

# *Hexactinolaimus* Yeates, 1973, a junior synonym of *Paractinolaimus* Meyl, 1957 and a revised classification of Actinolaimidae (Nematoda : Dorylaimida)

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## SUMMARY

*Hexactinolaimus aneityi* Yeates, 1973 and *Neoactinolaimus proximus* Yeates, 1973 are redescribed on the basis of type material. It was found that both represent one and the same species belonging to the genus *Paractinolaimus* and are therefore renamed *Paractinolaimus proximus* (Yeates, 1973) n. comb. A new diagnosis is given. The genus *Hexactinolaimus* formerly occupied a basic position in the cladogram illustrating the phylogenetic relationships in the family Actinolaimidae (Vinciguerra, 1988). This cladogramme ainsi que la classification de la famille sont révisés à partir des informations contenues dans le présent article et de celles précédemment publiées sur les genres *Trachypleurosum* Andrassy, 1959 et *Trachactinolaimus* Andrassy, 1963 (Coomans, Vinciguerra & Loof, 1990).

## RÉSUMÉ

*Hexactinolaimus* Yeates, 1973, synonyme mineur de *Paractinolaimus* Meyl, 1957  
et classification révisée des Actinolaimidae (Nematoda : Dorylaimida)

*Hexactinolaimus aneityi* Yeates, 1973 et *Neoactinolaimus proximus* Yeates, 1973 sont redécrits à partir du matériel type. L'un et l'autre représentent une seule et même espèce, appartenant au genre *Paractinolaimus*, renommée *Paractinolaimus proximus* (Yeates, 1973) n. comb. et dont une nouvelle diagnose est donnée. Le genre *Hexactinolaimus* occupait précédemment une position de base dans le cladogramme illustrant les relations phylétiques à l'intérieur de la famille des Actinolaimidae (Vinciguerra, 1988). Ce cladogramme ainsi que la classification de la famille sont révisés à partir des informations contenues dans le présent article et de celles précédemment publiées sur les genres *Trachypleurosum* Andrassy, 1959 et *Trachactinolaimus* Andrassy, 1963 (Coomans, Vinciguerra & Loof, 1990).

Yeates (1973) described a new actinolaimid genus from the New Hebrides, *Hexactinolaimus*, characterized by having six onchia in the mouth cavity instead of four, which is the condition in all the genera of the family Actinolaimidae. In the revised classification of the family by Vinciguerra (1988), based on a phylogenetic approach, the presence of six onchia was considered a plesiomorphy (primitive character), which set apart *Hexactinolaimus* at the root of the phylogenetic tree of Actinolaimidae, and the subfamily Hexactinolaiminae was established to accommodate it. Nonetheless, this genus shared some apomorphies (advanced characters) with other, more evolved, genera of the family : namely, the sexual dimorphism in the tail and the absence of denticles in the cheilostome. This situation, even though it could be explained as the result of parallel evolution, did not seem highly probable; hence we decided to examine the type material of *Hexactinolaimus aneityi* Yeates, 1973, together with that of *Neoactinolaimus proximus* Yeates, 1973, described from the same region.

This material, which allowed us to settle the status of the genus *Hexactinolaimus*, is redescribed below, together with a female from the New Hebrides attributed by Yeates also to *Hexactinolaimus* (pers. comm.) but found in a different sample and never described before.

### *Paractinolaimus proximus* (Yeates, 1973) nov. comb.

= *Neoactinolaimus proximus* Yeates, 1973  
= *Hexactinolaimus aneityi* Yeates, 1973  
(Figs 1, 2)

## MEASUREMENTS

*Population 1* (types of *H. aneityi*) : see Table 1.

*Population 2* (female from Mt Tabwemasana) : see Table 1.

*Population 3* (types of *N. proximus*) : see Table 1.

Table 1  
Comparative measurements of the studied actinolaims

n	<i>Hexactinolaimus aneityi</i> type specimens		<i>H. aneityi</i>	<i>Neoactinolaimus proximus</i>	
	female	male	spare female	female	male
	2	1	1	1	2
L (mm)	2.39-2.43	2.29	2.79	2.00	1.70-1.99
a	36-42	40	49	42	36-42
b	3.9-4	4	4.3	3.7	3.3-3.9
c	13-16	80	15	9	52-60
c'	4-6	0.6	5.6	7	0.6
V/VD	53-54	54	51.5	50.5	55-56.5
G <sub>1</sub>	13-14	14	14	13	4-6
G <sub>2</sub>	12-17	13	20 (outstr.)	14	4-7
Lip region width (µm)	21-21.5		22	21.5	20-21
Lip region height (µm)	7		8.5	9.5	7-7.5
Fixed ring-anterior end (µm)	19		19	17	16-17
Odontostyle (µm)	28-29.5		27	24.5	24-25
Odst. LW	1.3-1.5		1.2	1.1	1.1-1.2
Odontophore (µm)	29		28	27	25-28
Odst. base-phar. constriction	54-57		59	51	50-53
Amphid opening	8-9.5		8.5	9.5	9.5
Fusus-amphid. open.	21.5		22	17	17-18
Neck (µm)	585		631	526	
DO	48.2 %		49.2 %	49.3 %	
DN	50.0 %		51.3 %	50.3 %	
S <sub>1</sub> O <sub>1</sub> (S <sub>1</sub> N <sub>1</sub> )	75.5 %		75.8 %	75.9 %	
S <sub>1</sub> O <sub>2</sub> (S <sub>1</sub> N <sub>2</sub> )	76.5 %		77.0 %	76.9 %	
S <sub>2</sub> N	84.5 %		84.5 %	84.7 %	
S <sub>2</sub> O	85.5 %		85.2 %	86.1 %	
Prerectum (µm)	129-143	147	140	113	115-118
Prerectum/ABW	3.9-4	4-5	4-5	4	3-3.4
Rectum (µm)	45	—	48	45	—
Rectum/ABW	1.3-1.4	—	1.5	1.5	—
Spicules (µm)	—	64-67	—	—	61
Lat.g.p. (µm)	—	15.5-18	—	—	14-15
Sperm (µm)	—	8.5 (7.5-10.5)	8.3 (7.5-9.5)	—	7.8 (7-9)
Supplements	—	8-10	—	—	9-10
Cuticle (µm)	4	3	5	5	4
Nerve ring-anterior end (µm)	160			153	
Endolids-n.r. (µm)	18			21.5	
Caudal pores	2	5	2	2	5
Tail (µm)	136-188	21-22	176	206	21.5

## DESCRIPTION

## Population 1

*Female* : Body almost straight in its anterior half, ventrally curved posteriorly. Cuticle with fine transverse striations. Body pores small. Lip region slightly set off by constriction. Anterior papillae arranged in two circlets of respectively ten (six inner labial + four cephalic ones) and six (the outer labial ones). Amphids with cup-

shaped fovea. Anterior part of cheilostome with two sclerotized rings and radiating prongs in between (for more details see male). This part is followed by the region with four onchia which are anteriorly covered and flanked by denticles. Odontostyle robust, but partly dissolved in the two paratype specimens, longer than lip region width. Guide sheaths showing longitudinal wrinkles. Odontophore poorly demarcated from the remainder of the pharyngeal lining; the distance between the

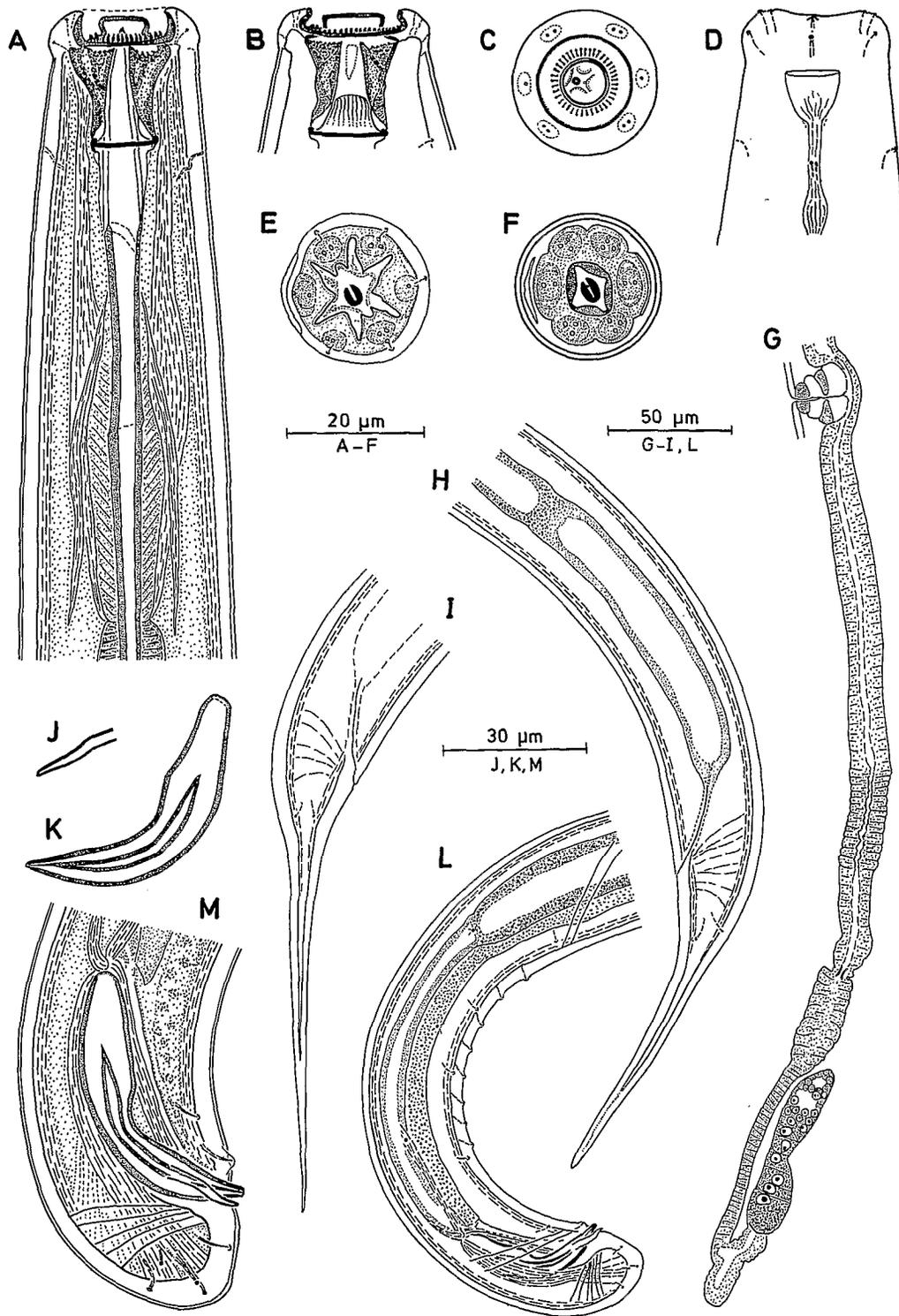


Fig. 1. *Hexactinolaimus aneityi*. A : Anterior end; B : Head end with guide sheath; C : En face; D : Head end with papillae and amphid; E : Optical section through anterior cheilostome; F : Optical section through median part of cheilostome; G : Posterior branch of female reproductive system; H : Posterior end of female; I : Female tail; J : Lateral guiding piece; K : Spicule; L : Posterior end of male; M : Male tail.

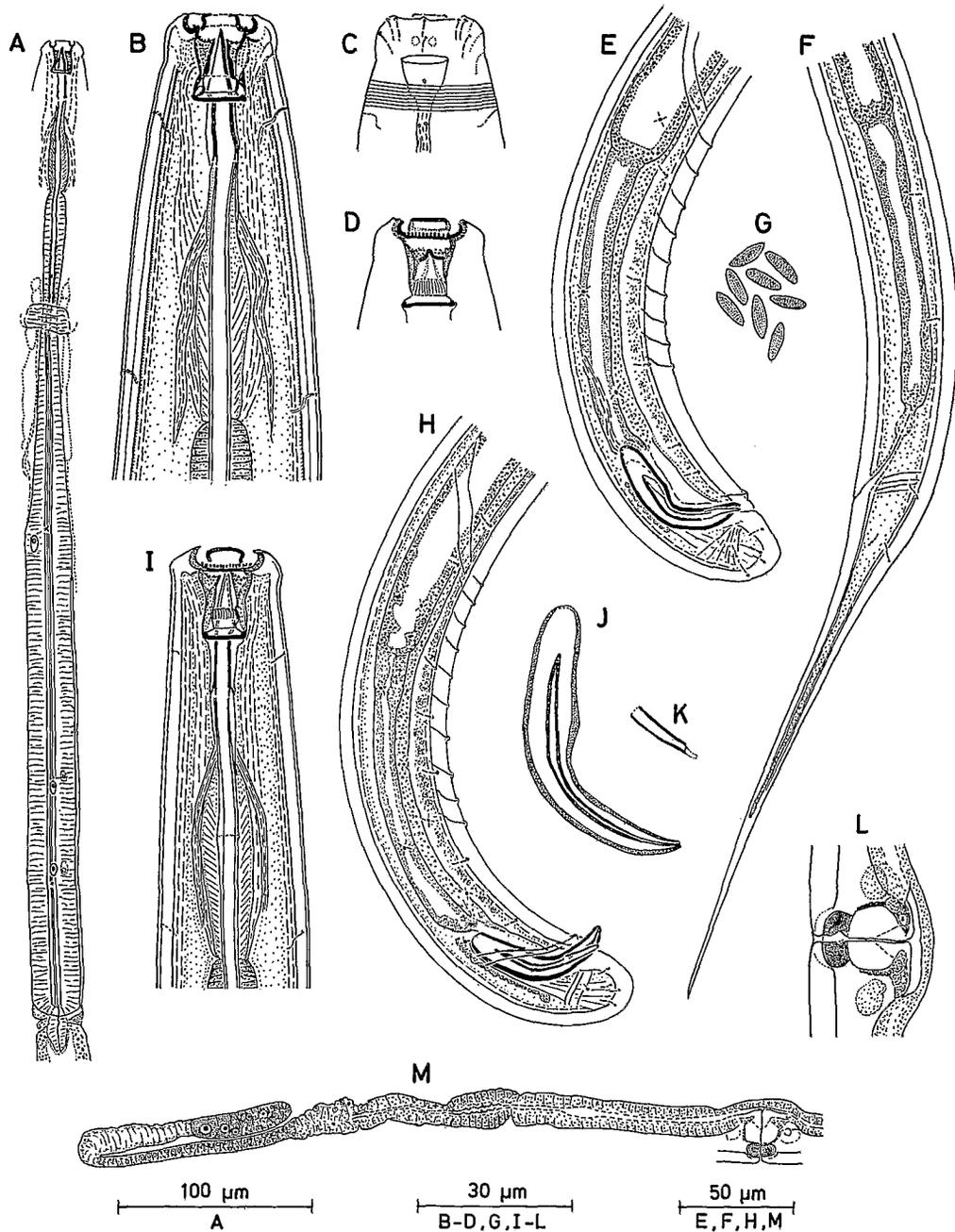


Fig. 2. *Neoaetiolaimus proximus*. A-E : Allotype; A : Pharynx; B : Anterior end; C : Head end in surface view; D : Head end with guide sheath; E : Posterior end; F : Posterior end of female; G : Sperm; H : Posterior end of male; I : Anterior end of female; J : Spicule; K : Lateral guiding piece; L : Vulva-vagina region; M : Anterior branch of female reproductive system.

odontostyle base and the posterior end of the anterior spindle-shaped part of pharynx, the so called "oesophageal constriction", is about two odontostyle lengths. Pharynx typical, enlarging about halfway its length. Nerve ring 160  $\mu\text{m}$  distant from anterior end; endolids 18  $\mu\text{m}$  in front of middle of nerve ring. Cardia heart-shaped. Prerectum about 4 and rectum 1.4 anal body widths long. Tail first dorsally convex-conoid, then elongated, 4.0-5.7 times as long as anal body width, with finely rounded terminus and two pairs of caudal pores. Reproductive system amphidelphic, with each branch consisting of reflexed ovary, ovarial sac, oviduct, sphincter and uterus with well developed *pars muscosa* with wrinkled inner wall. Both uteri joining each other at vagina without differentiated ovejector. Vagina thick-walled; vulval-vaginal junction sclerotized; vulva a small transverse oval.

**Male** : Similar to female in general appearance, but with posterior end more curved and with short tail. The round oral aperture is surrounded by an inner sclerotized ring connected with 40 radial sclerotized prongs and surrounded by an outer sclerotized ring. More inward the labial cuticle clearly separates the six lips through deep invaginations, resulting in conical prominences into the cheilostome. Two of these prominences (the right subdorsal and the left subventral) are bifid (Fig. 1 E). Eight to ten ventromedian spaced supplements; five subventral papillae in the region of the supplements. Tail convex-conoid with bluntly rounded terminus, less than one anal body width long, with five pairs of caudal pores.

#### Population 2

Female specimen from Mt Tabwemasana, New Hebrides.

The specimen is similar in all respects to the female paratypes of *H. aneityi*, though somewhat larger. The posterior gonad is outstretched, but this is considered an abnormality.

#### Population 3

These specimens, attributed to a species of *Neoactinolaimus* for the absence of denticles, show on the contrary numerous small denticles in the cheilostome. Moreover, though they are somewhat smaller than the type specimens of *H. aneityi* and the female has a slightly longer tail, this species could not be differentiated from the former by any character.

#### DISCUSSION

Having found that *H. aneityi*, type and only species of the genus *Hexactinolaimus*, possesses only four onchia in the mouth cavity, the character on which this genus was established lapses. The presence of cheilostomal denticles, the tail sexual dimorphism and the arrangement in series of the supplements led us to

regard this species as belonging to the genus *Paractinolaimus*. This species is also considered identical to that described by Yeates (1973) as *Neoactinolaimus proximus*. Since the latter species was described before the former one though in the same paper, the valid name for it is *Paractinolaimus proximus* (Yeates, 1973) n. comb. (syn. : *Neoactinolaimus proximus* Yeates, 1973; *Hexactinolaimus aneityi* Yeates, 1973 n. syn.).

#### LOCALITIES (all from New Hebrides)

**Population 1** : Summit of ridge, 745 m altitude, about 5 km NNE of Anelgauhat, Aneityum Island. *Metrosideros*, ferns and mosses, 0-5 cm soil. Collected 21 July 1971 by G. W. Yeates.

**Population 2** : Summit of Mt Tabwemasana, Espiritu Santo Island. Very stunted montane rainforest. Altitude 1879 m. Parent material of soil : basic andesite; 0-12 cm matted fine roots, humus and some soil. Collected 4 September 1971 by G. W. Yeates.

**Population 3** (type locality) : Rain forest, 17 km inland (West) from Ipota, Erromanga island. On ridge crest west of Nouankoa River. Altitude 200 m, 1-15 or 20 cm soil, including root mat. Collected 3 August 1971 by G. W. Yeates.

#### TYPE MATERIAL

Deposited in the National Nematode Collection of New Zealand, Entomology Division, DSIR, Auckland, New Zealand.

#### DIAGNOSIS OF AND RELATIONSHIPS

*P. proximus* is characterized by medium size ( $L = 1.70-2.79$  mm), odontostyle 24-30  $\mu\text{m}$  long, slightly longer than head width, thick-walled vagina and sclerotized vulval-vaginal junction, female tail convex-conoid, then elongate, 4-7 times as long as anal body width, male tail convex-conoid with blunt terminus, shorter than anal body width, with five pairs of caudal pores, spicules 61-67  $\mu\text{m}$  long, 8-10 spaced supplements.

It resembles *P. baldus* Thorne, 1967 in size and general aspect, but the latter species has numerous denticles filling the mouth cavity and smaller vaginal sclerotization. It resembles also the group of related species *P. longidrilus* Eveleigh, 1982, *P. intermedius* Altherr, 1968, *P. macrolaimus* (de Man, 1880) and *P. microdentatus* (Thorne, 1939) but it differs from all of them by being somewhat smaller and by having a definitely lower number both of supplements and caudal pores.

#### Revised classification of the family Actinolaimidae based on its phylogeny

Vinciguerra (1988) recognized in the family Actinolaimidae three subfamilies : Actinolaiminae, to which

she attributed sixteen of the eighteen described genera, with four onchia, Trachypleurosinae, with the single genus *Trachypleurosum* Andr ssy, 1959, lacking onchia, and Hexactinolaiminae, with the single genus *Hexactinolaimus* Yeates, 1973, with six onchia. Coomans, Vinciguerra and loof (1990), studying the type specimens of *Trachypleurosum conforme* (Schneider, 1935), type species of the genus *Trachypleurosum*, found that the typical four onchia were present, even though considered absent by Schneider (1935), while the described denticles were not observed. They regarded the genus as different from the otherwise similar genus *Trachactinolaimus* Andr ssy, 1963, in the absence of denticles in the cheilostome but attributed it to the subfamily Actinolaiminae and abolished the subfamily Trachypleurosinae.

The present discovery that *Hexactinolaimus aneityi*, having four onchia and cheilostomal denticles, is indeed a species of *Paractinolaimus*, brings about the abolition of the subfamily Hexactinolaiminae as well. As a consequence, also the subfamily Actinolaiminae is here abolished, since it would presently include all the genera left in the family and would therefore be a redundancy.

Because of these major modifications and of an improved knowledge of the group due to the recent description of further new species, an updated hypothesis on the phylogeny of the taxon is proposed here, based on the same ground on which the previous hypothesis had been constructed (Vinciguerra, 1988).

In Table 2 a list of the main diagnostic characters of the genera of Actinolaimidae is given. For each of them the plesiomorphic and the apomorphic state is indicated.

In Fig. 3 for each genus the apomorphic character states are indicated, so that synapomorphies and autapomorphies can be recognized. The polarity of the characters, that is the direction of the character transformation, is the same as in Vinciguerra (1988) but the character numbers do not correspond to the previous ones, since the character states " onchia absent " and " six onchia " are no longer retained in accordance with the discussion above. For easier comparison, each character number used in the present construction is accompanied by the number (given in brackets) of the same character in the previous paper. The cladogram constructed on this basis is shown in Fig. 4. It differs from the previous one (Vinciguerra, 1988) essentially by the absence of the genus *Hexactinolaimus* and in the position of *Trachactinolaimus* Andr ssy, 1963 now being the most primitive genus of the family with only plesiomorphic characters, while *Trachypleurosum* Andr ssy, 1959 shows the lack of denticles as an autapomorphy. Besides, a new interpretation is given of the relationship between the very closely related genera *Brasilaimus* Lordello & Zamith, 1957, *Stomachoglossa* Andr ssy, 1968, *Actinca* Andr ssy, 1964 and *Brittonema* Thorne, 1967. We found that thick vaginal sclerotization and weakly developed vestibular ring are characters common to all of them, while the very high and conoid lip region

Table 2  
Characters used to construct the cladogram

	Characters	Plesiomorphic rate	Apomorphic state
1	(3)* Male tail	elongated as in female	short and round
1 a	(3 a)		with filiform appendix
2	(4) cheilostomal denticles	present	absent
3	(5) cheilostomal walls	without basket-like ribbing	with basket-like ribbing
4	(6) supplements	in series	in fascicles
5	(7) onchia	simple	with secondary teeth
6	(8) onchia	separate	fused
7	(9) cuticle	smooth or finely transversely striated	also with longitudinal ridges
8	(10) anterior half of pharynx	muscular	short non-muscular + long muscular middle portion
8 a	(10 a)		long non-muscular + short muscular middle portion
9	(11) odontostyle	short and stout	long and slender
10	(12) lip region	low	high
11	(15) vaginal sclerotization	small	large and thick
12	(13) vestibular ring	well developed	weakly developed
13	(14) innervation of supplements	shallow	deep
14	(16) pharyngeal lumen	without appendix	with glossa-like appendix
15	(17) lip region	not expanded	very expanded
16	(12 a) lip region	lower, truncate or expanded	higher and conoid

\* numbers in brackets according to Vinciguerra (1988).

CHARACTERS GENERA	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Trachactinolaimus																
Trachypleurosum		●														
Paractinolaimus	●															
Westindicus	●		●													
Afractinolaimus	●			●												
Egtitus	●	●														
Mactinolaimus	●	●		●												
Neoactinolaimus	●	●		●	●											
Metactinolaimus	●	●		●		●										
Actinolaimus	●	●		●			●									
Parastomachoglossa	●	●		●			●	●								
Practinocephalus	●	●		●			●	● 8a	●	●					●	
Brasilaimus	●	●		●			●	● 8a	●	●	●	●				
Actinca	●	●		●			●	● 8a	●	●	●	●				●
Stomachoglossa	●	●		●			●	● 8a	●	●	●	●		●		
Brittonema	● 1a?	●		●			●	● 8a	●	●	●	●	●			

Fig. 3. Apomorphic character states in the genera of Actinolaimidae (indicated by the black disks).

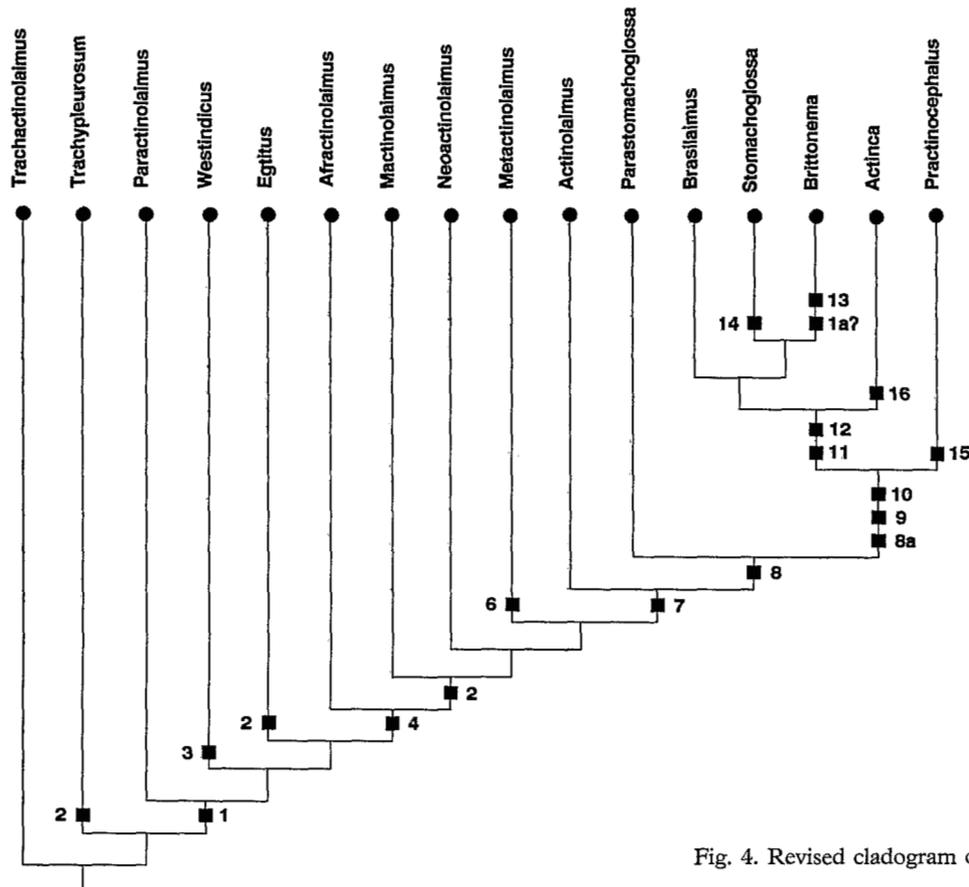


Fig. 4. Revised cladogram of Actinolaimidae.

is exclusive of *Actinca*; therefore *Brasilaimus* seems to be the least specialized of the four genera, while each of the other three genera has at least an autapomorphic character and does not share any apomorphy with any of the other genera as far as we know (we have never had the chance to observe the types of *Brittonema* and *Brasilaimus*).

From the present cladogram, revised on the basis of the new knowledge, the family Actinolaimidae appears even a more homogeneous taxon than before, which strengthens the choice made for giving it a lower rank than in the past. The kind of approach used to construct a classification for the family is proved to be valid, since even important modifications due to new information, like those illustrated here, have not significantly modified the classification of the whole taxon.

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