

Nematodes of the family Ungellidae Chitwood, 1950 from Laotian earthworms

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Summary. Four new species of *Siconema* Timm, 1966 and *Synoeconema laotense* sp. n. are described from Laotian earthworms. *Siconema inaequicrassum* sp. n. is distinguished by the thin cephalic hooks, circular suckers in both sexes and mammilate ornamentation on the egg surface. *S. aequicrassum* sp. n. is similar to *S. inaequicrassum* sp. n., but differs in egg-shell, oesophagus and hook measurements. *Siconema laotense* sp. n. is characterized by very large cephalic hooks. *Siconema aculeatum* sp. n. has very characteristic rod-like appendages on the egg surface. A unique feature of *Synoeconema laotense* sp. n. is the presence of a singular cephalic hook.

Key words: Drilonematoidea, *Siconema*, *Synoeconema*, new species, earthworm hosts.

Investigations of Indochina earthworms are carried out at the Vietnam Pedobiology Center under the supervision of Dr. Thai Tran Bai from the Hanoi teachers' college. During his taxonomic work with earthworms Dr. Thai Tran Bai recovered the parasitic nematodes from the earthworms, which were sent to the Institute of Parasitology for identification. Here we present the descriptions of five new species found in earthworms from Laos. Although this contribution is not an attempt to revise the Ungellidae, we are obliged to reflect our understanding of the composition of this group. Therefore, we include in the genus *Synoeconema* Magalhaes, 1905 only Ungellidae with long, sometimes poorly visible groove-like, slit-like or meandering caudal suckers, whereas the nematodes with circular or rounded suckers are placed mainly in *Siconema* Timm, 1966. We question the diagnostic features proposed for *Siconemella* both in the first description (Timm, 1966b) and in the "CIH keys to the groups and genera of nematode parasites of invertebrates" (Poinar,

1977). We consider both *Siconemella* species as forms of indeterminate taxonomic position.

MATERIAL AND METHODS

All earthworms were dissected by Dr. Thai Tran Bai after field fixation in formalin and nematodes were collected from the coelomic cavity. Nematodes from each sample were sent to Moscow in 10% formalin, with information on the host species, place and date of collection, where they were mounted in glycerol. All the nematodes were extracted from the coelomic cavity of earthworms belonging to the genus *Pheretima* (Megascolecidae). Drawings and some measurements were obtained using a camera lucida. Body length (L), De Man indices a (calculated as ratio of L to mid-body diameter, not maximal one), b and c (if anal and vulvar openings were discernible), also d and V, are given in the descriptions. Also Ex and Rs - distances between the anterior end and the excretory pore or anterior tip of the spermatheca are presented when appropriate.

DESCRIPTION

Siconema inaequicrassum sp. n.
(Fig. 1)

Holotype female: L = 1270 μm , a = 25.4, b = 11.7, c = 7.8, Ex = 85 μm , Rs = 138 μm , V = 63%.

Paratype females (n=7): L = 1201 (1116-1370) μm , a = 24.9 (19.7-28.5), b = 11.7 (11.0-13.0), c = 6.5 (5.5-7.3), Ex = 77 (68-90) μm , Rs = 118 (100-150) μm , V = 67 (64-70)%, Eggs 45-52 x 20-25 μm .

Paratype males (n=3): L = 884 (818-967) μm , a = 22.5 (17.3-25.4), b = 8.4 (7.8-8.8), c = 5.0 (4.4-5.4), Ex = 82 (75-88) μm .

Female. Body yellowish, tapering to anterior end, with swollen tail region. Cephalic hooks displaced ventrally, with 6-8 μm long base embedded in head tissue with pointed blades 4-5 μm long. Oesophagus clavate with 6 μm wide corpus and 16-17 μm wide bulb. One large nucleus in dorsally displaced bulb. Excretory pore 1 μm wide, duct 40 μm long. Prominent anal opening anterior to tail swelling, rectum 20-25 μm long, perpendicular to body surface. Germinative tip cell close to anal opening; ovary reflexed near tail terminus. Up to 40 spermatozoa in spermatheca in anterior portion of gonad. Up to 8 fully formed eggs in uterus, 3 to 4 underdeveloped eggs anteriorly. Egg-shell with thin mammillate ornamentation, caps on polar region from coarse flattened knobs. Caudal suckers transversally elongated, 30x40 μm , without chamber. Spongy tissue beneath suckers with thin channel running anteriorly from sucker center. In some females sucker on one side reduced. No spongy tissue under reduced sucker, instead replaced by deep invagination. Tail conically pointed.

Male. Hooks base length 6-9 μm . Testis reflexed close to mid-body. Prominent pericloacal elevation. Circular caudal suckers of 30 μm diameter.

Type host and locality. Infected *Pheretima* sp. found in mountain village Phac Kha (Song Khon) close to Bang Hieng river, 29 October 1987.

Type material. Holotype (Jc 320) is deposited in the collection of Moscow State University Zoological Museum. Paratypes deposited in the German Nematode Collection (Munster) and in the USDA Nematode Collection, Beltsville.

Differential diagnosis. *S. inaequicrassum* sp. n. can be distinguished from other *Siconema* species by its: thin hook base, circular suckers in both sexes, mammillate ornamentation on the egg-shell with two polar caps. Only the type species of the genus - *S. siamense* Timm 1966, described from Thailand and Burma has characteristics similar to the Laotian *S. inaequicrassum* sp. n. The latter species has smaller hook blades (4-5 μm vs. 15 μm), smaller oesophagus (145-187 μm in *S. siamense* females and 93-115 μm in *S. inaequicrassum* sp. n. females). The main difference can be found in the egg-shell structure: *S. siamense* has double corona (two layers of refractile rods) but no polar caps. *S. inaequicrassum* sp. n. has a unique feature - occasional rudimentation of sucker structures on one side, and the name proposed for the species reflects the observed assymetry of the caudal end.

Siconema aequicrassum sp. n.
(Fig. 2)

Holotype female: L = 1833 μm , a = 32.1, b = 16.3, Ex = 78 μm , Rs = 180 μm , V = 64%.

Paratype females (n=10): L = 2076 (1708-2375) μm , a = 30.2 (24.4-34.2), b = 19.0 (15.8-24.2), Ex = 87 (75-105) μm , Rs = 210 (150-255) μm , V = 62 (56-67)%, Eggs 62-68 x 23-25 μm .

Paratype males (n=3): L = 1279 (1023-1450) μm , a = 21.6 (18.1-26.3), b = 11.3 (9.1-13.8), c = 6.0 (5.5-6.8), Ex = 94 (88-100) μm .

Female. Body transparent, slightly greenish, tapering to anterior end, with swollen tail region. Cephalic hooks slightly displaced dorsally, with 10 μm long base and 4-5 μm long blades. Thin cuticular hood on head apex. Oesophagus clavate with 10 μm wide corpus and 20 μm wide bulb; one large nucleus in dorsal sector of bulb. Excretory pore 2 μm wide, duct 50-60 μm long. Anal opening inconspicuous.

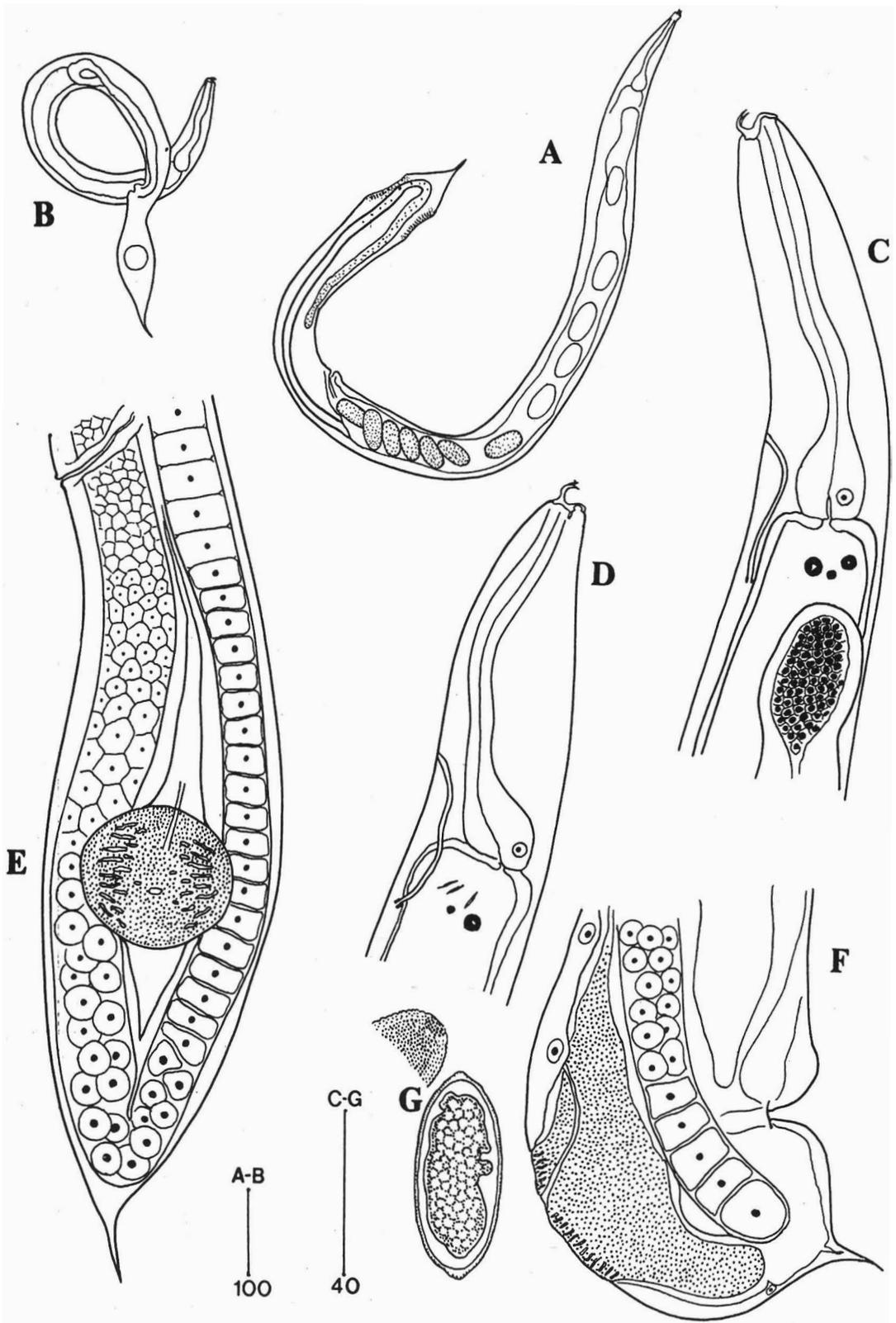


Fig.1. *Siconema inaequicrassum* sp.n. A: Female, total view; B: Male, total view; C: Female, anterior end, laterally; D: Male, anterior end, laterally; E: Female tail, laterally; F: Female tail with abnormal sucker, ventrally; G: Egg-shell, structure. Bars in μm .

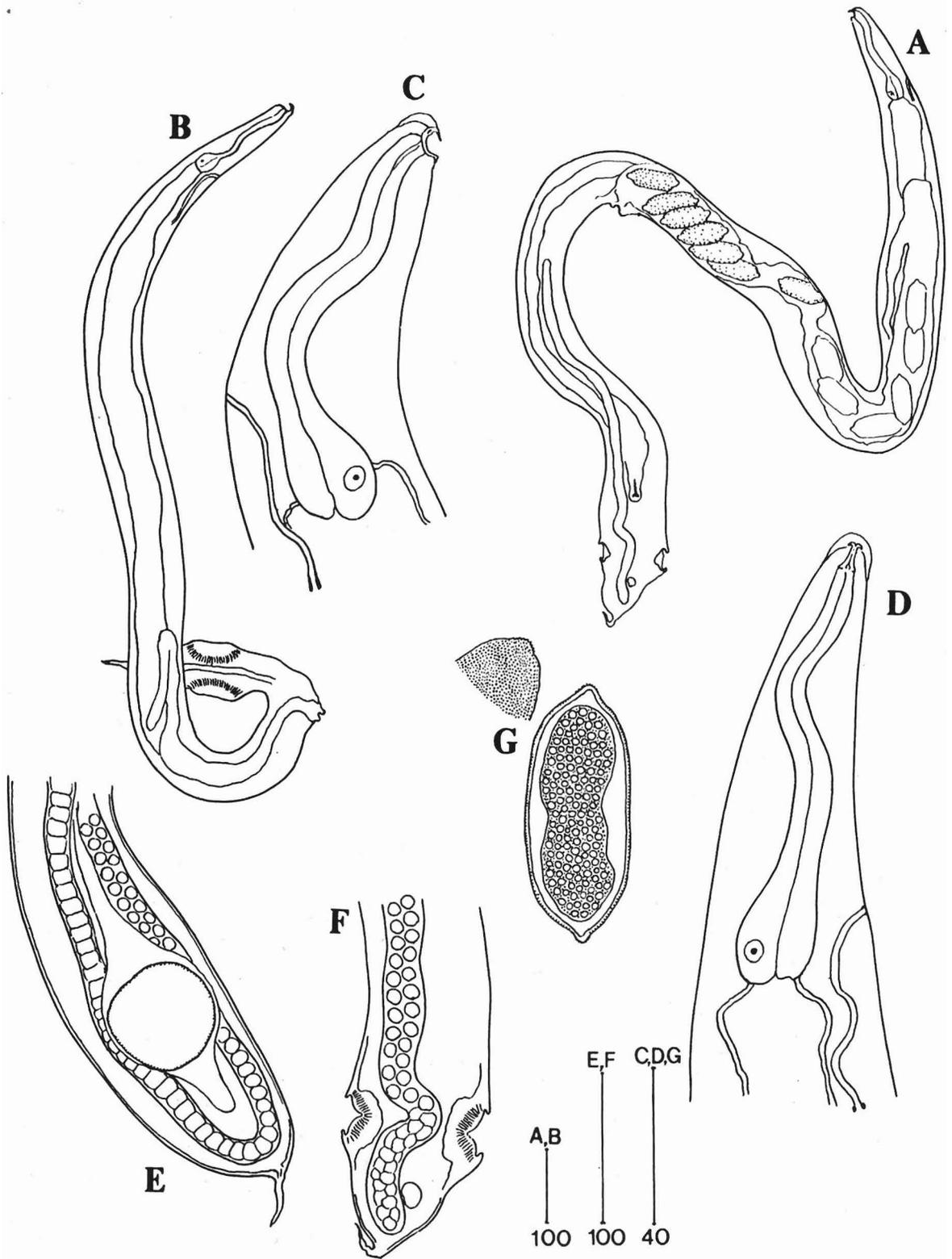


Fig.2. *Siconema aequicrassum* sp.n. A; Female, total view; B: Male, total view; C: Female anterior end, laterally; D: Female, anterior end, apical part ventrally; E: Female tail, laterally; F: Female tail, ventrally; G: Egg-shell structure. Bars in μm .

Germinative tip cell close to mid-body; ovary reflexed near tail terminus. About 40-50 spermatozoa in elliptical spermatheca in anterior region of gonad. About 7-10 fully formed eggs in uterus, 3 to 4 eggs anteriorly with thin underdeveloped shells. Egg-shell finely mammillate with thickened caps on poles. Circular caudal suckers 70 μm diameter. In median view suckers appear as 25 μm deep invaginations of cuticle with underlying 35 μm thick fibrous layer. This layer was reduced in two females.

Male. Testis reflexed at 460-610 μm from anterior end. Pericloacal elevation 6-10 μm high. Circular caudal suckers without prominent cuticular invagination.

Type host and locality. Infected *Pheretima* sp. found in mountain village Phac Kha (Song Khon) close to Bang Hieng river near Muong spring, 6 October, 1987.

Type material. Holotype (Jc 321) deposited in the collection of Moscow State University Zoological Museum. Paratypes are deposited in the German Nematode Collection (Munster) and in the USDA Nematode Collection, Beltsville.

Differential diagnosis. *S. aequicrassum* sp. n. is close to *S. inaequicrassum* sp. n. and *S. siamense* having: cephalic hooks with thin base, circular suckers in both sexes, egg-shell with mammillate ornamentation and polar caps. *S. aequicrassum* sp. n. is distinguished from *S. siamense* sp. n. in the form of egg-shell and oesophagus and hook measurements. From other similar species *S. inaequicrassum* sp. n. differs by the presence of a transparent apical hood, small egg-shells and presence of cuticular invagination on the normally developed caudal sucker.

Siconema laotense sp. n. (Fig. 3)

Holotype female: L = 2317 μm , a = 23.2, b = 14.0, Ex = 108 μm , Rs = 141 μm , V = 56%.

Paratype females (from Savannakhet, n=5): L = 1807 (1092-2598) μm , a = 23.8 (19.8-25.9), b = 13.5

(7.4-20.7), c = 5.4 (5.2-5.6), Ex = 89 (82-100) μm , Rs = 140 (120-150) μm , V = 54 (52-60) %, Eggs 55-60 x 27-29 μm .

Paratype females (from Thapha, n=2): L = 1423 μm , 2134 μm ; a = 21.3, 28.4; b = 14.2, 10.5; Ex = 95 μm , 92 μm , Rs = 140 μm , 140 μm , V = 58 %, 51 %, Eggs 60-62 x 28-30 μm .

Paratype male (from Savannakhet): L = 1180 μm , a = 18.2, b = 9.8, c = 7.8, Ex = 75 μm .

Paratype male (from Thapha): L = 1109 μm , a = 22.2, b = 7.3, c = 4.9, Ex = 100 μm .

Female. Body brownish, tapering anteriorly, with swollen tail region. Large cephalic hooks with 20 μm long base and 10 μm long blades. Dorsal proximity of base strongly enlarged with separated 6 μm thick piece. Cylindrical stoma 14 μm long, 3 μm wide opening between hook blades. Hook base with 12 μm long separate ventral piece oriented along body axis. Oesophagus clavate, with 10 μm wide corpus and up to 40 μm wide bulb. Three large nuclei in bulb. Excretory pore 1.5 μm wide, duct 2.5-3 μm wide and 60-80 μm long. Germinative tip cell close to tail terminus; point of reflexion touching the bulb; anterior portion of gonad with spermatheca containing about 20 spermatozoa. Uterus contains up to 18 eggs with developed shells. Anterior part of uterus composed from strongly swollen cells harbors about 10 eggs with underdeveloped shells. Egg-shell with 4.5 μm thick wall of two layers: thin basal layer and outer layer consisting of separate rods with delicate coating. Operculum-like differentiation on both poles from flattened knobs. Circular caudal suckers of 55-90 μm diameter. Spongy tissue beneath suckers. Small pore in sucker center with channel running anteriorly.

Male. Testis flexed near mid-body. Caudal suckers - 25 μm deep with 10 μm wide invaginations.

Type host and locality. Infected *Pheretima campipapillata* Thai & Samphon, 1988 collected in Noong-phu village near Savannakhet, 28 August 1987. Other specimens found in the same host in the

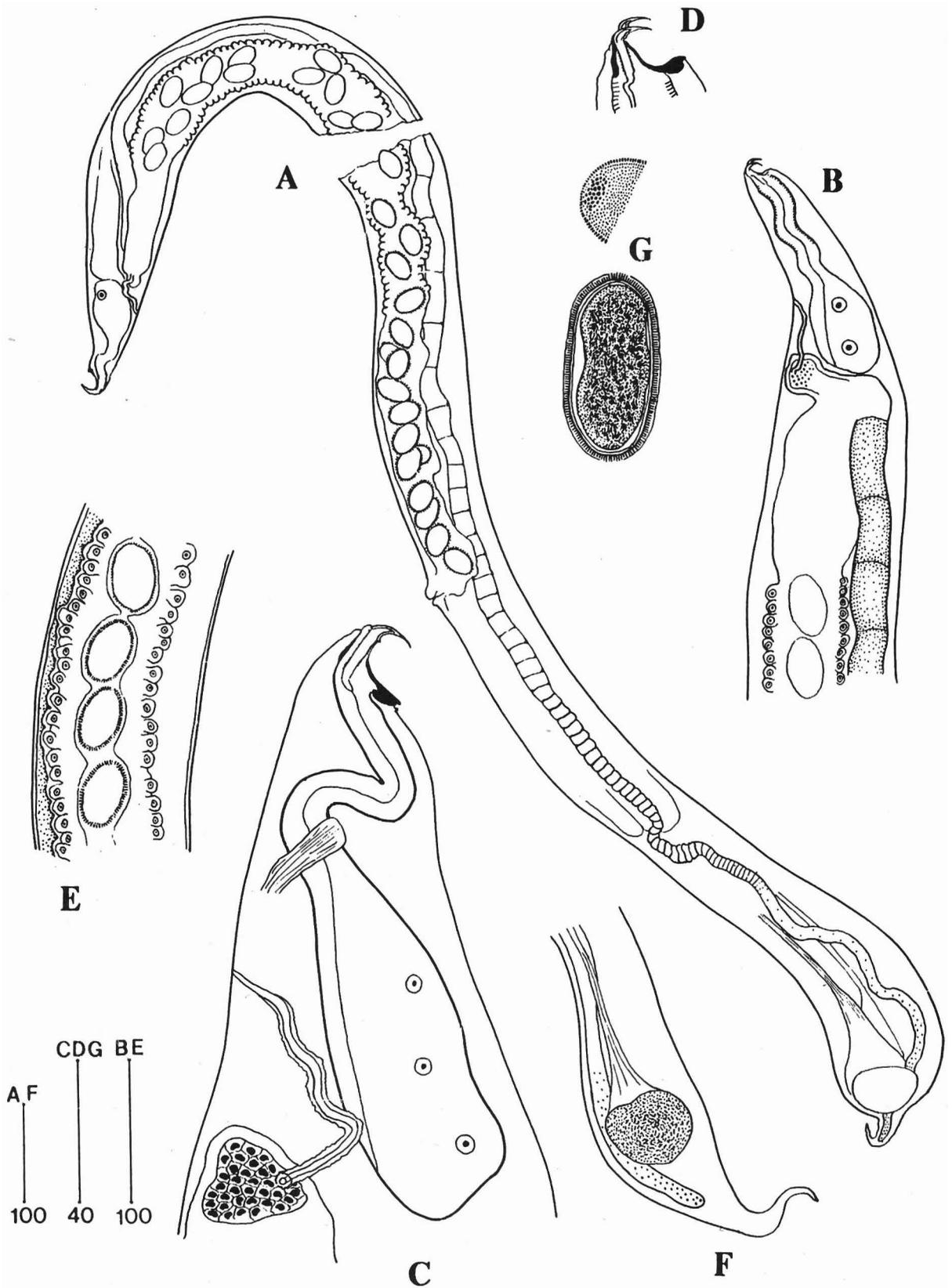


Fig.3. *Siconema laotense* sp.n. A: Female, total view (body broken in preparation); B: Female, anterior end, laterally; C: Female oesophagus laterally; D: Female hooks, laterally; E: Oviduct; F- Female tail, laterally; G: Egg-shell structure. Bars in μm .

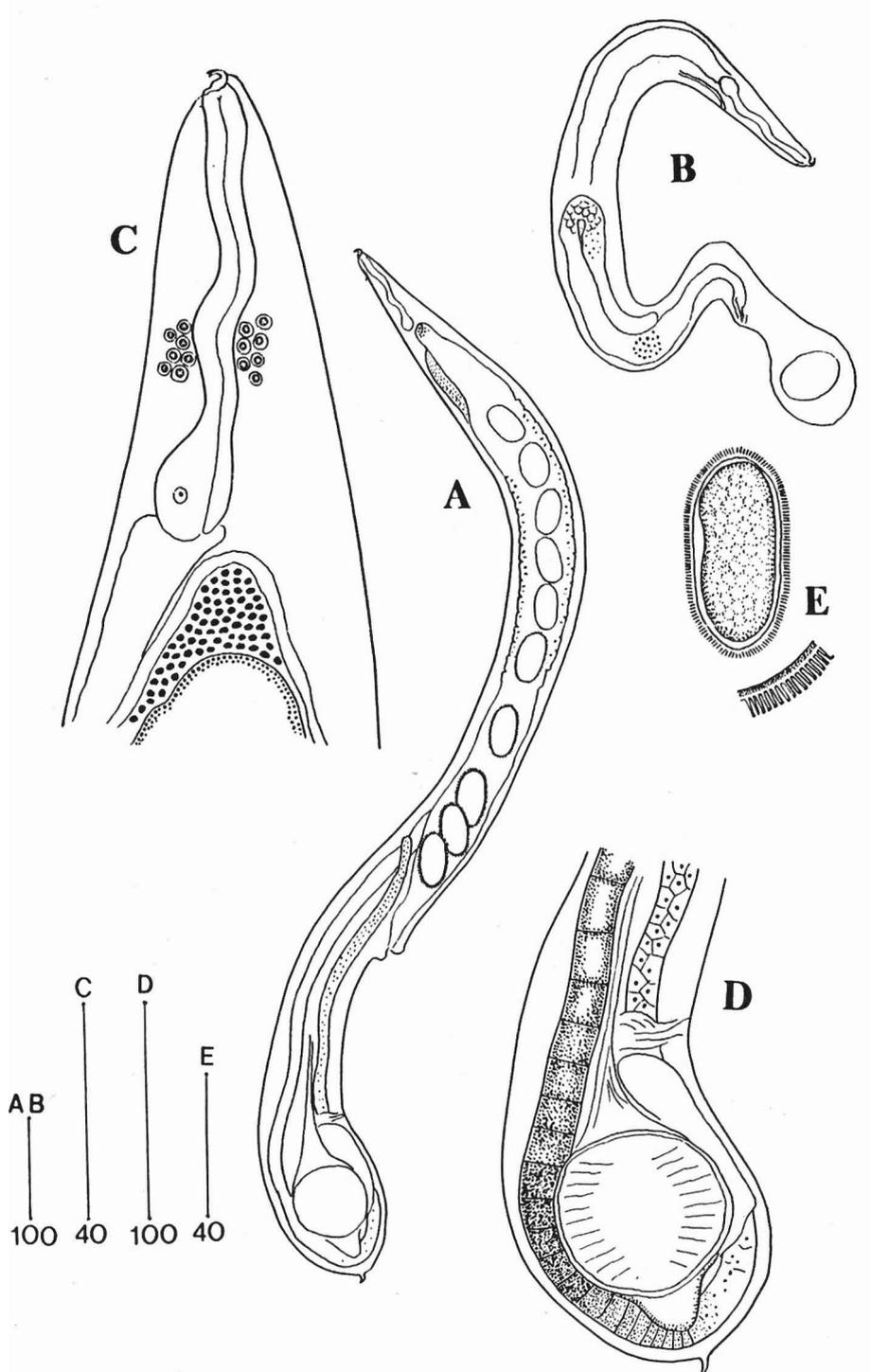


Fig.4. *Siconema aculeatum* sp. n. A: Female, total view; B: Male, total view; C: Female, anterior end, laterally; D: Female tail, laterally; E: Egg-shell structure, enlarged drawing of shell surface without scale. Bars in micrometers. Bars in μm .

forest near Thapha, 27 August 1985.

Type material. Holotype (Jc 350) deposited in the collection of Moscow State University Zoological Museum. Paratype deposited in the German Nematode Collection (Munster).

Differential diagnosis. Caudal morphology of *S. laotense* sp. n. is similar to those of *S. siamense* and *S. sinense* (Timm, 1966b). *S. sinense* has very thick hook base, without separate proximal pieces or long blades. *S. siamense* has double layer of rods (double corona in Timm's terminology) and crescent-like hook base without proximal pieces. Some resemblance to *S. laotense* can be found in the hook structure of *S. saccaturum* (Timm, 1966) and *S. duplicoecum* (Spiridonov & Danilova, 1986). However, both species have completely different egg-shell morphology: coarsely mammillated and echinate respectively.

Siconema aculeatum sp. n. (Fig. 4)

Holotype female: L = 976 μm , a = 16.2, b = 11.5, Ex = 70 μm , Rs = 53 μm , V = 60%.

Paratype females (n=8): L = 1171 (760-1343) μm , a = 17.4 (15.3-19.7), b = 15.2 (9.2-19.1), Ex = 71 (67-80) μm , Rs = 92 (77-105) μm , V = 66 (59-74)%, Eggs 57-62 x 31-35 μm .

Paratype males (n=2): L = 823 μm , 677 μm , a = 13.1, 16.9, b = 6.7, 9.3, c = 5.3, 4.1, Ex = 105 μm , 64 μm .

Female. Body yellowish, tapering to anterior end, with swollen tail region. Cephalic hooks small, apical, with 7-8 μm long base and 4-5 μm long blades. Oesophagus clavate with 6-7 μm wide corpus and 12 μm wide bulb. Excretory pore 1 μm wide, duct 50 μm long. Germinative tip cell close to vulva. Gonad reflexed behind suckers. Poorly separated spermatheca with 15-50 spermatozoa in anterior portion of gonad. About three eggs with developed shells in uterus and 6 to 7 eggs with underdeveloped shells anteriorly. Egg-shell strongly echinate with outer layer formed from numerous nail-like rods. No

polar differentiation. Circular suckers of 85-95 μm diameter in mature females. Radial folds near sucker margins. Tail appendage 23-25 μm long.

Male. Hook blades 8 μm long. Testis flexed in anterior body half. No prominent pericloacal elevation. Suckers elliptical, transversally elongated up to 75 μm in one paratype and circular (30 μm diameter) in another.

Type host and locality. Infected *Pheretima campipapillata* collected in the forest near Thapha, 27 August 1985.

Type material. Holotype (Jc 348) deposited in the collection of Moscow State University Zoological Museum. Paratypes deposited in the German Nematode Collection (Munster) and at the USDA Nematode Collection, Beltsville.

Differential diagnosis. *S. aculeatum* sp. n. is characterized by very small cephalic hooks, which are similar only with those of *S. micronchium* (Timm, 1966b). However, the latter species possess very long suckers (in our opinion this species should be transferred to *Synoeconema*). In general the tail shape *S. aculeatum* sp. n. resembles that of *S. laotense* sp. n. and *S. siamense*. *S. aculeatum* sp. n. can be readily distinguished by the small size of hooks and nail-like rods on the egg-shell surface.

Synoeconema laotense sp. n. (Fig. 5)

Holotype female: L = 1643 μm , a = 20.5, b = 8.9, c = 2.3, Ex = 130 μm , Rs = 185 μm , V = 54%, Eggs 49-53 x 27-29 μm .

Paratype females (n=4): L = 1370 (1213-1550) μm , a = 23.5 (20.8-25.9), b = 8.9 (6.3-11.1), c = 2.3 (2.2-2.6), Ex = 124 (118-138) μm , Rs = 188 (163-228) μm , V = 54 (51-59)%, Eggs 50-55 x 25-29 μm .

Female. Body brownish, gradually tapering to both ends, without caudal swelling. Singular cephalic hook with 14 μm long base and 12 μm long blade. Dorsal proximity of base enlarged, with wavy posterior edge. Oesophagus clavate with 8 μm wide

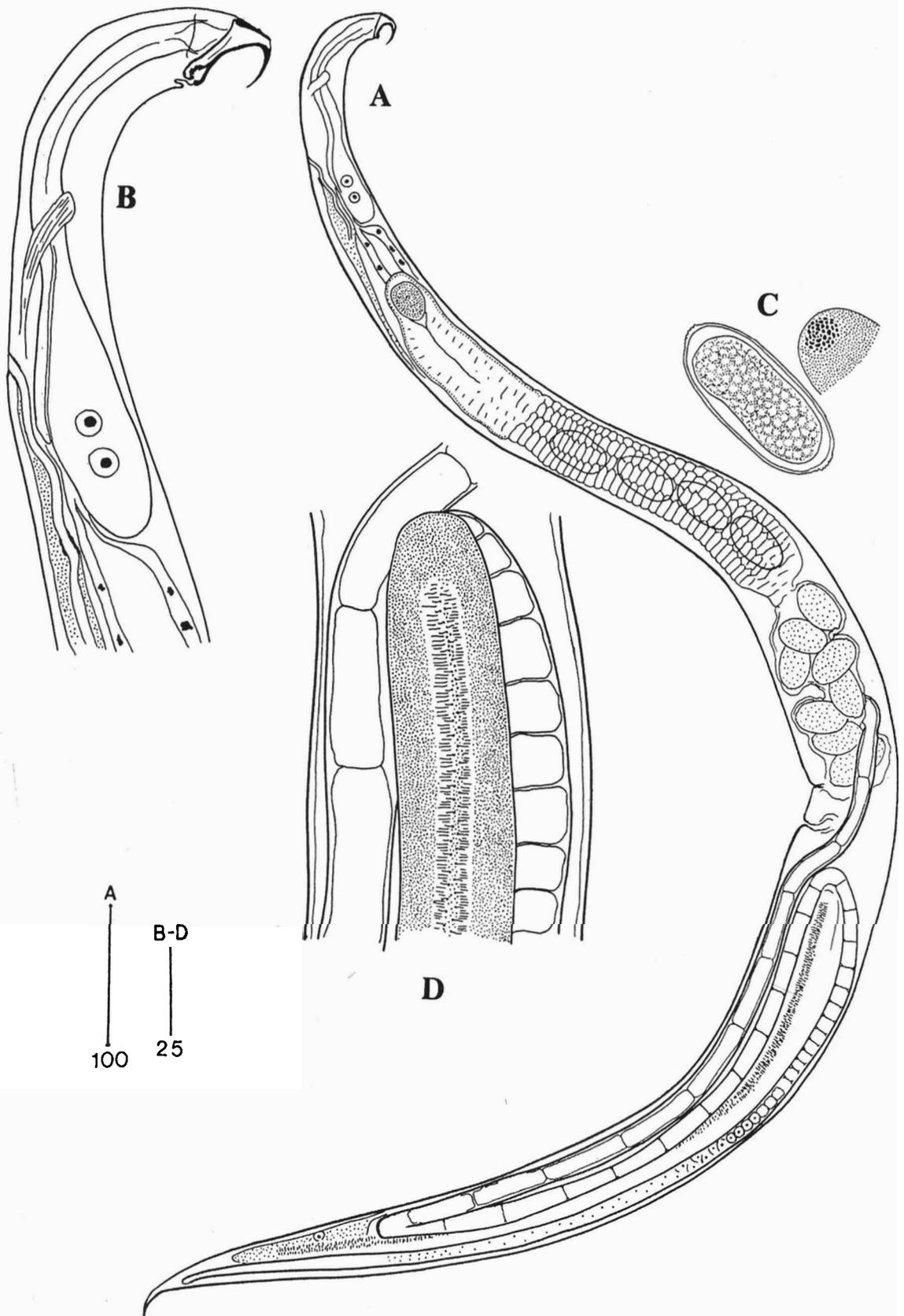


Fig.5. *Synoecnema laotense* sp. n. A: Female, total view; B: Female anterior end, laterally; C: Egg-shell structure; D: Sucker structure near its anterior margin. Bars in μm .

corpus and 25 μm wide bulb. Two large nuclei in strongly enlarged dorsal portion of bulb. Excretory pore 3 μm wide, duct 50 μm long. Germinative tip cell near tail terminus, then gonad runs anteriorly, reflexes close to vulva, and again reflexes near tail terminus. Poorly separated spermatheca on anteriormost point of reflexion near to bulb. Up to 10 eggs with fully formed shells in uterus with 3 to 4 eggs with underdeveloped shells anteriorly. Egg-shell nearly smooth, finely mammillated, with two polar operculum-like caps from flattened knobs. Clearly visible anal opening and rectum near to vulva. Caudal sucker - 14 μm wide lateral groove along tail. Spongy tissue under groove from level of vulva to tail terminus.

Male unknown.

Type host and locality. Infected *Pheretima bucculenta* Gates, 1935 collected in Muonghum, 10 August, 1987.

Type material. Holotype (Jc 337) is deposited in the collection of Moscow State University Zoological Museum. Paratype is deposited in the German Nematode Collection (Munster).

Differential diagnosis. The long caudal suckers are characteristic for *Synoeconema* (Poinar, 1977). *S. laotense* sp. n. can be distinguished from other ungelids by the presence of a singular blade on the

cephalic hook. This feature is common for Homungellidae, but the latter nematodes have a completely different morphology of their suckers and egg-shells (Timm, 1966a).

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Спиридонов. С. Э. Нематоды семейства Ungellidae Chitwood, 1950 от дождевых червей Лаоса.

Резюме. Описаны пять новых видов нематод от дождевых червей Лаоса. *Siconema aequicrassum* sp. n. характеризуется тонкими головными крюками, округлыми хвостовыми органами у особей обоих полов и тонкой папиллярной орнаментацией оболочек яиц. *S. inaequicrassum* sp. n. сходен с *S. aequicrassum* sp. n., отличаясь размерами яиц, длиной крюков и пищевода. *S. laotense* sp. n. характеризуется крупными головными крюками. Отличительная особенность *S. aculeatum* sp. n. - наличие палочковидных выступов на поверхности оболочки яиц. Уникальная особенность *Synoeconema laotense* sp. n. - наличие только одного острия головных крюков.
