmad*

Section of Nematology, Department of Zoology, Aligarh Muslim University,
Aligarh- 202 002, India

Summary. Two new and two known species belonging to the family Belonidiridae are described from Costa Rica. *Belondira tropica* sp. n. is characterized by having 0.85-0.91 mm long body, unsclerotized labial region, pharynx expanding behind its mid-point, short anterior uterine branch, and clavate tail with distinct radial striae. *Amphibelondira bongersi* sp. n. represents the second species of the rare genus, and is characterized by having 1.07-1.12 mm long body, lip region offset with amalgamated lips, sclerotized vestibule, 12.5 μ m long odontostyle, amphidelphic gonad, and short hemispheroid tail. *Belondira apitica* Thorne, 1939 and *B. cylindrica* Thorne, 1964 are reported for the first time from Costa Rica.

Little is known about the dorylaimid nematode fauna of Costa Rica. Loof and Zullini (2000) in their very first paper on dorylaims from Costa Rica described two new genera and six new and nine known species. Two known species, *Oxydirus tropicus* Thorne, 1964 and *Oxydirus tenuicaudatus* Thorne, 1964 represented the family Belonidiridae in this paper. During summer of 2001, one of us (WA) was invited by Instituto Nacional de Biodiversidad (INBio), Costa Rica, to study the dorylaim nematodes available in their collection. Some fresh material was also collected with the help of Dr. Alejandro Esquivel and Hans Arias. We have identified and described great number of new and known species of Dorylaimida from this material (Ahmad, 2004; Ahmad and Shaheen, 2003, 2004, 2005; Shaheen and Ahmad, 2004, 2005). The present paper is the seventh in the series concerning that collection and provides descriptions of two known and a new species of the genus *Belondira* Thorne, 1939 and a new species of the rare genus *Amphibelondira* Rahman *et al.*, 1987. They are described and illustrated here.

MATERIALS AND METHODS

Nematodes were extracted from soil samples by Cobb's sieving and decantation method and the Baermann funnel technique. Nematodes obtained in water were killed and fixed in hot TAF, dehydrated by the Seinhorst (1962) rapid glycerine method and mounted on slides in anhydrous glycerine. Measurements were done using ocular micrometer and drawings were made using a drawing tube attached to the microscope.

DESCRIPTIONS

BELONDIRA APITICA Thorne, 1939

Measurements. See Table I

Remarks. Thorne (1939) described *Belondira apitica* as the type species of the genus from specimens collected at an elevation of 2896 m on Mt. Wolverine near Brighton, Utah, USA. During the course of the present study several females were found in a soil sample from Costa Rica. Measurements of these specimens completely fit the description and measurements provided by Thorne (1939) except for longer odontostyle (10-11 *vs* 7-9 μ m) and shorter pre-rectum (2.4-3.8 *vs* 5-6 anal body widths long).

Habitat and locality. Litter sample, forest plantation, La Amistad, Caribe Conservation Area, Barbillia National Park, Costa Rica.

BELONDIRA CYLINDRICA Thorne, 1964

Measurements. See Table I

Remarks. *Belondira cylindrica* was originally described by Thorne (1964) from Puerto Rico. Ferris *et al.* (1983) recorded this species from Panama, Brazil and Colombia. The present specimens from Costa Rica closely fit the earlier descriptions except for having a slightly anterior vulva (V = 36.0-37.5 *vs* 38-41) and longer pre-rectum (5.2-5.4 *vs* 3.5-4.6 anal body widths long). Males have not yet been recorded in this species, and the absence of spermatozoa in the uteri of the present females helps confirm the absence of males in this species, which seems to be widely distributed in South and Central America.

Habitat and locality. Litter from forest plantation, La Amistad Caribe Conservation Area, Barbillia National Park, Costa Rica.

* Corresponding author: ahmadwasim57@yahoo.co.in

Table I. Measurements of *Belondira apitica* Thorne, 1939 and *B. cylindrica* Thorne, 1964 (all measurements in μm except L in mm).

Character	<i>B. apitica</i> (3 females)	<i>B. cylindrica</i> (2 females)
L (mm)	2.23-2.35 (2.28)	1.2-1.3
a	40-48 (45)	38-39
b	5.4-5.7 (5.5)	4.0-4.1
c	114-140 (127)	78-92
c'	0.52-0.86 (0.65)	0.80
V	32-34 (33)	36.0-37.5
G2	12-22 (17)	14-19
Lip region width	8-10 (9)	6.8
Lip region height	4-6 (5)	4.5
Amphid aperture	5-6 (5.5)	5
Odontostyle length	10-11(10.5)	4.5
Odontophore length	15-16	9.0-9.5
Guide ring from ant. end	6-8 (7)	6
Nerve ring from ant. end	122-132 (127)	94-101
Neck length	399-426 (411)	307-328
Expanded part of pharynx	201-230 (215)	161-201
Cardia length	13-19 (16)	10-12
Body width at neck base	48-58 (51)	32-34
Body width at anus	22-33 (28)	21
Anterior genital branch	-	19-20
Posterior genital branch	279-492 (335)	169-249
Vaginal depth	17-25 (19)	15-16
Vulva from ant. end	735-807 (759)	474-478
Prerectum length	67-100 (88)	48
Rectum length	29-31 (30)	22.5-25.5
Tail length	16-19 (17.5)	13.5-16.5

***BELONDIRA TROPICA* sp. n.**

(Fig. 1)

Measurements. See Table II

Female. Body almost straight when fixed. Cuticle finely striated, 1.0-1.5 μm thick at mid body and 4-5 μm on tail, striations more prominent in tail region. Lateral chords occupying about one-third of the corresponding body width at mid-body. Lateral, dorsal and ventral body pores indistinct.

Lip region elevated, continuous, about one-fourth as wide as body width at neck base; labial sclerotization absent. Amphids cup-shaped, their aperture about two-thirds of the corresponding body width wide. Odontostyle very small, 0.8-1.0 times lip region width, its aperture about one-third its length. Guide ring single, about one lip region width from anterior end. Odontophore simple, rod-like, about twice the length of odontostyle. Nerve ring at 35-38% of neck length from anterior end. Expanded part of pharynx occupying about 43-47% of total neck length, surrounded by spiral muscle sheath. Cardia short, conoid, about one-third of the corresponding body width. Pharyngeal gland nuclei and their orifices are located as follows: DO = 63-64; DN = 64-65;

DO-DN = 1.5; S₁N₁ = 75-77; S₁N₂ = 80-81; S₂N = 85-86; S₂O = 88-89.

Genital system mono-opisthodelphic; anterior uterine branch represented by a sac measuring 16-25 μm . Posterior branch well developed; ovary reflexed, measuring 70-207 μm with oocytes arranged in a single row, except near tip. Oviduct measuring 42-95 μm , joins ovary subterminally. Uterus measuring 36-109 μm ; sphincter present at oviduct-uterus junction. Vulva situated in a depression, large, pore-like. Vagina extending inward, about half of the corresponding body width; vaginal sclerotization absent. *Pars proximalis vaginae* measuring 9-10 \times 8-9 μm ; *pars distalis vaginae* 2.5-3.0 μm long with curved walls. Prerectum 3.6-4.1 anal body widths long. Rectum 1.1-1.5 anal body widths long. Tail short, slightly clavate, 1.1-1.3 times anal body widths long, hyaline part occupying 42-44% of total tail length giving a fin-like appearance.

Male. Not found.

Type habitat and locality. Soil around roots of forest trees from INBio PARQUE, Heredia, Costa Rica.

Type material. Holotype female on slide *Belondira tropica* sp. n./1; paratype females on slides *B. tropica* sp. n./2-4; deposited in the nematode collection of the

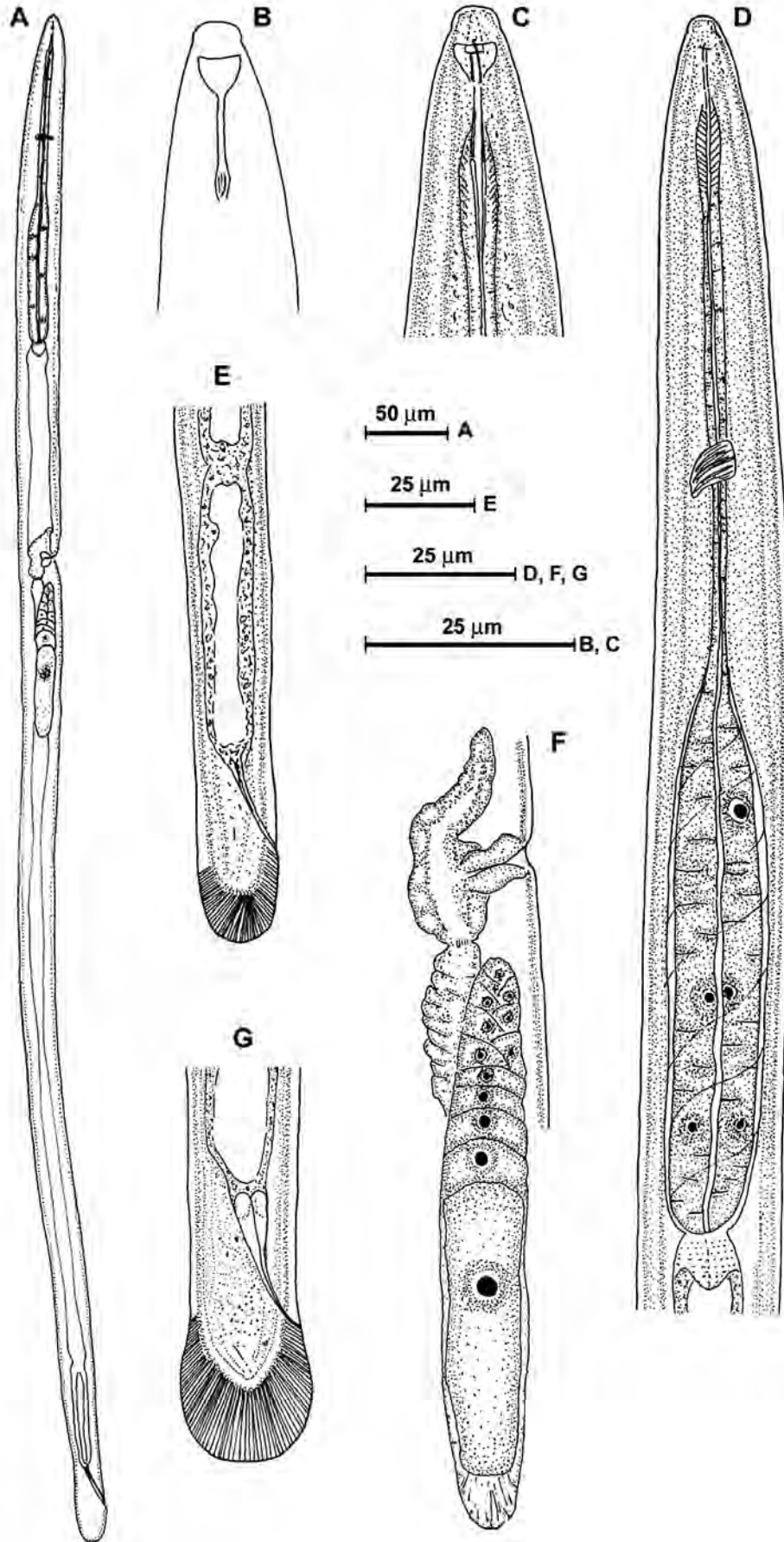


Fig. 1. *Belondira tropica* sp. n. A: entire female; B-C: Anterior region; D: pharyngeal region; E: female posterior region; F: female genital system; G: female posterior end.

Table II. Measurements of *Belondira tropica* sp. n. (all measurements in μm except L in mm).

Character	Holotype female	Paratype females (n = 8)
L (mm)	0.95	0.81-0.96 (0.86)
a	39.5	36.5-39.5 (37.8)
b	4.66	4.12-4.81 (4.45)
c	41	39-47 (42)
c'	1.2	1.1-1.3 (1.2)
V	32.6	32-36 (34.5)
G1	2.14	2.2-2.4 (2.3)
G2	14	12-24
Lip region width	6	6
Lip region height	3	3
Amphid aperture	4	4-5
Odontostyle length	5	5-6
Odontophore length	9	9-10
Guide ring from ant. end	6.5	5-7 (5.5)
Nerve ring from ant. end	76	73-80 (76)
Neck length	206	182-207 (197)
Expanded part of pharynx	94	78-97 (87)
Cardia length	9	6-10 (8)
Body width at neck base	24.5	21.5-25.5 (23.2)
Body width at anus	19.5	16.5-18.5 (17.6)
Anterior genital branch	20	16-25 (20.5)
Posterior genital branch	134	89-249 (168)
Vaginal depth	12.5	11.5-14.5 (10.8)
Vulva from ant. End	313	285-341 (305)
Prerectum length	76.5	60.5-77.5 (71)
Rectum length	24.5	18.5-27.5 (23.5)
Tail length	23.5	18.5-24.5 (21)

Nematology Laboratory, Universidad Nacional, Costa Rica. Two paratype females deposited in the nematode collection of the Department of Zoology, Aligarh Muslim University, India.

Diagnosis. *Belondira tropica* sp. n. is characterized by having 0.81-0.95 mm long body, unsclerotized labial region, pharynx expanding behind its mid-point; short anterior uterine branch and clavate tail with distinct radial striae.

Relationships. The new species closely resembles *B. sacca* Thorne, 1964 but differs from it in the absence of labial sclerotization (*vs* labial sclerotization distinct), in having a robust odontostyle with distinct aperture (*vs* odontostyle thin, attenuated), anterior vulva (*vs* V = 36-41) and shorter tail (*vs* c' = 1.5-2.0), and in the absence of a post-rectal sac (*vs* post-rectal sac present). It resembles *B. murtazai* Siddiqi, 1968 but differs from it in having slightly longer odontostyle (*vs* odontostyle 4 μm), lower c value (*vs* c = 46-53) and clavate tail (*vs* hemispheroid tail).

Belondira tropica sp. n. also closely resembles *B. nepalensis* Siddiqi, 1964 but differs from it in having shorter pharyngeal bulb (*vs* pharyngeal bulb 51% of neck length), lower c value (*vs* c = 53.4), smaller pre-

rectum (*vs* prerectum five times anal body widths long). *Belondira tropica* sp. n. has a characteristic clavate fin-like tail with distinct radial striae, whereas, in *B. nepalensis* the tail is elongate hemispheroid. Further, *B. nepalensis* is a bisexual species whereas *B. tropica* is almost certainly monosexual (sperms were not present in the uteri of any of the females studied).

AMPHIBELONDIRA BONGERSI sp. n.
(Fig. 2)

Measurements. See Table III

Female. Body slightly curved ventrally upon fixation. Cuticle finely striated, 1.5-2.0 μm thick at mid body and 4.5 μm on tail. Inner layer of cuticle distinctly striated. Lateral chords about one-third body width at mid body. Lateral, dorsal and ventral body pores indistinct.

Lip region offset, slightly narrower than adjoining body, as wide as high and about one-third as wide as body width at neck base; labial framework well developed. Amphids with large cup-shaped fovea, their aperture about 0.65-0.70 times the corresponding body width long. Odontostyle 1.3-1.4 times lip region widths long, its aperture about one fifth to one quarter of its

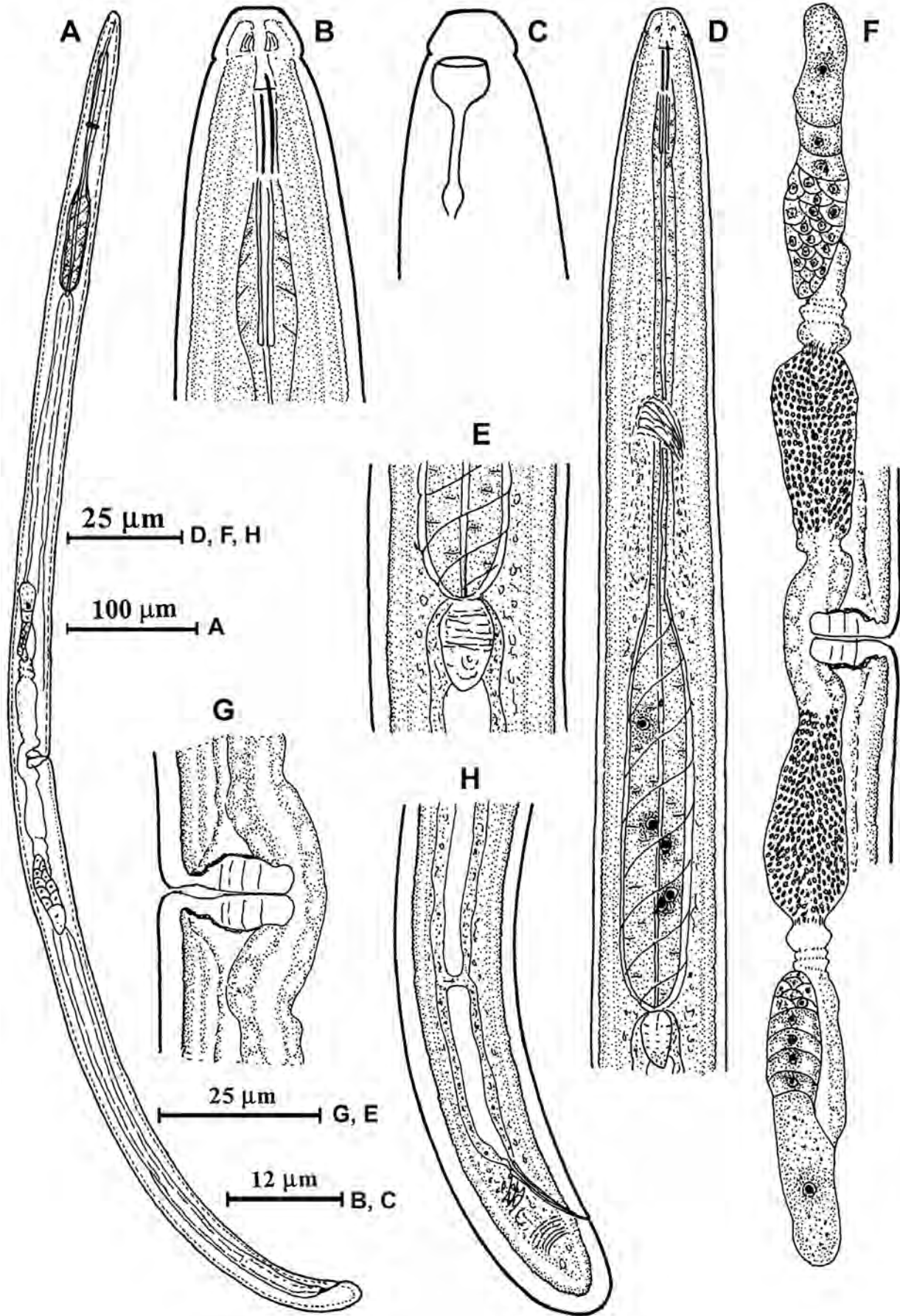


Fig. 2. *Amphibelondira bongersi* sp. n. A: entire female; B: anterior region; C: anterior end showing amphid; D: pharyngeal region; E: pharyngo-intestinal junction; F: female genital system; G: vulval region; H: female posterior region.

Table III. Measurements of *Amphibelondira bongersi* sp. n. (all measurements in μm except L in mm).

Character	Holotype female	Paratype females (n = 3)
L (mm)	1.17	1.07-1.12 (1.1)
a	41	34.5-40.5 (37.5)
b	5.1	4.9-5.5 (5.2)
c	60	54-58 (56.5)
c'	0.80	0.86-1.05 (0.92)
V	52	51.0-51.5 (51.2)
G1	12	9.5-10.5 (10)
G2	12	10.5-11 (11)
Lip region width	10	9-10
Lip region height	5	5
Amphid aperture	6	6-7
Odontostyle length	12.5	12.5
Odontophore length	18.5	20.5-23.5 (21.7)
Guide ring from ant. end	5	5-6
Nerve ring from ant. end	90	89-112 (97)
Neck length	229	198-225
Expanded part of pharynx	93	66-91 (79)
Cardia length	15.5	10-14 (11.5)
Body width at neck base	28.5	26.5-32.0 (29.5)
Body width at anus	24.5	19.5-22.5 (21.5)
Anterior genital branch	142	105-115 (111)
Posterior genital branch	140	118-124 (121)
Vaginal depth	19.5	13.5-22.5(17)
Vulva from ant. end	518	508-545 (512)
Prerectum length	56	55-68 (62)
Rectum length	22.5	17.5-18.5 (18)
Tail length	19.5	17.5-18.5 (18)

length. Guide ring single, at 0.5-0.6 times lip region width from anterior end. Odontophore simple, rod-like, 1.8-1.9 times the odontostyle length. Nerve ring at 41-46% of neck length from anterior end. Pharynx expanding gradually; expanded part enclosed in a sinistrally spiral muscular sheath, occupying 33-44% of total neck length. Cardia elongate, conoid, 37-55% of corresponding body width long. Pharyngeal gland nuclei and their orifices are located as follows: DO = 68-70; DN = 70-71; DO-DN = 2; S₁N₁ = 82-83; S₁N₂ = 84-85; S₂N = 90-91; S₂O = 91-92.

Genital system amphidelphic; both sexual branches almost equally developed. Ovaries reflexed, measuring 46-64 μm (anterior) and 53-65 μm (posterior) with oocytes arranged in a single row except near tip. Oviduct 49-59 μm (anterior) and 33-63 μm (posterior) long. Sperms present in the uterus. A distinct sphincter present at oviduct-uterus junction. Vulva transverse; vagina extending inwards about half of the corresponding body width. *Pars proximalis vaginae* measuring 14-15 \times 11.5-12.5 μm with straight walls supported by strong muscles; *pars refringens vaginae* absent; *pars dis-*

talis vaginae 3-4 μm long with curved walls. Pre-rectum 2.5-3.4 anal body widths long. Rectum 0.8-0.9 anal body widths long. Tail short, obtusely rounded, 0.91-0.95 anal body width long, with a hyaline part occupying 20-25% of total tail length.

Male. Not found.

Type habitat and locality. Mosses growing on tree trunk, gathered close to Fortuna water fall, Primary forest, Arenal National Park, Arenal Conservation Area, Costa Rica.

Type material. Holotype female on slide *Amphibelondira bongersi* sp. n./1; paratype females on slides *Amphibelondira bongersi* sp. n./2-3; deposited in the nematode collection of the Nematology Laboratory, Universidad Nacional, Costa Rica. A paratype female deposited with the nematode collection of the Department of Zoology, Aligarh Muslim University, India.

Diagnosis. *Amphibelondira bongersi* sp. n. is characterised by having 1.07-1.12 μm long body, lip region offset with amalgamated lips, vestibule sclerotized, 12.5 μm long odontostyle, amphidelphic gonad and short hemispheroid tail.

Relationships. The new species differs from the type and only known species of the genus, *A. bhutanensis* Rahman *et al.*, 1987, in having shorter body size (*vs* L = 1.38 μ m), inner layer of cuticle distinctly striated (*vs* finely striated), continuous lip region (*vs* slightly offset), shorter odontostyle and odontophore (*vs* odontostyle 14 μ m and odontophore 16 μ m), shape and size of cardia (*vs* cardia 17 μ m long, with a disc-like structure present between cardia proper and base of pharynx), posterior vulva (*vs* V = 45) and shorter pre-rectum (*vs* 75 μ m).

The new species further differs from *A. bhutanensis* in having a distinct hemizonid at the level of the nerve ring.

Etymology. The species is named after Dr. Tom Bongers in recognition of his contributions to the Nematode Biodiversity project, Costa Rica.

ACKNOWLEDGMENTS

The authors are thankful to Dr. Tom Bongers, Wageningen, The Netherlands, and to Dr. A. Esquivel, UNA, Heredia and the INBio, Costa Rica for extending an invitation to one of us (WA) to visit Costa Rica for studying dorylaim nematodes.

LITERATURE CITED

- Ahmad W., 2004. *Scalpelus loofi* gen. n., sp. n. (Nematoda: Dorylaimida) from Costa Rica. *Journal of Nematode Morphology and Systematics*, 7: 85-90.
- Ahmad W. and Shaheen A., 2003. Two new species of the genus *Oriverutus* Siddiqi, 1971 (Nematoda: Dorylaimida) from Central America. *Journal of Nematode Morphology and Systematics*, 5: 18-190.
- Ahmad W. and Shaheen A., 2004. Five new and two known species of the family Dorylaimidae (Nematoda: Dorylaimida) from Costa Rica. *Nematology*, 6: 567-584.
- Ahmad W. and Shaheen A., 2005a. A redescription of *Nygolaimium menzeli* (Micoletzky, 1925) Heyns, 1968 (Nematoda: Nygolaimina) with designation of its neotype from Costa Rica. *Journal of Nematode Morphology and Systematics*, 7: 153-158.
- Ahmad W. and Shaheen A., 2005b. A new and a known species of the genus *Chrysonema* Thorne, 1929 (Nematoda: Dorylaimida) from Costa Rica. *Nematologia Mediterranea*, 33: 55-60.
- Ferris V.R., Ferris J.M. and Goseco C.G., 1983. Revision of *Belondira* and notes on *Oxybelondira* in Belondiroidea (Nematoda: Dorylaimida). *Research Bulletin Purdue University, Agricultural Experiment Station, West Lafayette, Indiana*, 979: 48 pp.
- Loof P.A.A. and Zullini A., 2000. Free living nematodes from nature reserves in Costa Rica. *Nematology*, 2: 605-633.
- Rahman M.F., Jairajpuri M.S., Ahmad W. and Ahmad I., 1987. *Amphibelondira* gen. n. (Nematoda: Belondiroidea) from Bhutan. *Indian Journal of Nematology*, 16: 149-151.
- Shaheen A. and Ahmad W., 2004. Three new and known species of Dorylaimida (Nematoda) from Costa Rica. *International Journal of Nematology*, 14: 177-185.
- Siddiqi M.R., 1964. Four new species in the family Belondiridae (Nematoda: Dorylaimida). *Labdev Journal of Science and Technology*, 2: 37-41.
- Siddiqi M.R., 1968. Five new species of Belondiroidea (Nematoda) from Sibsagar, India with a revised classification of the superfamily. *Proceedings of the Helminthological Society of Washington*, 35: 248-258.
- Thorne G., 1939. A monograph of the superfamily Dorylaimoidea. *Capita Zoologica*, 8: 1-261.
- Thorne G., 1964. Nematodes of Puerto Rico: Belondiroidea, new superfamily, Leptonchidae Thorne, 1934, and Belonenchidae new family (Nematoda, Adenophorea, Dorylaimida). *University of Puerto Rico Agriculture Experiment Station Technical Paper No. 39*: 51 pp.