

## 7.13 Order Desmodorida De Coninck, 1965

*Diagnosis.* Chromadorea. Nematodes fixed with formol often look yellowish or brownish. Cuticle usually with distinct annulations, but in some species very finely striated or even smooth; punctation may occur rarely. Cephalic cuticle is often smooth. Anterior sensilla are arranged in three separate circles, six inner labial papillae, six outer labial papillae and four cephalic setae. Amphideal fovea is ventrally coiled, usually oligo- or unispiral. Cheilostom is equipped with twelve longitudinal ribs or rugae that, however, are not always distinct. There is a more or less pronounced dorsal tooth in the stegostoma, whereas subventral teeth are smaller or absent. Pharynx muscular, with more or less developed posterior bulb. Ovaries are paired (rarely a single anterior ovary) and mostly antidromously reflexed (outstretched in two families). Gubernaculum is usually devoid of a dorsocaudal apophysis.

In the frame of the order, three first families are closely related and, hence, are united in the superfamily Desmodoroidea Filipjev, 1922 (e.g., Lorenzen 1981), where specialized taxa Draconematidae and Epsilonematidae are derived from relatively more generalized group Desmodoridae. Three other families are united in the superfamily Microlaimoidea Micoletzky, 1922; interrelationships between Microlaimidae, Aponchidae and Monoposthiidae need further study. Family Richtersiidae retains an isolated position within Desmodorida.

### 7.13.1 Superfamily Desmodoroidea Filipjev, 1922

*Diagnosis:* Desmodorida. Body cuticle annulated, never punctated. Two reflexed ovaries. Single anterior testis.

Three families: Desmodoridae Filipjev, 1922, Draconematidae Filipjev, 1918 and Epsilonematidae Steiner, 1927.

The three families form a monophyletic group based on the synapomorphy that only anterior testis is present (Lorenzen 1981, 1994). Two of the three families, i.e., Epsilonematidae and Draconematidae, are considered to be monophyletic.

#### 7.13.1.1 Family Desmodoridae Filipjev, 1922

*Diagnosis:* Desmodoroidea. Body cylindrical. Cuticle is distinctly annulated, without dots, but spines, fringes or longitudinal ornamentations may be present. No specialized ambulatory setae at anterior and posterior body ends. Locomotion is sinuous, typical for nematodes.

Six subfamilies: Desmodorinae Filipjev, 1922, Spiriniinae Gerlach & Murphy, 1965, Pseudonchinae Gerlach & Riemann, 1973, Stilbonematinae Cobb, 1936, Molgolaiminae Jensen, 1978, and Prodesmodorinae Lorenzen, 1981.

##### 7.13.1.1.1 Subfamily Desmodorinae Filipjev, 1922

*Diagnosis* (after Decraemer & Smol 2006, Verschelde et al. 2006): Desmodoridae. Cuticle annulated except in head region. Head region with thickened cuticle except in lip region and set off as a conspicuous cephalic capsule. Amphideal fovea generally not surrounded by striation of body cuticle; may be located on a cuticularized plate. Buccal cavity mostly with distinct teeth. Pharyngeal bulb round to elongated.

Type genus: *Desmodora* de Man, 1889

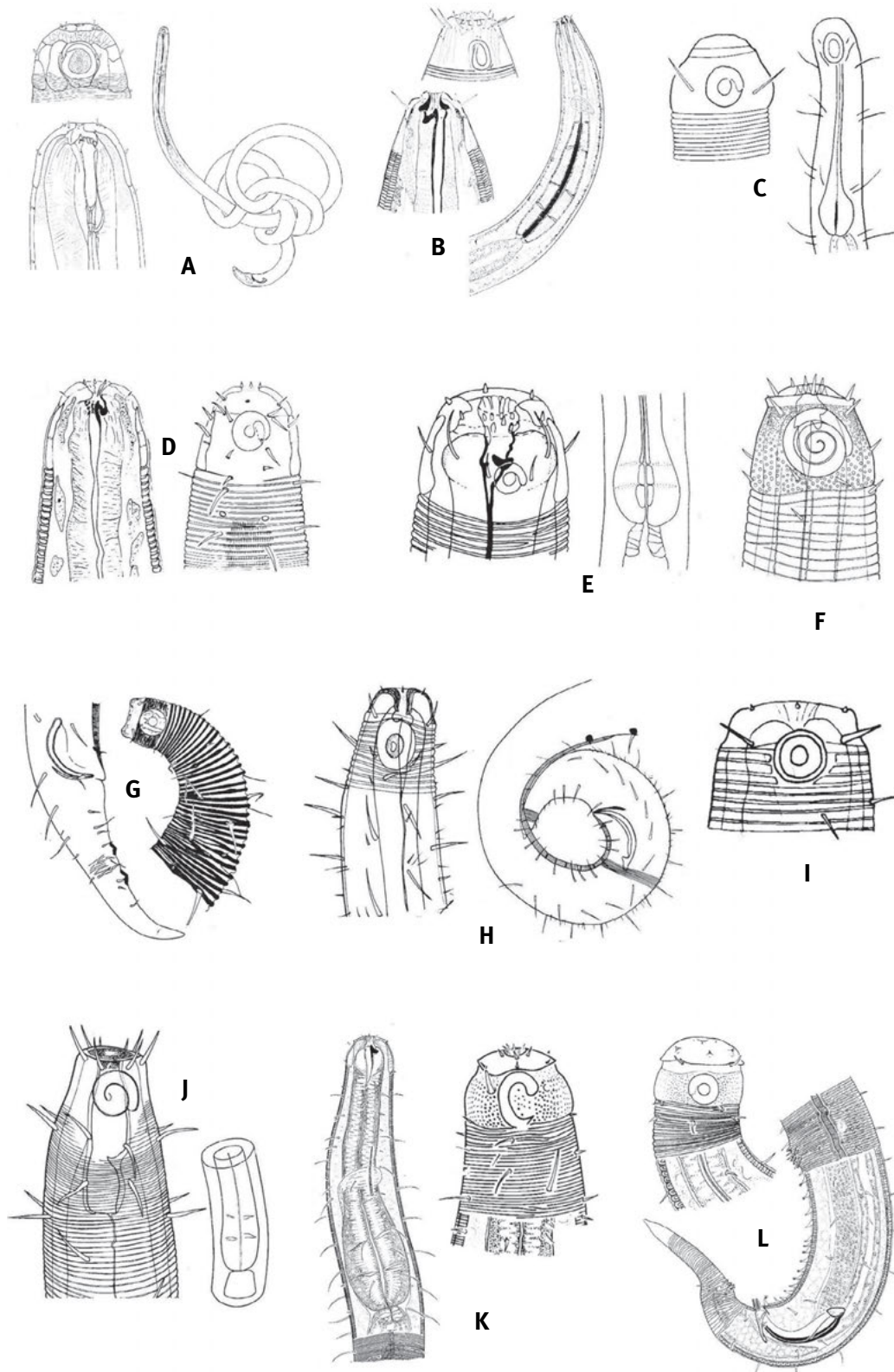
##### Genus *Acanthopharyngoides* Chitwood, 1936 (Fig. 7.100 A)

*Diagnosis* (after Decraemer & Smol 2006): Desmodorinae. Head capsule composed of joined plates. Subcephalic setae present. Amphideal fovea unispiral, located on a cuticularized plate. Buccal cavity cylindrical with a large dorsal tooth and two or more ventrosublateral teeth. Pharyngeal bulb elongate, i.e., half as long as the pharynx and tripartite. Male with mid-ventral row of papilloid precloacal supplements and a larger posterior-most supplement. Number of species: 6

Type species: *Acanthopharyngoides scleratus* Chitwood, 1936

##### Genus *Acanthopharynx* Marion, 1870 (Fig. 7.100 B) (= *Xanthodora* Cobb, 1920)

*Diagnosis:* Desmodorinae. Head capsule unbroken. Amphideal fovea unispiral, located on a cuticularized plate. Buccal cavity cylindrical with a large dorsal tooth and possibly two or more ventrosublateral teeth. Pharyngeal bulb elongate, i.e., half as long as the pharynx



**Fig. 7.100:** Desmodorinae, examples of genera. A, *Acanthopharyngoides quintus* (from Riemann & Schrage 1977, Abb. 1); B, *Acanthopharynx distechei* (from Decraemer & Coomans 1978, Fig. 2); C, *Bolbonema longisetosum* (from Jensen 1985, Fig. 14); D, *Croconema otti* (from Gourbault & Vincx 1990, Figs. 1, 2); E, *Desmodora communis* (from Platt & Warwick 1988, Fig. 141); F, *Desmodorella tenuispiculum* (from Boucher 1975, Fig. 7); G, *Echinodesmodora axi* (from Blome 1982, Abb. 22E, 23A); H, *Metadesmodora spinulosa* (from Wieser 1959, Fig. 47); I, *Paradesmodora campbelli* (from Gerlach 1963); J, *Parallelocoilas dollfusi* (from Boucher 1975, Fig. 3); K, *Psammonema ovisetosum* (from Verschelde & Vincx 1995, Figs. 1, 2); L, *Pseudochromadora securis* (from Verschelde et al. 2006, Fig. 7).

and tripartite. Male with mid-ventral row of pore-like or papilloid preloacal supplements.

Number of species: 13

Type species: *Acanthopharynx* Marion, 1870

**Genus *Bolbonema* Cobb, 1920 (Fig. 7.100 C)**

*Diagnosis* (after Verschelde et al. 1998): Desmodorinae. Globular head capsule. Cephalic setae located posterior to the amphideal fovea. Long and shorter somatic setae.

Number of species: 2

Type species: *Bolbonema brevicolle* Cobb, 1920

*Bolbonema* is assumed as a subgenus of *Desmodora* by Gerlach (1963a: 90) and reconsidered as a genus by Verschelde et al. (1998).

**Genus *Croconema* Cobb, 1920 (Fig. 7.100 D)**

(syn.: *Aculeonchus* Kreis, 1928; *Bla* Inglis, 1963; *Xenodesmodora* Wieser, 1951)

*Diagnosis* (after Verschelde et al. 1998): Desmodorinae. Cuticle thick, coarsely annulated and often ornamented with ridges or spines. Head capsule long, labial region separated by a sutura. Amphideal fovea located anteriorly on the head capsule. Numerous subcephalic setae arranged in three or more circles. Buccal cavity with prominent dorsal tooth and one or two small sub-ventral teeth.

Number of species: 18

Type species: *Croconema cinctum* Cobb, 1920. Brood protection is known for some species (Ott 1976, Gourbault & Vincx 1990).

*Croconema* is assumed as a subgenus of *Desmodora* (see Gerlach & Riemann 1973) and reconsidered as a genus by Verschelde et al. (1998).

**Genus *Desmodora* de Man, 1889 (Fig. 7.100 E, 7.114 A–B)**

(syn.: *Mastodex* Steiner, 1921; *Amphispira* Cobb, 1920)

*Diagnosis* (after Verschelde et al. 1998): Desmodorinae. Cuticular annulation from fine to coarse, without special ornamentation, spines or alae. Cephalic capsule well-developed, smooth, often with small vacuoles in the inner cuticle. Cephalic setae situated anterior to the amphideal fovea or at the level of the anterior ridge of the fovea. Amphideal fovea cryptospiral to spiral in one-two turns, seldom loop-shaped. Subcephalic setae, if present, few in number and situated posterior to the fovea. Short somatic setae in six or eight longitudinal rows. Pharynx with terminal rounded bulb. Tail short conical to long conico-cylindrical. Preloacal pore-like supplements may be present.

Number of species: 49

Type species: *Desmodora communis* (Bütschli, 1874). Revised by Verschelde et al. (1998)

**Genus *Desmodorella* Cobb, 1933 (Fig. 7.100 F)**

*Diagnosis* (after Verschelde et al. 1998): Desmodorinae. Body cuticular annules ornamented with longitudinal rows of ridges or spines. Lateral alae absent. Head capsule blunt or rounded. Amphideal fovea large and multispiral, located on the head capsule. Cephalic setae anterior to or at the level of the anterior edge of the amphideal fovea. Pharynx with rounded or only slightly prolonged terminal bulb.

Number of species: 12.

Type species: *Desmodorella cephalata* Cobb, 1933.

*Desmodorella* was reduced to a subgenus of *Desmodora* by Wieser (1954: 40) and reconsidered as a genus by Verschelde et al. (1998).

**Genus *Echinodesmodora* Blome, 1982 (Fig. 7.100 G)**

*Diagnosis* (after Blome 1982, Decraemer & Smol 2006): Desmodorinae. Cuticle with annulation surrounding the cryptospiral amphideal fovea. Body with stout spine-like somatic setae with, in between, numerous irregularly arranged hair-like setae. No cephalic helmet. Buccal cavity with a small dorsal tooth and two minute ventrosublateral teeth. Preloacal supplements tubiliform.

Number of species: 3

Type species: *Echinodesmodora axi* Blome, 1982

**Genus *Metadesmodora* Schuurmans Stekhoven, 1942 (Fig. 7.100 H)**

*Diagnosis* (after Decraemer & Smol 2006): Desmodorinae. Body cuticular annulation beginning posterior to amphideal fovea. No cephalic helmet. Amphideal fovea located on a cuticularized plate.

Number of species: 2

Type genus: *Metadesmodora amphidiscata* Schuurmans Stekhoven, 1942

**Genus *Paradesmodora* Schuurmans Stekhoven, 1950 (Fig. 7.100 I)**

*Diagnosis* (after Decraemer & Smol 2006): Desmodorinae. Amphideal fovea partially surrounded by striated body cuticle and not situated on cuticularized plates. No cephalic helmet.

Number of species: 7

Type species: *Paradesmodora cephalata* Schuurmans Stekhoven, 1950 (considered species inquirendae by Wieser & Hopper 1967)

**Genus *Parallelocoilas* Boucher, 1975 (Fig. 7.100 J)**

*Diagnosis* (after Boucher, 1975): Desmodorinae. Four subcephalic setae inserted in a common circle with four cephalic setae. Large cylindrical buccal cavity with a dorsal tooth in the middle. Posterior pharyngeal bulb not developed.

Type and only species: *Parallelocoilas dollfusi* Boucher, 1975

**Genus *Psammonema* Verschelde & Vincx, 1995 (Fig. 7.100 K)**

*Diagnosis* (after Verschelde & Vincx 1995): Desmodorinae. Cuticle finely annulated; lateral alae present from anterior third of pharynx length to anal region. Different types of somatic setae in female. Cephalic capsule with well-offset labial region. No subcephalic setae but additional setae may be present. Amphideal fovea open, loop-shaped in male, cryptospiral to closed loop-shaped in female. Buccal cavity with a crown of denticles, a strong dorsal tooth and two small ventrosublateral teeth. Pharynx with tripartite slightly prolonged end bulb. Brood protection may be present in female.

Type and only species: *Psammonema ovisetosum* Verschelde & Vincx, 1995

**Genus *Pseudochromadora* Daday, 1899 (Fig. 7.100 L)**

(= *Micromicron* Cobb, 1920, = *Bradylaimoides* Timm, 1961)

*Diagnosis* (after Verschelde et al. 1998, Verschelde et al. 2006): Desmodorinae. Cuticle with lateral alae extending from posterior to the cardia to the tail. Cephalic capsule present. Cephalic setae anterior to or at the level of the anterior edge of the amphids. Amphids located centrally on the cephalic capsule. No subcephalic setae. Buccal cavity without denticles. Pharynx with rounded or only slightly prolonged terminal bulb.

Number species: 7

Type species: *Pseudochromadora quadripapillata* Daday, 1899. Six marine and one freshwater species

**Genus *Pseudodesmodora* Boucher, 1975 (Fig. 7.101 A)**

*Diagnosis* (after Boucher 1975, Decraemer & Smol 2006): Desmodorinae. Cephalic helmet present. Amphideal fovea spiral in 1.25 turns, located on a large cuticularized plate extending to or into anterior-most annules of the body cuticle. Subcephalic setae present at the base of helmet. Buccal cavity with a large dorsal tooth and a single ventrosublateral tooth. Males unknown.

Number of species: 3

Type species: *Pseudodesmodora amphidiscata* Boucher, 1975

**Genus *Sibayinema* Swart & Heyns, 1991 (Fig. 7.101 B)**

*Diagnosis* (after Swart & Heyns 1991, Verschelde et al. 2006): Desmodorinae. Cuticle coarsely annulated, with longitudinal rows of brush-like ornamentations in adults. Prominent lateral cuticular alae present. Cephalic capsule not annulated. Cephalic setae at level of anterior margin of the amphideal fovea. Cuticular lining of the basal pharyngeal bulb strongly sclerotized and divided into two parts. Tail tip perforated, not annulated.

Type and only species: *Sibayinema natalensis* Swart & Heyns, 1991, freshwater

**Genus *Stygodesmodora* Blome, 1982 (Fig. 7.101 C)**

*Diagnosis* (after Blome 1982, Decraemer & Smol 2006): Desmodorinae. Head relatively short and not off-set. Cuticle with wide annules surrounding the spiral amphideal fovea, which is located on a basal plate. No cephalic helmet. Buccal cavity with large dorsal tooth and a small ventrosublateral tooth. Precloacal supplements setiform papillae.

Number of species: 2

Type species: *Stygodesmodora epixantha* Blome, 1982

**Genus *Zalonema* Cobb 1920 (Fig. 7.101 D)**

(= *Heterodesmodora* Micoletzky, 1924)

*Diagnosis* (after Verschelde & Vincx 1996, Verschelde et al. 1998): Desmodorinae. Cuticular annulation fine, without ornamentation. Cephalic capsule rounded triangular. Subcephalic setae present. Amphideal fovea coiled in two or more turns.

Number of species: 5

Type species: *Zalonema nudum* Cobb, 1920

**7.13.1.1.2 Subfamily Spiriniinae Chitwood, 1936**

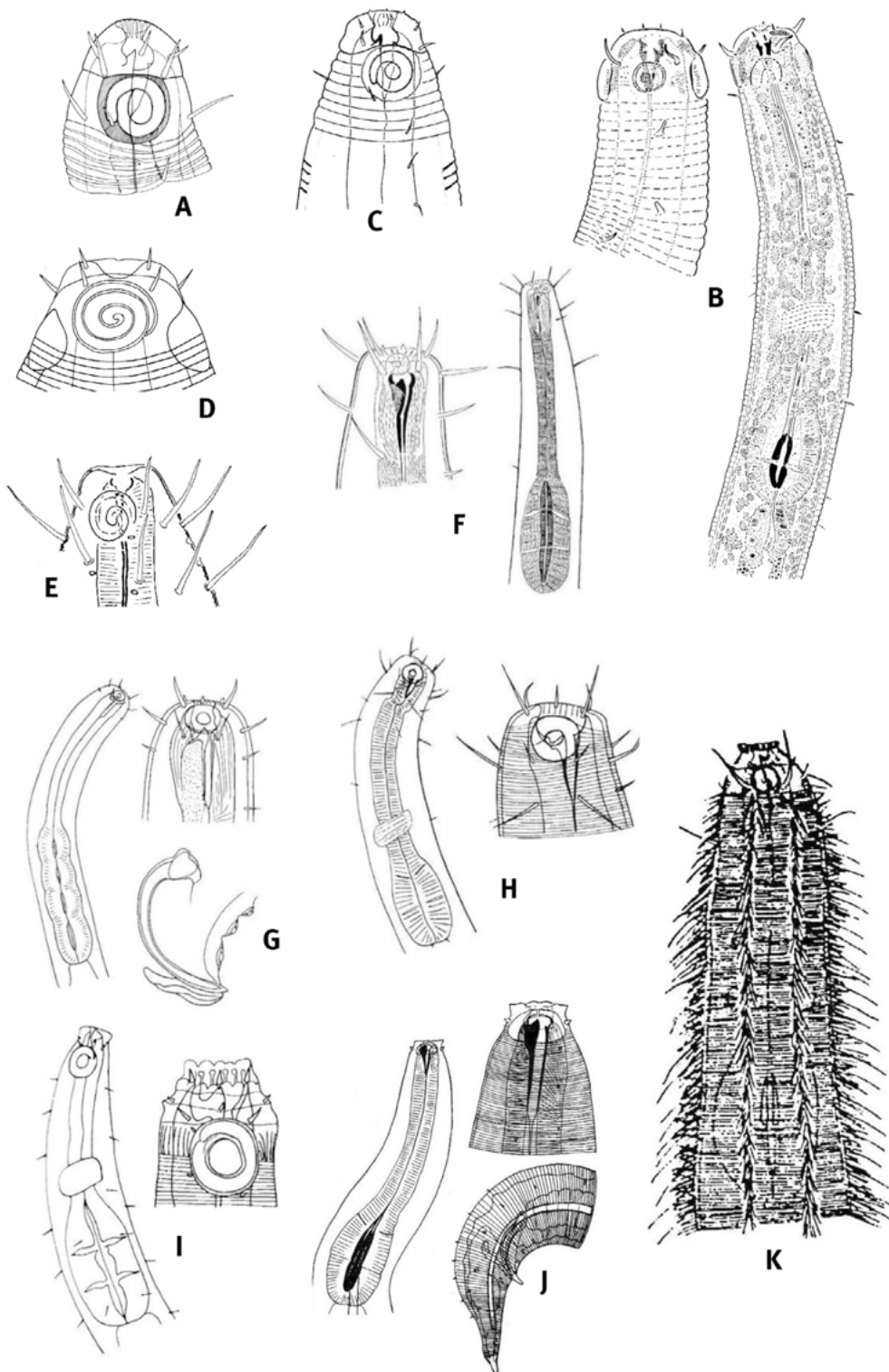
(syn. Metachromadorinae Chitwood, 1936)

*Diagnosis* (after Wieser & Hopper 1967, Decraemer & Smol 2006): Desmodoridae. Body cuticle finely striated (sometimes the striation is faint and the cuticle seems smooth). Head cuticle not thickened, not modified and not demarcated as a cephalic capsule. Amphideal fovea a simple spiral, usually located close to the apex and surrounded with cuticular striation. Buccal cavity rather tight, typically with a distinct or minute dorsal tooth; two smaller ventrosublateral teeth may be present or absent. Posterior pharyngeal bulb usually present, either round or oval.

Type genus: *Spirinia* Gerlach, 1963

The genus *Metachromadora* Filipjev, 1918 consists of subgenera proposed by Gerlach (1951) and supported by Wieser & Hopper (1967): *Bradylaimus* Stekhoven, 1931, *Chromadoropsis* Filipjev, 1918, *Metachromadora* Filipjev,





**Fig. 7.101:** Desmodorinae (continuation) and Spiriniinae, examples of genera. A, *Pseudodesmodora amphidiscara* (from Boucher 1975, Fig. 8C); B, *Sibayinema natalensis* (from Swart & Heyns 1991, Fig. 1); C, *Stygodesmodora epixantha* (from Blome 1982, Abb. 22A); D, *Zalonema megalosoma* (from Gerlach 1963); E, *Alaimonema multicinctum* (adapted from Cobb 1920, Fig. 107); F, *Bradylaimus onyxoides* (from Hopper 1961, Figs. 24, 25); G, *Chromadoropsis quadribulba* (from Gerlach 1956a, Fig. 3); H, *Chromaspirina pontica* Filipjev, 1918 (after Gerlach 1951, Abb. 4 A–E); I, *Metachromadora chandleri* (from Gerlach 1955, Abb. 11); J, *Metachromadoroides remanei* (from Gerlach 1951, Abb. 1); K, *Metonyx horrida* (from Chitwood 1936, Fig. 1Z).

1918, *Metachromadoroides* Timm, 1961, *Metonyx* Chitwood, 1936 and *Neonyx* Cobb, 1933. The subgenera differ from one another in the presence/absence of cuticular hairs on the body, presence/absence of cuticular alae, variations in amphideal fovea and cuticular differentiations in the head region and shape of preloacal supplementary organs in males. However, Timm (1961) interpreted the genus *Metachromadora* in the strict sense and noted that the subgenera of *Metachromadora* sensu lato are diverse enough to be regarded as distinct genera. Furstenberg & Vincx (1988) pointed out the genus *Metachromadora* s. l. as heterogeneous and poorly defined and restored the generic status of *Chromadoropsis*. As, first, a concept of subgenus is not widely adopted in marine nematode taxonomy, and second, the subgenera of *Metachromadora* do not differ to a lesser degree from one another than true genera of Spiriniinae, these subgenera are treated here as separate genera.

**Genus *Alaimonema* Cobb, 1920 (Fig. 7.101 E)**

*Diagnosis:* Spiriniinae. Cuticle finely striated. In addition to four cephalic setae, three sets of four subcephalic setae are present. Cervical setae scattered. There are cuticular pores arranged in two paralateral rows on each side along the body. Amphideal fovea spiral in 2 turns, surrounded with striated cuticle. Three very small teeth in the buccal cavity. Pharyngeal terminal bulb pyriform, with a spheroidal, simple valve. Elevated "campanulate" supplementary organs present.

Type and only species: *A. multicinctum* Cobb, 1920

Formerly, *Alaimonema* was referred to Diplopeltidae (Araeolaimida) (Gerlach & Riemann 1973), but Lorenzen (1981) adduced proofs for the genus belonging to Spiriniinae.

**Genus *Bradylaimus* Stekhoven, 1931 (Fig. 7.101 F)**

*Diagnosis* (combined from Gerlach 1951; Wieser & Hopper 1967): Spiriniinae. No lateral differentiation of the body cuticle. Amphideal fovea not strongly cuticularized. Dorsal tooth in buccal cavity well-developed. Posterior pharyngeal bulb well developed with a thick internal cuticular lining often partitioned into two or three sections. Preanal supplementary papillae indistinct; thin midventral preanal intracuticular ducts may be present.

Number of species: 11

Type species: *Bradylaimus parvus* Stekhoven, 1931 (considered by De Coninck & Stekhoven 1933)

**Genus *Chromadoropsis* Filipjev, 1918 (Fig. 7.101 G, 7.114 C–D)**

*Diagnosis* (combined from Gerlach 1951, Wieser & Hopper 1967, Furstenberg & Vincx 1988): Spiriniinae. Cuticle faintly striated. Buccal cavity with prominent dorsal tooth,

ventrosublateral teeth not evident. Pharynx with buccal bulb and elongated posterior bulb with thickened internal cuticular lining divided into two or four parts. Preanal supplements conical (evident when body curved ventrally), with apical pore and pullout sucker-like element. Inner cuticular lining of the bulb sectioned.

Number of species: 4

Type species *Chromadoropsis vivipara* (de Man, 1907) (four species)

**Genus *Chromaspirina* Filipjev, 1918 (Fig. 7.101 H)**

*Diagnosis* (after Platt & Warwick 1988, Muthumbi et al. 1995): Spiriniinae. Cuticle faintly annulated. Six outer labial sensilla setiform. Amphideal fovea spiral with circular outline, surrounded by the cuticular annulation. Buccal cavity with a large well-developed dorsal tooth and two small subventral teeth. Pharynx with weakly developed posterior bulb only slightly swollen; internal cuticular lining of the posterior bulb not thickened. Tubular preloacal supplementary organs may be present.

Number of species: 27

Type species: *Chromaspirina pontica* Filipjev, 1918

**Genus *Metachromadora* Filipjev, 1918 (Fig. 7.101 I)**

(syn. *Ichthyodesmodora* Chitwood, 1951)

*Diagnosis* (modified after Gerlach 1951, Wieser & Hopper 1967, Platt & Warwick 1988): Spiriniinae. Head cuticle longitudinally striated. Cephalic setae short and may be reduced to papillae. Amphideal fovea strongly cuticularized. Distinct dorsal tooth in buccal cavity. Posterior pharyngeal bulb well-developed with a thick internal cuticular lining often partitioned into two or three sections.

Number of species: 9

Type species: *Metachromadora macroutera* Filipjev, 1918

**Genus *Metachromadoroides* Timm, 1961 (Fig. 7.101 J)**

*Diagnosis:* Spiriniinae. Cuticle with lateral wings. Cephalic sensilla short and stout or indistinct. Amphideal fovea on cuticular thickening. Posterior pharyngeal bulb well-developed with a thick internal cuticular lining often partitioned into two or three sections.

Number of species: 5

Type species: *Metachromadoroides vulgaris* (Timm, 1961)

**Genus *Metonyx* Chitwood, 1936 (Fig. 7.101 K)**

*Diagnosis* (combined from Gerlach 1951, Wieser & Hopper 1967): Spiriniinae. Somatic setae arranged densely in ten rows throughout the body. Posterior pharyngeal bulb well-developed with a thick internal cuticular lining partitioned into two or three sections.

Type and only species: *Metonyx horrida* Chitwood, 1936

**Genus *Neonyx* Cobb, 1933 (Fig. 7.102 A)**

*Diagnosis* (combined from Gerlach 1951, Wieser & Hopper 1967): Spiriniinae. Body cuticle laterally differentiated into wings. Posterior pharyngeal bulb well-developed with a thick internal cuticular lining, often partitioned into two or three sections.

Number of species: 7

Type species: *Neonyx cancellatus* Cobb, 1933

**Genus *Onyx* Cobb, 1891 (Fig. 7.102 B)**

(syn. *Oistolaimus* Ditlevsen, 1921)

*Diagnosis* (after Platt & Warwick 1988): Spiriniinae. Amphids not surrounded by cuticle striations. Buccal cavity with a long spear-like dorsal tooth. Posterior pharyngeal bulb without thickened cuticular lining. Pre-cloacal supplementary organs as cuticularized S-shaped tubes.

Number of species: 15

Type genus *Onyx perfectus* Cobb, 1891

**Genus *Papillonema* Verschelde, Muthumbi & Vincx, 1995 (Fig. 7.102 C)**

*Diagnosis* (after Verschelde et al. 1995): Spiriniinae. Inner and outer labial sensilla as papillae (not small setae). No cervical setae. Buccal cavity with a large dorsal tooth and two minute subventral teeth, possibly also with a crown of denticles. Pharynx with thick lumen cuticle, consisting of a slender cylindrical corpus and long, broad cylindrical postcorpus or elongate posterior bulb. Males with three or four precloacal supplements; each one consists of a papilliform base into which a protrusible trunk-shaped distal duct is retracted.

Number of species: 2

Type species: *Papillonema danieli* Verschelde, Muthumbi & Vincx, 1995

**Genus *Perspira* Wieser & Hopper 1967, (Fig. 7.102 D)**

*Diagnosis* (modified after Wieser & Hopper 1967, Vincx & Goubault 1989): Spiriniinae. Cuticle faintly striated on the body and prominently striated on the tail. Three minute teeth in buccal cavity or no teeth discernible. Terminal bulb of the pharynx round to pyriform. Male supplementary organs small pore-like, tubiform or lacking. Tail filiform.

Number of species: 6

Type species: *Perspira striaticaudata* (Timm, 1962)

**Genus *Polysigma* Cobb, 1920 (Fig. 7.102 E)**

*Diagnosis* (after Platt & Warwick 1988): Spiriniinae. Amphids not surrounded by striations. Buccal cavity with a dorsal S-shaped tooth. Posterior pharyngeal bulb

elongate, with or without a thickened lining. Spicules short. Precloacal supplementary organs as cuticularized S-shaped tubes arranged parallel to the longitudinal body axis just beneath the cuticle.

Number of species: 2

Type species: *Polysigma uniforme* (Cobb, 1920)

**Genus *Pseudometachromadora* Timm, 1952 (Fig. 7.102 F)**

*Diagnosis* (after Wieser 1954): Spiriniinae. Cuticle indistinctly striated or seemingly smooth. Buccal cavity wide, cylindrical, with large dorsal tooth. Pharynx only weakly dilated posteriorly, and its internal cuticular lining not modified posteriorly.

Number of species: 2

Type species *Pseudometachromadora longilaima* (Stekhoven, 1950)

**Genus *Sigmophoranema* Hope & Murphy, 1972 (Fig. 7.102 G)**

*Diagnosis* (after Platt & Warwick 1988): Spiriniinae. Eight subcephalic setae. Amphids not surrounded by striations. Buccal cavity with a dorsal S-shaped tooth and numerous denticles. Posterior pharyngeal bulb elongate, with or without a thickened lining. Spicules elongated. Precloacal supplementary organs as cuticularized S-shaped tubes arranged parallel to the longitudinal body axis just beneath the cuticle.

Number of species: 4

Type species: *Sigmophoranema rufum* (Cobb, 1933)

**Genus *Spirinia* Gerlach, 1963 (Fig. 7.102 H)**

(syn. *Spira* Bastian, 1865; *Spirina* Filipjev, 1918 (homonyms))

*Diagnosis* (modified after Wieser & Hopper 1967, Vincx & Goubault 1989): Spiriniinae. Cuticle finely striated. Somatic setae arranged in eight longitudinal rows. Amphideal fovea at the level of cephalic setae and surrounded with cuticular striation. Buccal cavity very small, with a minute dorsal tooth or no teeth present. Terminal bulb of the pharynx short and round, its internal cuticular lining not thickened. Male supplementary organs indistinct. Tail conical.

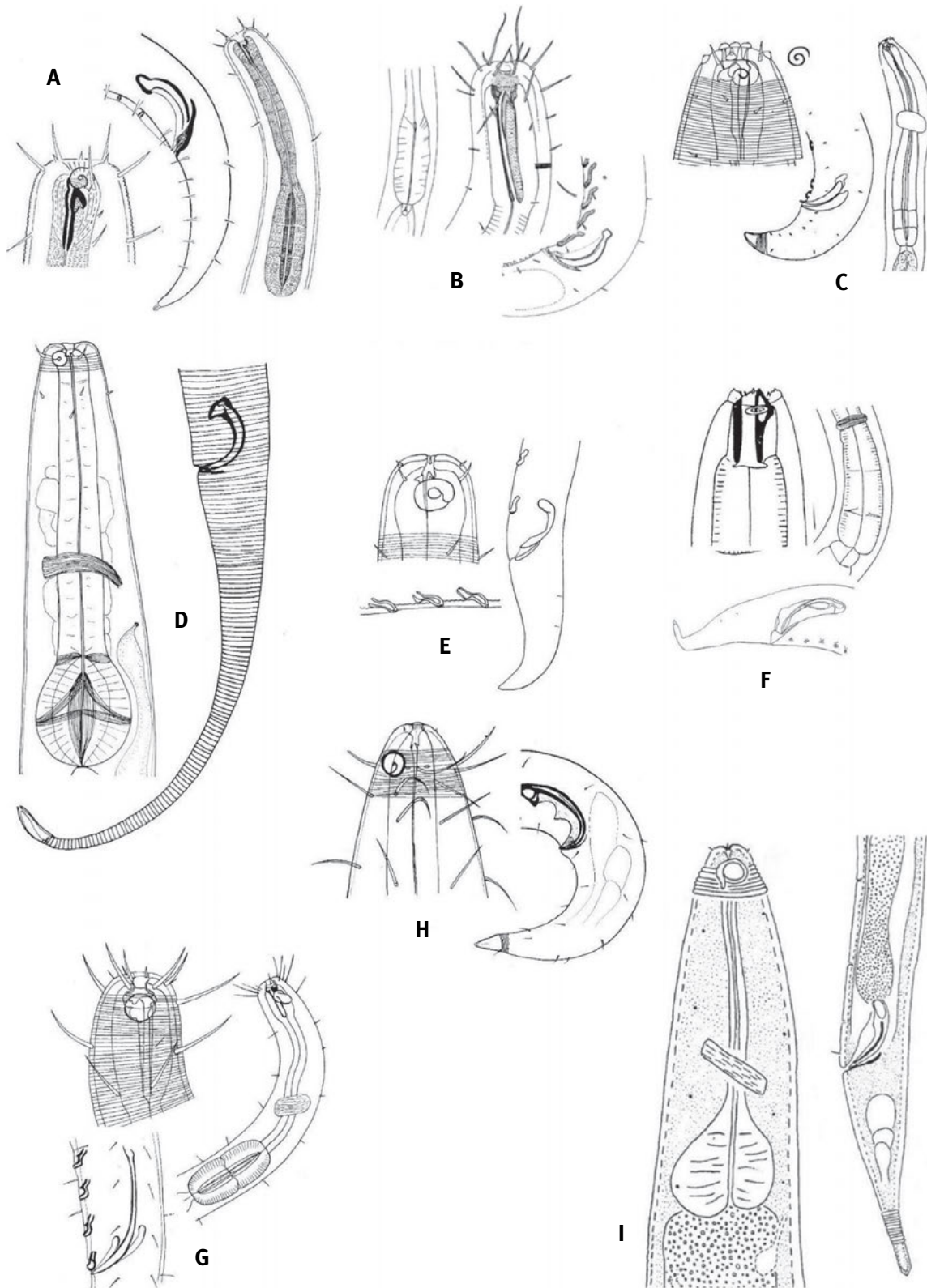
Number of species: 12

Type species: *Spirinia parasitifera* (Bastian, 1865)

**Genus *Spirodesma* da Fonseca Cavalcanti, da Silva & da Fonsêca-Genevois, 2009 (Fig. 7.102 I)**

*Diagnosis* (after da Fonseca Cavalcanti et al., 2009): Spiriniinae. Body tapering at extremities. Body cuticle with strong transverse annulations. Amphideal fovea unispiral. Buccal cavity with three equally small teeth. Pharynx





**Fig. 7.102:** Spiriniinae (continuation). A, *Neonyx pseudocampycoma* (from Hopper 1961, Figs. 19,20); B, *Onyx perfectus* (from Riemann 1966, Abb. 38); C, *Papillonema clavatum* (from Gerlach 1957, Abb. 6 I, G); D, *Perspira hamata* (from Wieser & Hopper 1967, Fig. 36 A, B); E, *Polysigma fuscum* (from Gerlach 1956b, Taf. 30, Figs. E, F, H); F, *Pseudometachromadora papillata* (from Stekhoven 1950, Fig. 76 B–D); G, *Sigmophoranema monstrosum* (from Gerlach 1956c, Fig. 4); H, *Spirinia laevis* (from Wieser 1959, Fig. 46); I, *Spirodesma magdae* (from Da Fonseca Cavalcanti et al. 2009, Figs. 2, 3).



with spherical terminal bulb, its internal cuticular lining not thickened. Three small tubular preloacal supplements. Tail conico-cylindrical.

Type and only species: *Spirodesma magdae* da Fonseca Cavalcanti, da Silva & da Fonsêca-Genevois, 2009

### 7.13.1.1.3 Subfamily Stilbonematinae Chitwood, 1936

*Diagnosis* (after Tchesunov 2013): Desmodoridae. Body very long, up to 10 mm, filiform, often with somewhat club-like inflated anterior body and head. Cuticle uniformly annulated throughout the body and devoid of lateral differentiation, spines or any other sculptures, etc. Mouth opening minute, buccal cavity small if present and unarmed. Pharynx very short in relation to the body length, slender and differentiated in three regions, anterior procorpus, intermediate slender isthmus and small posterior bulb.

Number of genera: 9

The stilbonematines are known primarily because of their remarkable association with ectosymbiotic bacteria. These sluggish nematodes may be especially numerous in carbonate sands of tropical shallows and can be quickly identified even at low magnification of a binocular microscope owing to a very long and thread-like body with somewhat swollen anterior end and bright snow-white appearance in reflected light. An unusual feature of many stilbonematines is multicellular sensory-glandular organs arranged in rows along the body. Obviously, these organs participate in maintaining association with bacteria (Nussbaumer et al. 2004, Bulgheresi et al. 2006). The symbiotic prokaryotes are inserted in the slime film issued over the body cuticle by the sensory-glandular organs. The symbionts look different in different genera; often the bacteria are large-sized and densely cover the entire nematode body except the mouth region and tail tip: they may cause the nematode appearance to be very odd. These symbionts are chemolithoautotroph organisms that build up organic compounds using the energy of chemical bonds that is released upon the oxidizing of sulfides (Ott & Novak 1989, Ott et al. 1991). Possibly, the stilbonematines live at the expense of primary production of bacterial chemosynthesis, like pogonophorans, vestimentiferans and vesicomyid bivalves. Usually, the stilbonematines live in sheltered intertidal and subtidal sediments where they are concentrated at the interface between the surface oxidized layer and the deeper anoxic sediment zone, as the stilbonematines need both oxygen for their respiration

and reduced compounds for chemosynthesis of their symbionts.

#### **Genus *Adelphos* Ott, 1997 (Fig. 7.103 A)**

*Diagnosis* (modified after Ott 1997): Stilbonematinae. Cuticle finely annulated. Head cuticle thickened but annulated. Amphideal fovea large, coiled in 1.5 turns, lateral but close to the apex, and surrounded with annulation. Anterior part of the pharynx swollen but not sharply differentiated from the median narrow region; round terminal bulb present. Gubernaculum with weak curved dorsocaudal apophysis. Males with one row of midventral thorn-like setae posterior to the neck region and paired rows of thorn-like setae on the tail. Body covered with long crescent symbiotic bacteria arranged in a spiral pattern.

Type species: *A. rolandi* Ott, 1997. Monospecific

#### **Genus *Catanema* Cobb, 1920 (Fig. 7.103 B)**

*Diagnosis* (after Tchesunov 2013): Stilbonematinae. Cuticle very finely annulated. Cephalic cuticle not thickened. Amphids apical, small, pore-like, difficult to see, with possible protruded sausage-like corpus gelatum. Minute onchia-like structures in the small stoma may be present. Anterior region of the pharynx swollen and distinctly separated from the narrow median region. Gubernaculum with dorso-caudal apophysis. In male, a series of enlarged midventral glands associated with tiny setae from the cardia to the anterior mdgut; several pairs of subventral tubular setae on the tail.

Number of species: 2

Type species: *Catanema exile* Cobb, 1920

#### **Genus *Eubostrichus* Greeff, 1869 (Fig. 7.103 C)**

*Diagnosis* (after Tchesunov 2013): Stilbonematinae. Cuticle with faint or sometimes indiscernible transverse striations. Head cuticle not thickened and not modified, striations of the cuticle start from the apex. Amphideal fovea large, spirally coiled, situated laterally; often it is obscure because its cuticular margin is not clear. Buccal cavity not developed as such. Anterior region of the pharynx slightly widened and not separated sharply from the narrow median region; small posterior bulb. Gubernaculum without a dorso-caudal apophysis. In males, strong and stout subventral setae (porids) occur on the tail. Body covered with long crescent symbiotic bacteria, often arranged in a spiral pattern.

Number of valid species: 6

Type species: *Eubostrichus filiformis* Greeff, 1869 (species inquirenda)

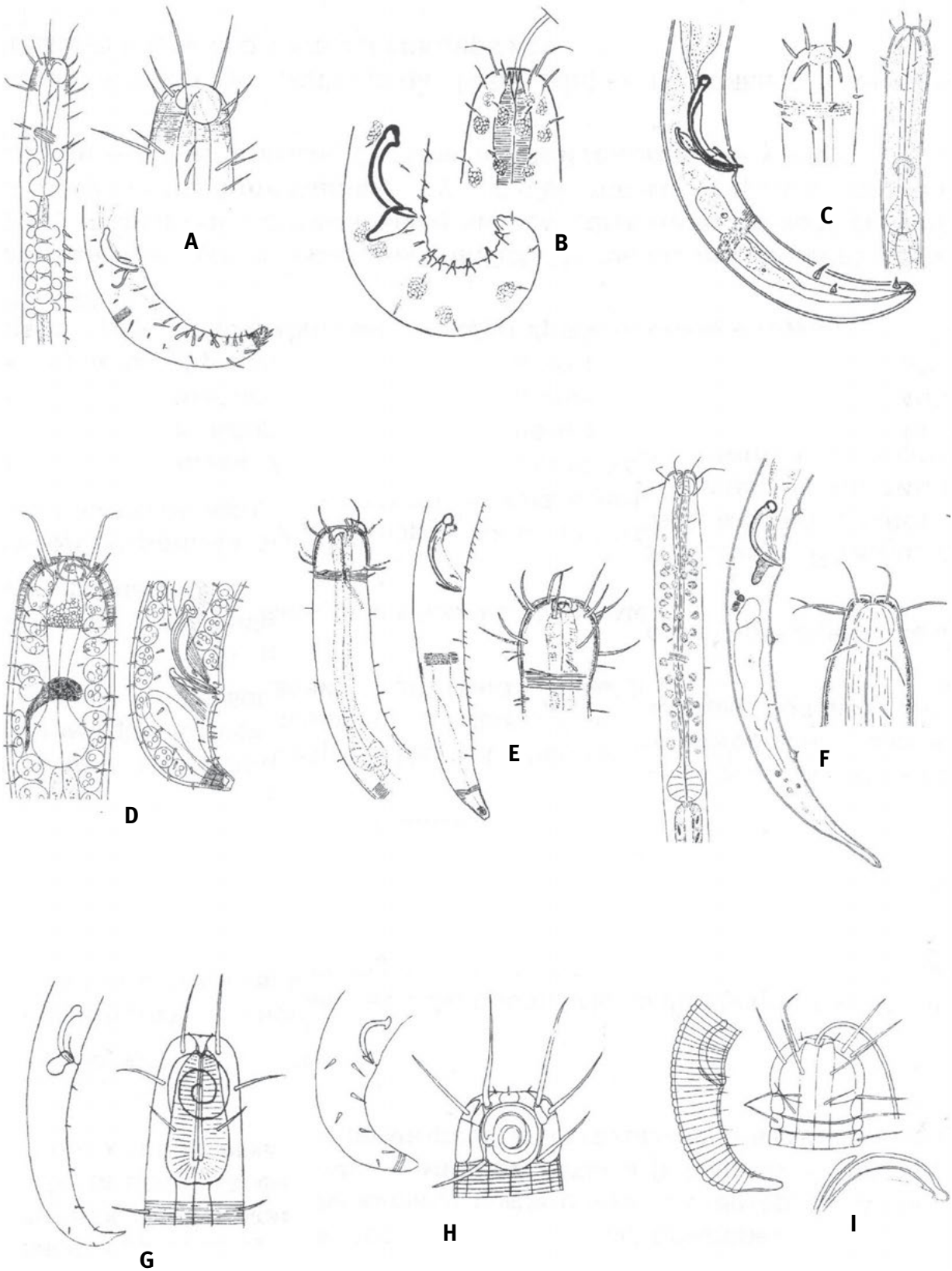


Fig. 7.103: Stilbonematinae, caricatures of genera. A, *Adelphos*; B, *Catanema*; C, *Eubostrichus*; D, *Laxus*; E, *Leptonemella*; F, *Parabostrichus*; G, *Robbea*; H, *Squanema*; I, *Stilbonema* (all from Tchesunov 2013, Fig. 1).

**Genus *Laxus* Cobb, 1894 (Fig. 7.103 D)**

*Diagnosis* (after Tchesunov, 2013): Stilbonematinae. Cuticle with fine transverse striae. Cephalic cuticle thickened; its surface irregularly annulated, reticulated, or sculptured in a fingerprint pattern. Amphideal fovea small, coiled in about 1.5 turns, situated close to the apex. Anterior region of the pharynx slightly swollen and not sharply separated from the narrow median region. Gubernaculum directed dorsally, no dorso-caudal apophysis. Tail short, conical, mostly 1.4–2 anal diameters long. Symbiotic bacteria coccoid.

Number of species: 6

Type species: *Laxus longus* Cobb, 1894

**Genus *Leptonemella* Cobb, 1920 (Fig. 7.103 E)**

*Diagnosis* (after Tchesunov 2013): Stilbonematinae. Cuticle with fine but distinct annulation. Cephalic capsule convex, smooth or punctuated, separated by a slight constriction from the annulated body cuticle. Amphideal fovea apicolateral, small, spirally coiled in 1.5 turns, loop-shaped or formed as a shepherd's crook; sausage-like corpus gelatum may be protruded. Buccal cavity not developed. Pharynx very slightly swollen anteriorly. Gubernaculum without dorso-caudal apophysis. Males of some species equipped with stout postcervical, preanal and postanal subventral setae. Tail elongate-conical, c' 3-5. Symbiotic bacteria coccoid to short-stick-shaped.

Number of species: 7

Type species: *Leptonemella cincta* Cobb, 1920

**Genus *Parabostrichus* Tchesunov, Ingels & Popova, 2012 (Fig. 7.103 F, 7.114 E–F)**

*Diagnosis* (after Tchesunov et al. 2012): Stilbonematinae. Cuticle with very faint or sometimes even indiscernible striations. Head cuticle not thickened and not modified, annulations of the cuticle start from the apex. Amphideal fovea situated laterally, large, spirally coiled, but obscure because its cuticular margin smoothed. Buccal cavity not developed as such. Anterior region of the pharynx slightly widened and not separated sharply from the narrow median region; small posterior bulb. Gubernaculum with a dorso-caudal apophysis. In males, short subventral setae on papilloid projections on the tail. Body covered with long crescent symbiotic bacteria, often arranged in a spiral pattern.

Type species: *Parabostrichus bathyalis* Tchesunov, Ingels et Popova, 2012. Monospecific.

**Genus *Robbea* Gerlach, 1956 (Fig. 7.103 G)**

*Diagnosis* (after Tchesunov 2013): Stilbonematinae. Cuticle finely striated. Cephalic capsule annulated or smooth, not

clearly separated for the most part. Four cephalic setae much longer than subcephalic ones and usually directed straight forward, Amphideal fovea large, spirally coiled in 1.5–2.5 turns, situated laterally posterior to the apex. Tiny unarmed cylindro-conical stoma with sclerotized walls. Pharynx tripartite, with anterior swollen muscular region clearly separated from the long slim median region, and small posterior swelling. Gubernaculum with dorso-caudal apophyses. Cervical prominent, cup-shaped supplementary organs may be present (in *R. tenax*). Cuticle often covered by coccoid symbionts inserted in supracuticular slimy pellicle.

Number of species: 7

Type species: *Robbea caelestis* Gerlach, 1956

**Genus *Squanema* Gerlach, 1963 (Fig. 7.103 H)**

*Diagnosis* (after Tchesunov 2013): Stilbonematinae. Body cuticle fine annulated. Cephalic cuticle is smooth and consists of plates. Amphideal fovea large, lateral, spirally coiled in 2 turns. Pharynx very slightly swollen anteriorly, with terminal bulb. Gubernaculum without dorso-caudal apophysis. Body covered with long crescent symbiotic bacteria.

Type species: *Squanema articulatum* Gerlach, 1963. Monospecific

**Genus *Stilbonema* Cobb, 1920 (Fig. 7.103 I)**

(= *Laxonema* Cobb 1920, opinion of Ott 1997)

*Diagnosis* (after Tchesunov 2013): Stilbonematinae. Cuticle thick, distinctly annulated, annules broad. Cephalic capsule bulging, with smooth or punctuated cuticle, separated by a constriction from the body cuticle. Amphideal fovea in apical position as a short, weakly sclerotized cylinder, often with long vermiform corpus gelatum protruding from the anterior outlet of the short cylinder. Buccal cavity not developed. Anterior muscular region of the pharynx not sharply separated from the median region. Gubernaculum without dorso-caudal apophysis. Cervical cup-shaped supplementary organs may be present. Symbiotic bacteria not mentioned.

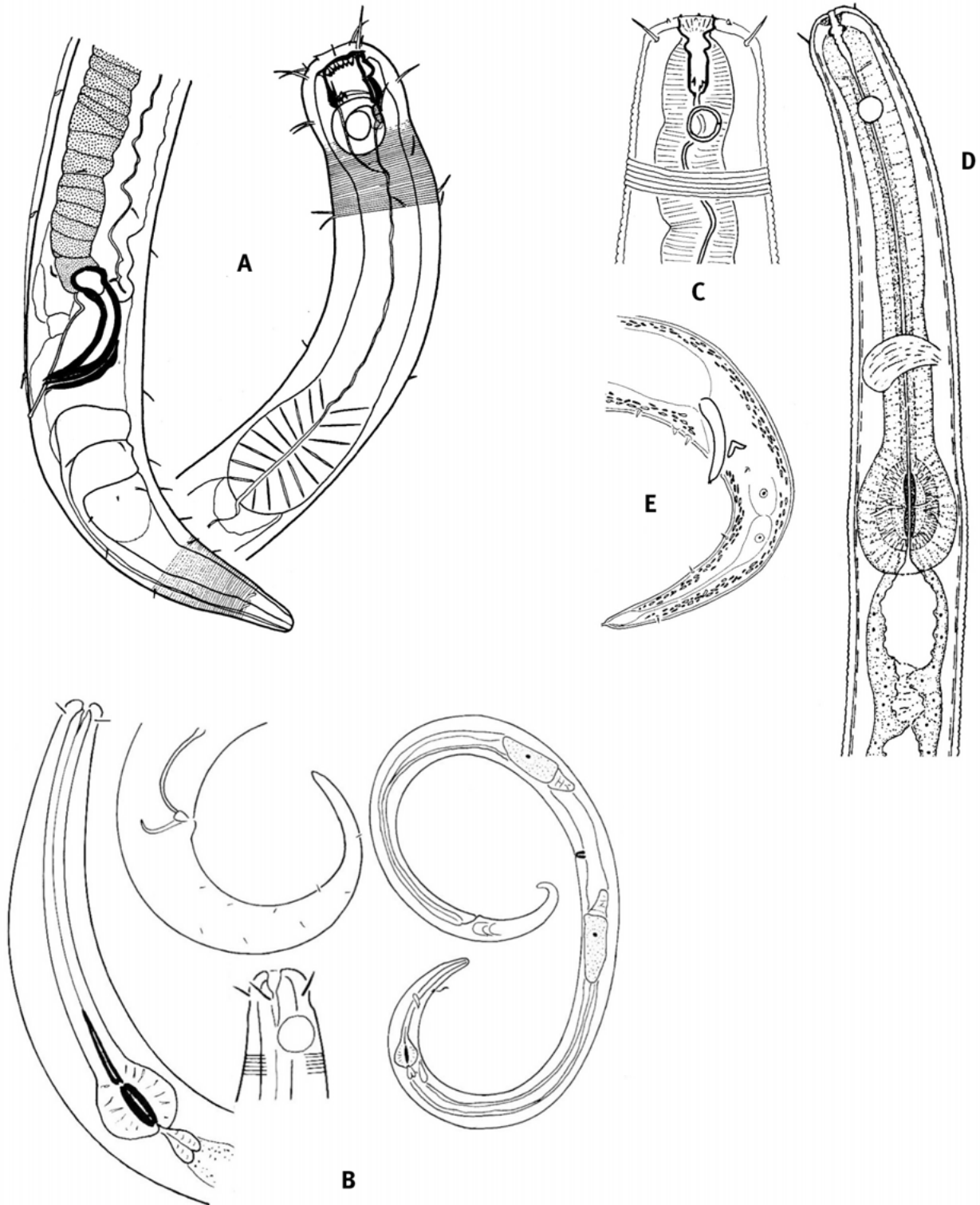
Number of species: 3

Type species: *Stilbonema brevicolle* Cobb, 1920

**7.13.1.1.4 Subfamily Pseudonchinae Gerlach & Riemann, 1973 (Fig. 7.104 A)**

*Diagnosis* (after Decraemer & Smol 2006): Desmodoridae. Body cuticle finely striated. Buccal cavity bilateral symmetric, large tubular, subdivided and without ventrosulateral teeth at level of junction; anterior part with rows of





**Fig. 7.104:** Pseudonchinae, Molgolaiminae and Prodesmodorinae, examples. A, *Pseudonchus decempapillatus* (Pseudonchinae, from Ward 1974, Fig. 3); B, *Molgolaimus turgofrons* (Molgolaiminae, from Jernsen 1978, Fig. 7); C, *Prodesmodora circulata*, female head (origin: a lake in Moscow Province, Russia); D, *Prodesmodora nigra*, female anterior body (from Ocana et al. 2001); E, *Prodesmodora circulata*, male tail (from Gagarin 1978).

odontia at the anterior margin. Subcephalic setae present. Amphideal fovea a single loop or round cryptospiral. Preloacal supplements, when present, located at level of thin midventral alae of the body cuticle.

Number of species: 12

Type and only genus: *Pseudonchus* Cobb, 1920; marine

#### 7.13.1.1.5 Subfamily Molgolaiminae Jensen, 1978 (Fig. 7.104 B)

*Diagnosis* (after Lorenzen 1974, Jensen 1978, Fonseca et al. 2006): Desmodoridae. Body length usually  $\leq 1$  mm. Cuticle finely and weakly striated to apparently smooth. Head narrow. Inner and outer labial sensilla very small or reduced, cephalic setae small but distinct. Amphideal fovea round, weakly or distinctly sclerotized, situated at some distance posterior to the cephalic setae, at the neck region. Buccal cavity weakly sclerotized, narrow, with small teeth. Pharynx with a distinct spherical posterior bulb with thickened and strongly sclerotized inner cuticular lining. Cardia elongate. Ventral pore anterior to the nerve ring. Female gonads paired, antidromously reflected. Male gonad singular, anteriorly directed. Spicules various from short and bent to long and slender. Gubernaculum with or without apophysis. Preanal supplementary papillae may be present. Tail with slender cylindrical posterior portion.

Type and only genus: *Molgolaimus* Ditlevsen 1921 ((37 valid species, marine (see recent revision of Fonseca et al. 2006))

The taxon had been initially erected as a family by Jensen (1978) and later included into Desmodoridae as a monotypic subfamily by Lorenzen (1981). Superficially, the molgolaimids may strongly resemble species of Micro-laimidae but differ sharply with antidromously reflected ovaries.

#### 7.13.1.1.6 Subfamily Prodesmodorinae Lorenzen, 1981 (Fig. 7.104 C–E)

*Diagnosis*: Desmodoridae. Body cuticle with distinct faint annulation starting just from the level of cephalic setae. Head slightly set off. Anterior sensilla in three circles, six inner labial papillae, six outer labial papillae and four cephalic setae. Amphideal fovea round or slightly oval, situated posterior to the buccal cavity. Short somatic setae distributed along the body more or less regularly. Buccal cavity; cheilostoma with twelve rugae; pharyngostoma

about elongate conical, with minute teeth, one dorsal and subventral. Pharynx with round muscular bulb. The latter with thickened internal cuticular lining divided into two parts. Ventral gland present, ventral pore posterior to the nerve ring. Monorchic. Spicules short, arcuate. Gubernaculum with a short dorsal apophysis. One or two preanal papillae present. Tail elongate conical, with terminal spinnerete. Female gonads paired, ovaries antidromously reflected. Males are rare. Reproduction predominantly parthenogenetic.

Type and only genus: *Prodesmodora* Micoletzky, 1923; terrestrial and freshwater species

Number of species: 9

Draconematidae and related Epsilonematidae are separated from Desmodoridae because of the uniqueness within the group of their body shape, which is considered a synapomorphy for these two families.

#### 7.13.1.2 Family Draconematidae Filipjev, 1918

(syn. Chaetosomatidae Pagenstecher, 1881; Drepanonematidae Johnston, 1938; Claparediellidae Allgén, 1954)

*Diagnosis* (emended from Lorenzen 1994, Allen & Noffsinger 1978): Desmodoroidea. Body more or less swollen in pharyngeal and midbody regions and narrowed between them. Relaxed specimens usually assume an open “S” body shape. Cuticle distinctly annulated; annules may be ornamented with tiny spines or granulation. Head cuticle devoid of annulations and denoted as rostrum. Amphids loop-shaped to spiral, located lateral to dorso-lateral on the rostrum. Somatic setae numerous. A few anterior subdorsal and laterodorsal setae modified as stiff adhesive setae bent anteriorly (CAT, cephalic adhesive tubes). Setae of lateroventral and subventral rows on the posterior body modified as adhesive stilts (PAT, posterior ambulatory tubes), often with bell-shaped tips. Buccal cavity obscure to moderately well-developed, armed or unarmed. Pharynx either with anterior and posterior swellings separated by constriction or with cylindrical corpus and posterior bulb. Female reproductive system very compact and situated anterior to the posterior adhesive stilts.

Two subfamilies: Draconematinae Filipjev, 1918 and Prochaetosomatinae Allen & Noffsinger, 1978.

Members of the family Draconematidae are easy to identify even at low magnification, particularly in live samples, because of their particular habitus and mode of locomotion. Unlike the majority of nematodes, the

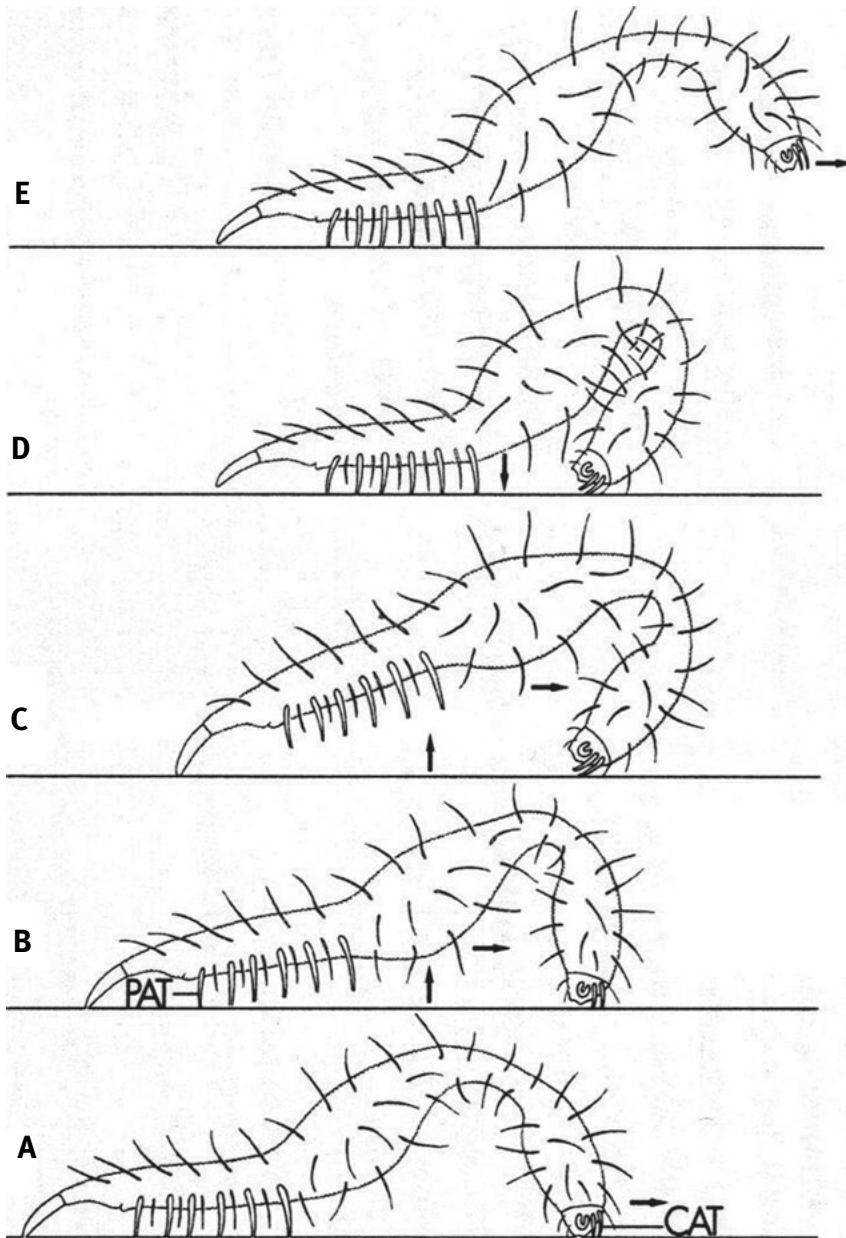


Fig. 7.105: Locomotion of a draconematid nematode (*Dracograllus* sp.) (from Gad 2006, Abb. 3).

draconematids don't glide by way of serpentine coiling, but walk by attaching alternatively with anterior and posterior adhesive setae or anterior and posterior adhesive tubes (Fig. 7.105) as do caterpillars of the geometrid moths. These are actually hollow cuticular tubes with bell-shaped distal ends. The adhesive tubes are connected with internal glands that produce a sticky secretion released at the distal ends. Four to six arched cephalic adhesive tubes are situated on the dorsal side of the head, usually in two transversal rows. Posterior adhesive tubes are longer and stronger and hence more evident. Their glands are bigger and arranged in longitudinal rows on the ventral body between the swollen midbody region and anus.

Those nematodes occur in a large range of milieus, but the highest number of species has been found in association with various kinds of marine algae, especially on red algae, as well as on coarse sands, broken shells and gravel, where rather large interstitial spaces allow such a type of walking locomotion. Larger species can move even on flat surfaces exposed to water current, such as on stones, corals and macroalgae, where other nematodes can barely hold.

#### 7.13.1.2.1 Subfamily Draconematinae Filipjev, 1918

*Diagnosis* (emended from Lorenzen 1994, Allen & Noffsinger 1978): Draconematidae. Body clearly swollen in



pharyngeal and midbody regions with distinct narrowing between them. Pharynx swollen in the middle and posteriorly (dumbbell-shaped). Buccal cavity small and unarmed.

Type genus: *Draconema* Cobb, 1913

**Genus *Draconema* Cobb, 1913 (Fig. 7.106 A)**

(syn. *Chaetosoma* Claparède, 1863, *Drepanonema* Cobb, 1933, *Claparediella* Filipjev, 1934)

*Diagnosis* (from Allen & Noffsinger 1978, Decraemer et al. 1997): Draconematinae. First anterior 7–14 annules of the head cuticle enlarged. Twelve CAT on rostrum in two transverse rows. Amphids on rostrum, usually loop-shaped in male, open spiral or unispiral in female. Two pairs of paravulval setae, one anterior and one posterior to vulva. No postanal PAT.

Number of species: 16

Type species: *Draconema cephalatum* Cobb, 1913

**Genus *Dracograllus* Allen & Noffsinger, 1978 (Fig. 7.106 B, O)**

(syn. *Dracotoranema* Allen & Noffsinger, 1978)

*Diagnosis* (from Allen & Noffsinger 1978, Decraemer et al. 1997): Draconematinae. Anterior-most annules of the head cuticle not enlarged. Usually eight CAT on rostrum. No postcloacal PAT in males, but postanal PAT in females often present.

Number of species: 18

Type species: *Dracograllus cobbi* Allen & Noffsinger, 1978

**Genus *Paradraconema* Allen & Noffsinger, 1978 (Fig. 7.106 C)**

*Diagnosis* (from Allen & Noffsinger 1978, Decraemer et al. 1997): Draconematinae. Anterior-most annules of the head cuticle not enlarged. Body annules may be ornamented by minute spines and subcuticular granulations. Amphids large, loop-shaped to spiral. Eyespots in the rostral region present. All PAT anterior to cloaca or anus. One pair or a single precloacal copulatory thorn usually present.

Number of species: 8

Type species: *Paradraconema floridense* Allen & Noffsinger, 1978

**7.13.1.2.2 Subfamily Prochaetosomatinae Allen & Noffsinger, 1978**

(syn. Cygnonematinae Allen & Noffsinger, 1978; Dracognominae Allen & Noffsinger, 1978; Notochaetosomatinae Allen & Noffsinger, 1978)

*Diagnosis* (emended from Lorenzen 1994, Allen & Noffsinger 1978, Decraemer et al. 1997): Draconematidae. Pharyngeal body region swelling slight or the swelling not developed at all. Pharynx without median narrowing (except for *Dracognomus*). Buccal cavity small to moderately developed, with unclear to conspicuous dorsal tooth.

Type genus: *Prochaetosoma* Micoletzky, 1922

**Genus *Prochaetosoma* Micoletzky, 1922 (Fig. 7.106 D, 7.115 A–B)**

*Diagnosis* (from Allen & Noffsinger 1978, Decraemer et al. 1997): Prochaetosomatinae. Pharyngeal body region slightly or not swollen. Rostrum rounded. Four to 14 CAT located posterior to rostrum. Amphideal fovea loop-shaped to uni- or doubled spiral. PAT all anterior to anus. Pharynx consists of cylindrical corpus and posterior bulb with well thickened walls. Buccal cavity moderately developed, with conspicuous dorsal tooth.

Number of species: 10

Type species: *Prochaetosoma primitiva* (Steiner, 1916) Micoletzky, 1922

**Genus *Apenodraconema* Allen & Noffsinger, 1978 (Fig. 7.106 E)**

*Diagnosis* (from Allen & Noffsinger 1978, Decraemer et al. 1997): Prochaetosomatinae. Pharyngeal body region slightly swollen. Margins of body cuticular annules (annular ridges) with spine-like projections. Eight CAT arranged on two transverse rows posterior to rostrum. PAT all anterior to anus. Amphideal fovea spiral. Pharynx consists of cylindrical corpus and posterior bulb with non-thickened internal cuticle. Buccal cavity weakly developed, dorsal tooth inconspicuous.

Number of species: 2

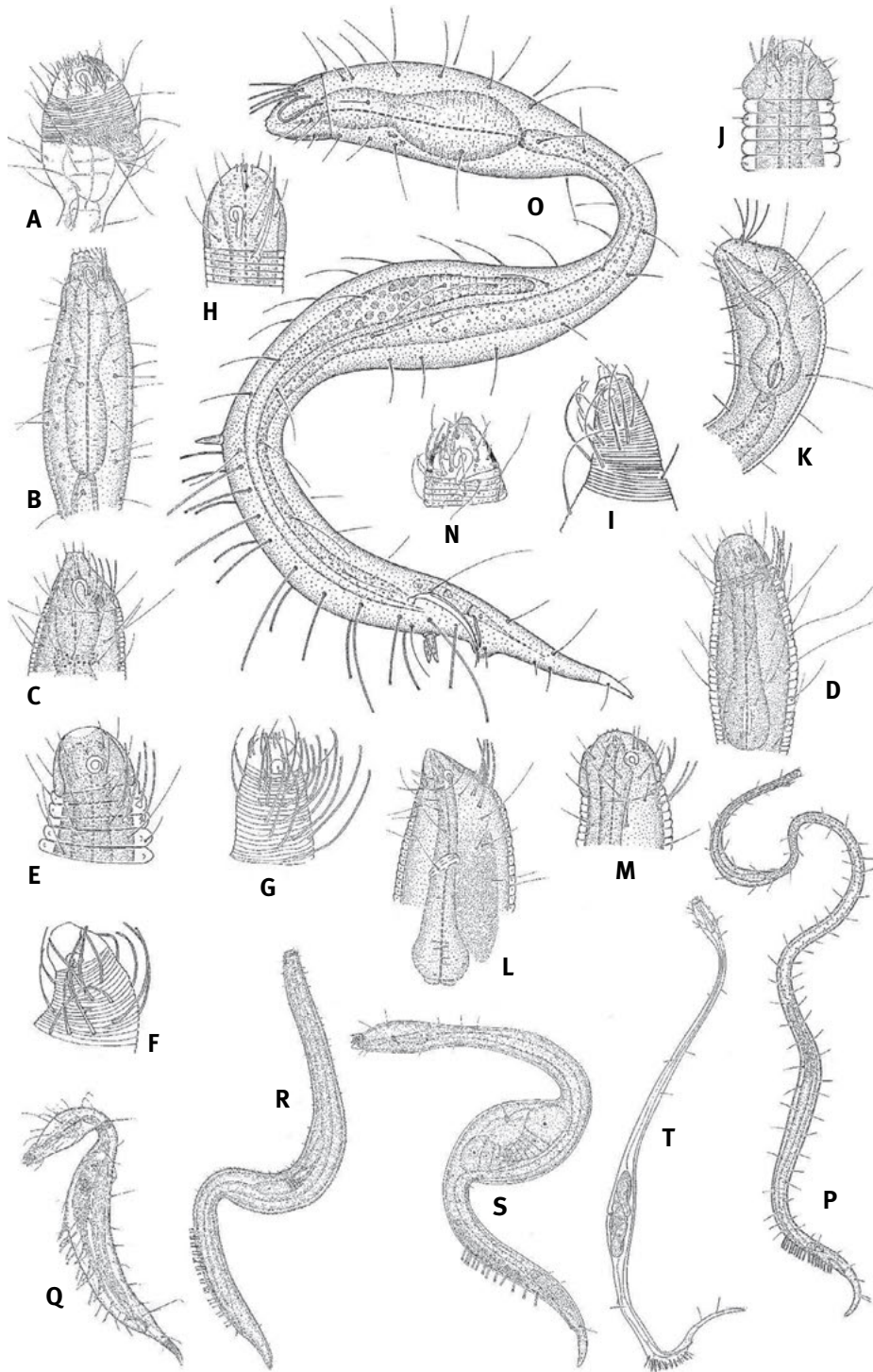
Type species: *Apenodraconema chlidosis* Allen & Noffsinger, 1978

**Genus *Bathychaetosoma* Decraemer, Gourbault & Backeljau, 1997 (Fig. 7.106 F)**

(syn. *Cephalochaetosoma* Kito, 1983, partim)

*Diagnosis* (from Decraemer et al., 1997): Prochaetosomatinae. Pharyngeal body region slightly swollen. Body cuticle annules with minute spines. Cuticle of rostrum smooth and not thickened; 16–18 CAT located posterior to rostrum. PAT all anterior to anus. Amphids spiral. Pharynx with terminal bulb; inner cuticle of the bulb moderately swollen. Buccal cavity well-developed with a dorsal and two small subventral teeth.

Type and only species: *Bathychaetosoma uchidae* (Kito, 1983)



**Fig. 7.106:** Draconematidae, examples of genera. A, *Draconema japonicum* (from Kito 1979, Fig. 2); B, *Dracograllus filipjevi* (after Allen & Noffsinger 1978, Fig. 113); C, *Paradraconema floridense* (after Allen & Noffsinger 1978, Fig. 50); D, *Prochaetosoma cayense* (after Allen & Noffsinger 1978, Fig. 148); E, *Apenodraconema chlidosis* (after Allen & Noffsinger 1978, Fig. 165); F, *Bathychaetosoma uchidai* (after Kito 1983, Fig. 5(2)); G, *Cephalochaetosoma pacificum* (after Kito 1983, Fig. 3(1)); H, *Cygnonema steineri* (after Allen & Noffsinger 1978, Fig. 169); I, *Dinetia nycterobia* (after Decraemer & Gourbault 1997, Fig. 2A); J, *Dracogalerus afrikaanus* (after Allen & Noffsinger 1978, Fig. 194); K, *Dracognomus notohalensis* (after Allen & Noffsinger 1978, Fig. 181); L, *Draconactus cutus* (after Allen & Noffsinger 1978, Fig. 161); M, *Notochaetosoma tenax* (after Allen & Noffsinger 1978, Fig. 185); N, *Tenuidraconema fiersi* (after Decraemer 1989, Fig. 2A); O, *Dracograllus trispinosum* (after Allen & Noffsinger 1978, Fig. 146); P, *Cygnonema steineri* (after Allen & Noffsinger 1978, Fig. 167); Q, *Dinetia nycterobia* (after Decraemer & Gourbault 1997, Fig. 1A); R, *Dracogalerus afrikaanus* (after Allen & Noffsinger 1978, Fig. 191); S, *Draconactus cutus* (after Allen & Noffsinger 1978, Fig. 160); T, *Tenuidraconema fiersi* (after Decraemer 1989, Fig. 1A).

**Genus *Cephalochaetosoma* Kito, 1983 (Fig. 7.106 G)**

*Diagnosis* (from Kito 1983, Decraemer et al. 1997): Prochaetosomatinae. Pharyngeal body region slightly swollen; 16–30 CAT located posterior to rostrum. PAT all anterior to anus. Amphids loop-shaped to spiral. Buccal cavity well-developed, with a dorsal and two small subventral teeth. Pharynx with terminal bulb; inner cuticle of the bulb moderately swollen.

Type and only species: *Cephalochaetosoma pacificum* Kito, 1983

**Genus *Cygnonema* Allen & Noffsinger, 1978 (Fig. 7.106 H, P)**

*Diagnosis* (from Allen & Noffsinger 1978, Decraemer et al. 1997): Prochaetosomatinae. Body long and slender; anterior 50%–59% attenuated. Ten CAT located posterior to rostrum. PAT all anterior to anus. Male amphids conspicuous, elongate, loop-shaped; female amphids inconspicuous, tubular-shaped. Pharynx with elongate cylindrical corpus, and terminal swelling with non-thickened internal cuticle. Buccal cavity weakly developed, with conspicuous dorsal tooth.

Type and only species: *Cygnonema steineri* Allen & Noffsinger, 1978

**Genus *Dinetia* Decraemer & Goubault, 1997 (Fig. 7.106 I, Q)**

*Diagnosis* (from Decraemer et al. 1997): Prochaetosomatinae. Pharyngeal body region slightly swollen. Rostrum not developed as such, as cephalic cuticle not thickened and annulated to the lip region; 15–19 CAT located in cervical region. PAT all anterior to anus. Amphids spiral, surrounded with annulated cuticle. Buccal cavity narrow, unarmed. Pharynx with terminal bulb provided with moderately thickened lumen walls.

Number of species: 2

Type species: *Dinetia nycterobia* Decraemer & Goubault, 1997

**Genus *Dracogalerus* Allen & Noffsinger, 1978 (Fig. 7.106 J, R)**

*Diagnosis* (from Allen & Noffsinger 1978, Decraemer et al. 1997): Prochaetosomatinae. Pharyngeal body region not conspicuously swollen. Body cuticle very thick. Eight to 12 CAT located on rostrum. PAT all anterior to anus. Amphids spiral. Pharynx cylindrical, with inconspicuous terminal swelling with non-thickened inner cuticle. Buccal cavity weak to moderately developed, unarmed.

Number of species: 3

Type species: *Dracogalerus afrikaanus* Allen & Noffsinger, 1978

**Genus *Dracognomus* Allen & Noffsinger, 1978 (Fig. 7.106 K)**

*Diagnosis* (from Allen & Noffsinger 1978, Decraemer et al. 1997): Chaetosomatinae. Pharyngeal body region slightly swollen more anteriorly. Rostrum asymmetric, ventral side shorter. Eight CAT located on rostrum. PAT often extending posteriorly beyond anus. PAT of two types: either all PAT modified or typical. Amphideal fovea staple-shaped or tubular, small, inconspicuous, located at rostrum base and first body rings. Corpus of the pharynx with small median swelling, posterior bulb with moderately thickened walls. Buccal cavity well-developed, with conspicuous dorsal tooth. Copulatory thorns or ventral expansions on tail may be present.

Number of species: 7

Type species: *Dracognomus marioni* Allen & Noffsinger, 1978

**Genus *Draconactus* Allen & Noffsinger, 1978 (Fig. 7.106 L, S)**

*Diagnosis* (from Allen & Noffsinger 1978, Decraemer et al. 1997): Chaetosomatinae. Pharyngeal body region swollen dorsally. Eight CAT located posterior to rostrum. PAT all anterior to anus. Amphids spiral, a base of rostrum. Pharynx cylindrical, with posterior bulb with non-thickened inner cuticle. Buccal cavity weakly developed, dorsal tooth conspicuous or inconspicuous.

Number of species: 2

Type species: *Draconactus cutus* Allen & Noffsinger, 1978

**Genus *Notochaetosoma* Irwin-Smith, 1918 (Fig. 7.106 M)**

*Diagnosis* (from Allen & Noffsinger 1978, Decraemer et al. 1997): Prochaetosomatinae. Body width nearly equal throughout body length. Cuticle very thick. Eight CAT located at border of rostrum and anterior body annules. PAT all anterior to anus. Amphids spiral. Pharynx with cylindrical corpus and inconspicuous terminal swelling with non-thickened inner cuticle. Buccal cavity weak to moderately developed, unarmed.

Type and only species: *Notochaetosoma tenax* Irwin-Smith, 1918

**Genus *Tenuidraconema* Decraemer, 1989 (Fig. 7.106 N, T)**

*Diagnosis* (from Decraemer 1989, Decraemer et al. 1997): Prochaetosomatinae. Body slender, shallow sigmoid, with swollen pharyngeal region. Body cuticle annulations anteriorly and posteriorly with vacuolar ornamentation at mid-body, smooth and interrupted by a marked lateral



field. Twelve CAT located on rostrum. PAT all posterior to anus. Amphids loop-shaped in males, spiral in females and juveniles. Pharynx with cylindrical corpus and terminal bulb with non-thickened inner cuticle. Buccal cavity narrow, unarmed.

Number of species: 3

Type species: *Tenuidraconema fiersi* Decraemer, 1989

### 7.13.1.3 Family Epsilonematidae Steiner, 1927

*Diagnosis* (modified after Gourbault & Decraemer 1996): Desmodoroidea. Body short,  $\epsilon$ (epsilon)-shaped or rare S-shaped, with enlarged pharyngeal and posterior body regions (except *Archepsilonema*, *Triepsilonema* and *Keratonema*, with approximately cylindrical bodies). Cuticle coarsely annulated, with possible additional ornamentation consisting of vacuoles, longitudinal striae and/or spines. Four cephalic setae and two to 21 subcephalic setae. Ambulatory setae in three to seven longitudinal rows, from midventral curvature to mid-posterior body region. Amphideal fovea usually ventrally wound in a spiral shape or in a derived spiral shape (except in males of *Leptepsilonema* and *Perepsilonema*). Buccal cavity narrow; small dorsal tooth and two minute subventral teeth often present. Pharynx with muscular terminal bulb, rarely cylindrical. Genital system posterior to dorsal body curvature. Ovaries antidromously reflexed, rarely outstretched. Spicules usually with capitulum and velum, preloacal supplements absent, copulatory thorns may be present.

Type genus: *Epsilonema* Steiner, 1927; marine

Epsilonematid nematodes have ambulatory setae on the ventral side of the posterior body, whereas draconematid species possess both cephalic and posterior adhesion tubes. Together with the caudal glands, the ambulatory setae enable the epsilonematids to attach themselves to a substratum and walk over its surface, thus resembling the locomotion of geometrid caterpillars (Fig. 7.107). Species of Epsilonematidae as well as

Draconematidae belong to the epifaunal nematodes (Raes et al. 2008).

#### 7.13.1.3.1 Subfamily Epsilonematinae Steiner, 1927

*Diagnosis* (modified after Gourbault & Decraemer, 1996): Epsilonematidae. Ambulatory setae present (except in *Perepsilonema*), slender, more or less bent and arranged in four to seven longitudinal rows. Head as slightly asymmetrical, truncated cone; lip region high. Pharynx with muscular terminal bulb (except in *Triepsilonema*). Female reproductive system didelphic with ovaries antidromously reflexed (anterior branch only outstretched in *Leptepsilonema* (partim) and both branches outstretched in *Triepsilonema* and also a *Leptepsilonema* species).

#### Genus *Akanthepsilonema* Gourbault & Decraemer, 1991 (Fig. 7.108 A)

*Diagnosis* (after Gourbault & Decraemer 1991, 1996): Epsilonematinae. Body  $\epsilon$ -shaped, largest width at level of reproductive system. Large middorsal thorns present at level of ventral curvature. Ambulatory setae slender and curved, arranged in six longitudinal rows in posterior body half; most setae anterior to vulva, a few posterior to vulva, and fine supporting setae present in females. Head with eight subcephalic setae. Amphideal fovea spiral.

Number of species: 2

Type species: *A. helleouetae* Gouibault & Decraemer, 1991

#### Genus *Archepsilonema* Steiner, 1931 (Fig. 7.108 B)

*Diagnosis* (after Steiner, 1931; Gourbault & Decraemer, 1996): Epsilonematinae. Body short, almost cylindrical, and ventrally curved. Ambulatory setae slender, straight and arranged in four longitudinal rows posterior to vulva; supporting setae present. Head with more than two subcephalic setae. Amphideal fovea spiral and ventrally wound. Pharynx with muscular terminal bulb.

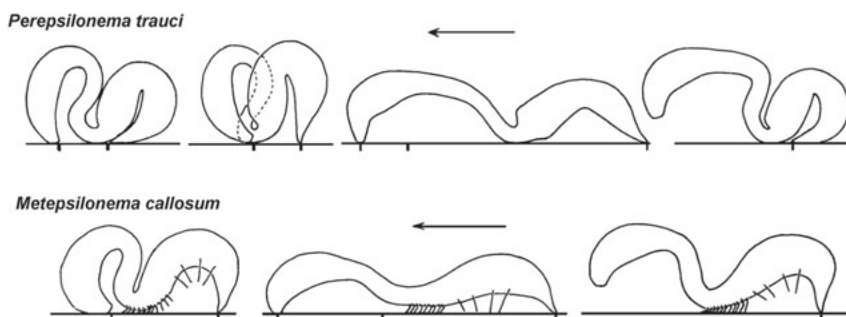


Fig. 7.107: Locomotion of two epsilonematid species (from Lorenzen 1973b, Abb. 3).

Number of species: 8

Type species: *A. celidotum* Steiner, 1931

**Genus *Bathyepsilon* Steiner, 1931 (Fig. 7.108 C)**

*Diagnosis* (after Gourbault & Decraemer 1996): Epsilonematinae. Body  $\epsilon$ -shaped with widest regions at level of pharynx and reproductive system. Ambulatory setae slightly bent, arranged in six longitudinal rows situated at mid-body region, all anterior to vulva. Supporting setae present. Rostrum with eight subcephalic setae. Amphideal fovea spiral, cryptospiral or almost circular with possible sexual dimorphism in size.

Number of species: 10

Type species: *B. drygalskii* Steiner, 1931

**Genus *Epsilonema* Steiner, 1927 (Fig. 7.108 D)**

(syn. *Rhabdogaster* Metschnikoff, 1867 and *Prochaetosoma* Baylis & Daubney, 1926 op Hope & Murphy, 1972: 31 and Gerlach & Riemann, 1973: 269 (preocc.; homonyms); syn. *Epsilonematina* Johnston, 1938, *Epsilonoides* Steiner, 1931, *Notochaetosoma* Irwin Smith, 1918 and *Bathyepsilon* Steiner 1931, partim op. Lorenzen, 1973: 39(447))

*Diagnosis* (after Gourbault & Decraemer 1996): Epsilonematinae. Body  $\epsilon$ -shaped with widest regions at level of pharynx and reproductive system. Ambulatory setae slender, straight or bent, arranged in four to five longitudinal rows in anterior half of posterior body region; pre- and postvulvar in females but only one or two pairs of setae being posterior to vulva (none in *E. meunierorum*, *E. oodamphis*). Supporting setae present. Rostrum with eight subcephalic setae (but six in *E. espeeli* and *lasium* and 16 setae at base of head in *E. enigmatis*). Amphideal fovea spiral, cryptospiral or almost circular with possible sexual dimorphism in size.

Number of species: 11

Type species: *E. cygnoides* (Metschnikoff 1867) Gerlach & Riemann, 1973

**Genus *Leptepsilon* Clasing, 1983 (Fig. 7.108 E)**

*Diagnosis* (after Gourbault & Decraemer 1996): Epsilonematinae. Body  $\epsilon$ -shaped, slender, with slightly larger regions at level of pharynx and posterior part of body. Ambulatory setae curved, arranged in five (rarely six) longitudinal rows in anterior part of posterior body region, usually anterior to vulva with exception of one to three pairs posterior to vulva. Supporting setae straight, usually strong and long. Head with eight subcephalic setae in two circles, one being anterior to amphids. Amphideal fovea with sexual dimorphism in size and shape: loop-shaped with flap in males and spiral in females. Copulatory thorns present.

Number of species: 10

Type species: *L. procerum* Clasing, 1983

**Genus *Metepsilon* Steiner, 1927 (Fig. 7.108 F)**

*Diagnosis* (after Gourbault & Decraemer 1996): Epsilonematinae. Body  $\epsilon$ -shaped, with larger regions at level of pharynx and reproductive system. Ambulatory setae slender curved, distally and/or proximally bent; arranged in four longitudinal rows (rarely five) at anterior part of posterior body region, i.e., in females all anterior to vulva. Supporting setae present. Head with two sublateral subcephalic setae. Amphideal fovea spiral, derived spiral (i.e., small oval or infrequently groove-shaped); sexually dimorphic in size and may or may not be dimorphic in shape. Copulatory thorns usually lacking.

Number of species: 17

Type species: *M. hagmeieri* (Stauffer 1925)

**Genus *Perepsilon* Lorenzen, 1973 (Fig. 7.108 G)**

*Diagnosis* (after Gourbault & Decraemer 1996): Epsilonematinae. Body  $\epsilon$ -shaped, with widest regions at level of pharynx and reproductive system and with folded posterior part of body. Ambulatory setae and supporting setae absent. Head with eight subcephalic setae (i.e., on each side of the head, one subdorsal seta at the base of the amphid, one subventral and one subdorsal seta just posterior to the cephalic setae, and one lateral seta (may be missing)). Amphideal fovea spiral and with sexual dimorphism. Copulatory thorns usually present. Posterior-most tail annules with paired subdorsal row of small spines.

Number of species: 9

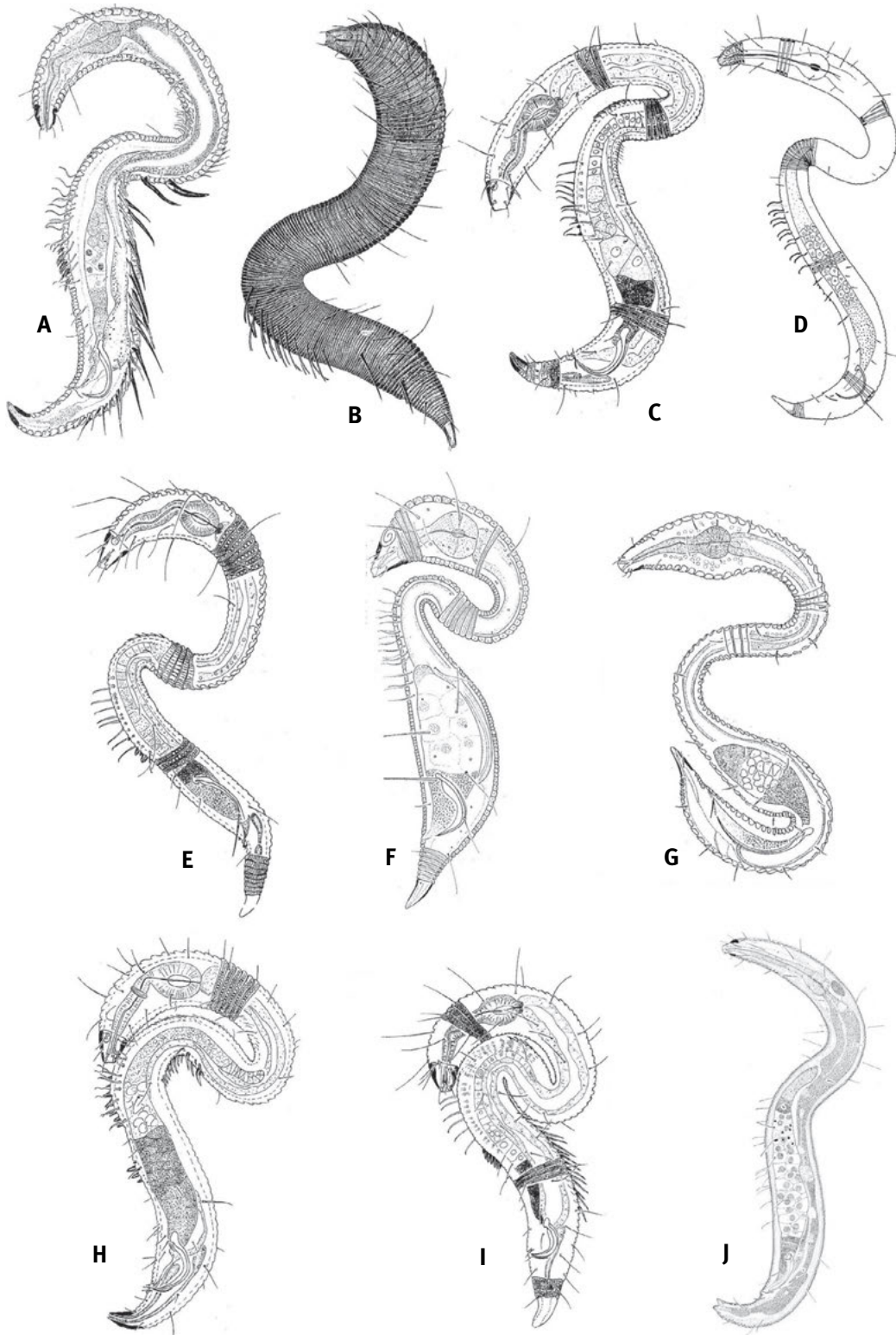
Type species: *P. papulosum* Lorenzen 1973

**Genus *Polkepsilon* Verschelde & Vincx, 1993 (Fig. 7.108 H)**

*Diagnosis* (after Verschelde & Vincx 1993, Gourbault & Decraemer 1996): Epsilonematinae. Body  $\epsilon$ -shaped, with widest regions at level of pharynx and reproductive systems. Fine doubly bent ambulatory setae arranged in central field of four to five rows flanked by pair of external rows and situated in the anterior half of posterior body region (and all setae well anterior to vulva); in males, external rows consisting of large, almost straight setae; females with stout supporting setae. Rostrum with four cephalic and 14 to 21 subcephalic setae in two circles, one anterior to amphid. Amphideal fovea sexually dimorphic, loop-shaped with flap in males, spiral in females.

Number of species: 3

Type species: *P. mombasae* Verschelde & Vincx, 1993



**Fig. 7.108:** Epsilonematinae, examples of genera. A, *Acanthepsilonema helleouetae* (from Goubault & Decraemer 1991, Fig. 1B); B, *Archeepsilonema schizocricum* (from Steiner 1931, Abb. 27); C, *Bathyepsilonema annulosum* (from Verschelde & Vincx 1992, Fig. 1); D, *Epsilonema byssicola* (from Lorenzen 1973, Abb. 4F); E, *Leptepsilonema richardi* (from Verschelde & Vincx 1992, Fig. 2); F, *Metepsilonema hagmeieri* (from Decraemer & Goubault 1998, Fig. 2C); G, *Perepsilonema moineau* (from Goubault & Decraemer 1992, Fig. 3); H, *Polkepsilonema mombasae* (from Verschelde & Vincx 1992, Fig. 1A); I, *Pterepsilonema servaesae* (from Verschelde & Vincx 1883, Fig. 2A); J, *Triepsilonema tripapillata* (from Decraemer 1982, pl. VIII, Fig. 3).



**Genus *Pternepsilonema* Vershelde & Vincx, 1993**  
(Fig. 7.108 I)

*Diagnosis* (after Vershelde & Vincx 1993, Gourbault & Decraemer 1996): Epsilonematinae. Body  $\epsilon$ -shaped, with widest regions at level of pharynx and reproductive system. Ambulatory setae straight, broad and tubular with bent posterior tip, arranged in six (seven) longitudinal rows, situated in anterior part of posterior body region, most setae anterior to vulva but a few posterior to vulva. Supporting setae present. Head with 14–16 subcephalic setae in one circle at base of rostrum. Amphideal fovea inconspicuous, pore-like.

Type species and only species: *P. servaesae* Vershelde & Vincx, 1993

**Genus *Triepsilonema* Decraemer, 1982 (Fig. 7.108 J)**

*Diagnosis* (after Gourbault & Decraemer 1996): Epsilonematinae. Body almost cylindrical and curved in slight  $\epsilon$ -shape. Ambulatory setae slender, straight with bent tip, arranged in six longitudinal rows situated in anterior part of posterior body region, most setae anterior to vulva but a few posterior to vulva. Supporting setae absent. Head with eight subcephalic setae. Amphideal fovea spiral; sexual dimorphism absent. Pharynx uniform to indistinctly set-off posterior bulb. Tail completely annulated, ending in three papillae and separate outlets of caudal glands.

Type and only species: *T. tripapillatum* Decraemer, 1982

**7.13.1.3.2 Subfamily Glochinematinae Lorenzen, 1974**

*Diagnosis* (after Lorenzen, 1974; Gourbault & Decraemer, 1996): Epsilonematidae. Anterior body region elongated, from base of pharynx to ventral curvature. Head globular. Lip region low. Dorsal cuticular thorns present in pharyngeal region. Ambulatory setae either of one type: slender, distally differentiated, and arranged in three or four longitudinal rows; or of two types: slender distally differentiated subventral setae and stronger straight laterodorsal setae arranged in five or six rows. Supporting setae absent. Type genus: *Glochinema* Lorenzen, 1974

**Genus *Glochinema* Lorenzen, 1974 (Fig. 7.109 A, B)**

*Diagnosis* (after Lorenzen 1974, Gourbault & Decraemer 1996): Glochinematinae. Ambulatory setae of one type, slender, bent, distally differentiated and arranged in three or four longitudinal rows; most setae anterior to vulva but a few posterior to vulva. Four to eight subcephalic setae.

Number of species: 6

Type species: *G. agile* Lorenzen, 1974

**Genus *Metaglochinema* Gourbault & Decraemer, 1986**  
(Fig. 7.109 C, D)

*Diagnosis* (after Gourbault & Decraemer 1986, 1996): Glochinematinae. Ambulatory setae of two types: slender, distally differentiated, subventral setae, and stronger, straight, laterodorsal setae arranged in five to six rows (ventral setae on a single line or not). Two subcephalic setae.

Number of species: 2

Type species: *M. globicephalum* Gourbault & Decraemer, 1986

**7.13.1.3.3 Subfamily Keratonematinae Gourbault & Decraemer, 1986**

*Diagnosis* (after Gourbault & Decraemer 1986, 1996): Epsilonematidae. Body almost cylindrical. Dorsal cuticular thorns present in pharyngeal region. One type of ambulatory setae: robust, distally differentiated and arranged in five longitudinal rows. Supporting setae absent. Head globular. Subcephalic setae present. Lip region low. Pharynx almost cylindrical.

Type genus: *Keratonema* Gourbault & Decraemer, 1986

**Genus *Keratonema* Gourbault & Decraemer, 1986 (Fig. 7.109 E–G)**

*Diagnosis* (after Gourbault & Decraemer 1986, 1996): Keratonematinae. Ambulatory setae with glandular, articulated, proximal part with asymmetrical arrangement. Head capsule heavily cuticularized with minute (possibly nine) subcephalic setae, asymmetrically inserted.

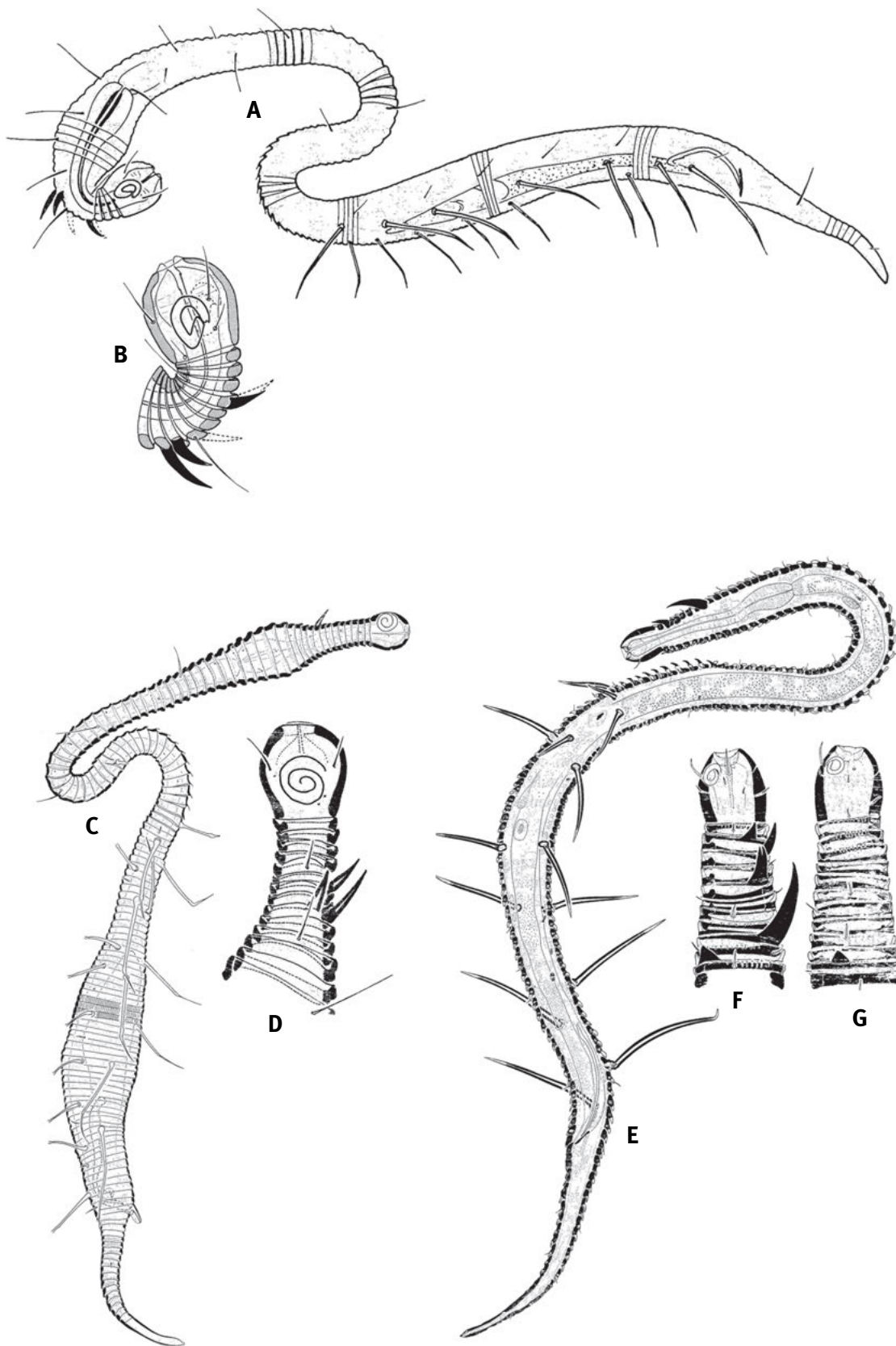
Type and only species: *K. singulare* Gourbault & Decraemer, 1986

**7.13.2 Superfamily Microlaimoidea**  
**Micoletzky, 1922**

*Diagnosis*: Desmodorida. Body cuticle annulated, and punctated in a few species. Ovaries outstretched or antidromously reflected, didelphic or monodelphic prodelphic. Testes paired or single (monorchic).

Number of families: 3 (Microlaimidae Filipjev, 1922, Aponchiidae Gerlach, 1963 and Monoposthiidae Filipjev, 1934)

According to Lorenzen (1981, 1994), the holophyly of Microlaimoidea can not be justified by holapomorphic structural characters. The Microlaimoidea is thus a paraphyletic remain within Desmodorida after identification of the holophyletic superfamily Desmodoroidea.



**Fig. 7.109:** Glochinematinae and Keratonematinae, examples of genera. A, B, *Glochinema agile* (from Lorenzen 1974, Abb. 1 A, C); C, D, *Metaglochinema globicephalum* (from Gourbault & Decraemer 1986, Fig. 2); E–G, *Keratonema singular* (from Gourbault & Decraemer 1986, Fig. 3).

### 7.13.2.1 Family Microlaimidae Micoletzky, 1922

**Diagnosis:** Microlaimoidea. Body often yellow-brownish. Cuticle usually distinctly annulated (with *Ixonema* the sole exception), without lateral differentiation; finely punctated or spiny in some species. Head cuticle smooth but not thickened or modified in a cephalic capsule; head usually slightly set off the body. Anterior sensilla six + six + four, inner labial sensilla as minute papillae, outer labial sensilla as papillae or short setae, cephalic sensilla as usually longer setae. Amphideal fovea circular with postero-dorsal interruption, more seldom uni- or even multispiral. Cheilostoma with twelve weak longitudinal folds. Pharyngostoma with sclerotized walls; small dorsal tooth and two opposite, even lesser, teeth usually present, or unarmed. Pharynx with posterior rounded muscular bulb. Ventral pore usually posterior to the nerve ring. Two opposed outstretched ovaries. Two opposed testes or only anterior testis. Tail conical.

Type genus: *Microlaimus* de Man 1880 (mainly marine)

#### Genus *Acanthomicrolaimus* Stewart & Nicholas, 1987 (Fig. 7.110 A)

**Diagnosis** (modified after Stewart & Nicholas 1987): Microlaimidae. Body cuticle ornamented with very strong, sharply pointed spines arranged in annuli and longitudinal rows. Pharyngeal bulb without strong cuticular lining. Posterior testis very reduced, whereas the anterior testis reaches almost as far forward as the pharyngeal bulb.

Type and only species: *Acanthomicrolaimus jenseni* Stewart & Nicholas, 1987

#### Genus *Aponema* Jensen, 1978 (Fig. 7.110 B)

**Diagnosis** (modified after Jensen, 1978): Microlaimidae. Cuticle finely striated. Pharynx with thick cuticular internal lining of posterior bulb. One or two testes. Copulatory structures strongly sclerotized; gubernaculum with dorso-caudal apophyses.

Number of valid species: 6

Type species: *Aponema torosum* (Lorenzen 1973) Jensen, 1978 (marine)

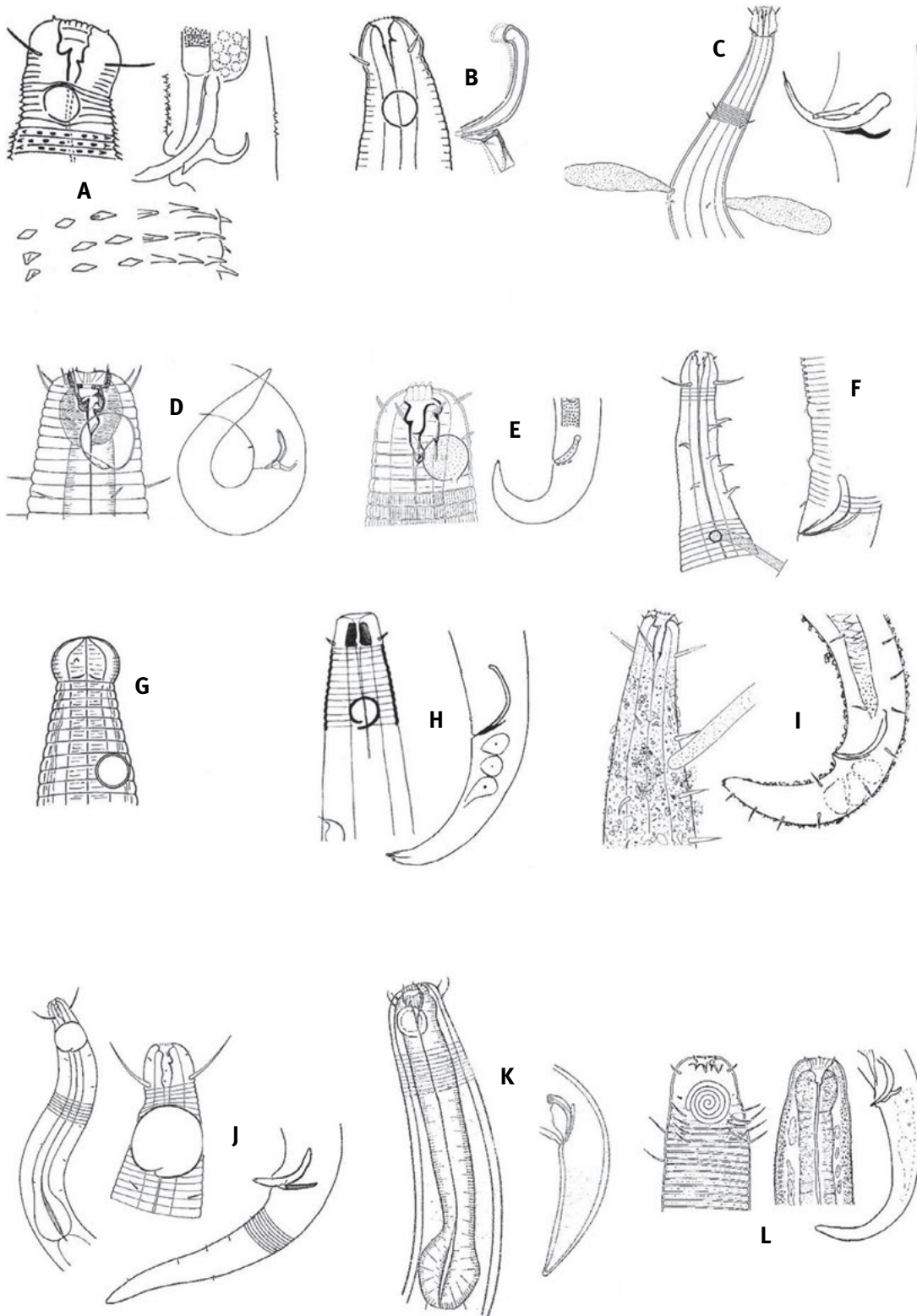
Jensen (1978) established the genus *Aponema* with only one species, *A. torosus* (= *Microlaimus t.* Lorenzen, 1973), mainly on the basis of a strongly sclerotized copulatory apparatus with well-developed dorso-caudal gubernacular apophysis. The type species

*A. torosus* is characterized also by the only anterior testis present (Jensen 1978, Lorenzen 1981). Since that time, some species of *Aponema* were added by Pastor de Ward (1980), Muthumbi & Vincx (1999), Bussau & Vopel (1999), Kovalyev & Miljutina (2009), Miljutin & Miljutina (2009) and Portnova (2009), which raised the number of nominal species to 11. Unfortunately, dorso-caudal apophyses of the gubernaculum and single anterior male gonad proved not to be coupled. As a result, both monorchic species (*A. bathyalis* Kovalyev & Miljutina, 2009, *A. martinezi* Miljutin & Miljutina, 2009, *A. minutissima* Kovalyev & Miljutina, 2009, *A. nanum* (Blome, 1982) Kovalyev & Miljutina, 2009, *A. ninae* Portnova, 2009, *A. papillatum* Pastor de Ward, 1980, *A. nympa* Bussau & Vopel, 1999, *A. torosum* (Lorenzen, 1973), *A. westindicum* Kovalyev & Miljutina, 2009) and diorchic species (*Aponema decramerae* Muthumbi & Vincx, 1999, *A. mnazi* Muthumbi & Vincx, 1999), as well as species with (*A. decramerae*, *A. mnazi*, *A. ninae*, *A. papillatum*, *A. torosum*) and without (*A. bathyalis*, *A. martinezi*, *A. minutissima*, *A. nympa*, *A. westindicum*) gubernacular apophyses and species completely lacking gubernaculum at all (*A. minutissima*, *A. nanum*) were united under the same generic name. Muthumbi & Vincx (1999) added two diorchic species with dorso-caudal gubernacular apophyses to *Aponema*. Kovalyev & Miljutina (2009), with a different understanding of *Aponema*, stressed the monorchic condition in their emended diagnosis of the genus and excluded diorchic species. Their list of valid *Aponema* species includes seven species with only anterior testis but disparate structure of the gubernaculum. I adhere to the conception of Muthumbi & Vincx (1999) on the grounds: 1) gubernaculum as a structural character is more evident and easily observable than male gonads; 2) number of testes is not reported for many if not majority of microlaimid species; 3) posterior testis may be very reduced in some microlaimids (e.g., *Acanthomicrolaimus jenseni* Stewart & Nicholas, 1987) and thus the presence or absence of the posterior male gonad may have no distinct hiatus to be used for discrimination genera.

#### Emended list of valid *Aponema* species:

- A. abyssalis* Miljutin & Miljutina, 2009 (= *Microlaimus a.* Miljutin & Miljutina, 2009). Diorchic.
- A. decraemerae* Muthumbi & Vincx, 1999. Diorchic.
- A. mnazi* Muthumbi & Vincx, 1999. Diorchic.
- A. ninae* Portnova, 2009. Monorchic.





**Fig. 7.110:** Microlaimidae, examples of genera. A, *Acanthomicrolaimus jenseni* (from Stewart & Nicholas 1987, Fig. 1); B, *Aponema torosus* (adapted from Jensen 1978, Fig. 5); C, *Bathynox clavata* (adapted from Bussau & Vopel 1999, Fig. 31, 32); D, *Bolbolaimus* sp. (adapted from Riemann 1966, Fig. 40); E, *Caligocanna mirabilis* (adapted from Bussau & Vopel 1999, Fig. 7, 10); F, *Calomicrolaimus rugatus* (adapted from Lorenzen 1976, Fig. 1); G, *Cinctonema papillata* (adapted from Timm 1962, Fig. 2); H, *Crassolaimus bipapillatus* (adapted from Wieser 1951, Abb. 5); I, *Ixonema sordidum* (adapted from Lorenzen 1971, Abb. 1); J, *Microlaimus conspicuus* (adapted from Lorenzen 1973a, Abb. 10); K, *Pseudomicrolaimus murinae* (adapted from Sergeeva 1976, Fig. 2); L, *Spirobolbolaimus bathyalis* (adapted from Soetaert & Vincx 1988, Fig. 1, 2).

*A. papillatum* Pastor de Ward, 1980. Monorchic.  
*A. torosum* (Lorenzen, 1973) Jensen, 1978. Monorchic.

**Former *Aponema* species possessing no gubernacular apophyses transferred to the genus *Microlaimus*:**

*M. bathyalis* (Kovalyev & Miljutina, 2009) comb. n. (= *Aponema b.* Kovalyev & Miljutina, 2009). Monorchic, no dorso-caudal apophysis.

*M. martinezi* (Miljutin & Miljutinae, 2009) comb. n. (= *Aponema m.* Miljutin & Miljutinae, 2009). Monorchic, no dorso-caudal apophysis.

*M. minutissimus* (Kovalyev & Miljutina, 2009) comb. n. (= *Aponema minutissima* Kovalyev & Miljutina, 2009). Monorchic, no dorso-caudal apophysis.

*M. nanus* Blome, 1982 (transferred to *Aponema* by Kovalyev & Miljutina (2009)). Monorchic, no gubernaculum at all.

*M. nympa* Bussau & Vopel, 1999 (= *Aponema n.* Bussau & Vopel, 1999). Monorchic; dorsal but not dorso-caudal apophysis.

*M. westindicus* Kovalyev & Miljutina, 2009 (= *Aponema westindicum* Kovalyev & Miljutina, 2009). Monorchic, no dorso-caudal apophysis.

**Genus *Bathynox* Bussau & Vopel, 1999 (Fig. 7.110 C)**

*Diagnosis* (after Bussau & Vopel 1999): Microlaimidae. Body spindle-shaped, minute. Cuticle annulated. Somatic setae on peduncles. Amphid far posterior to the anterior end; amphideal aperture small, with protruding clavate corpus gelatum.

Type species: *Bathynox clavata* Bussau & Vopel, 1999 (only species; marine, deep sea)

**Genus *Bolbolaimus* Cobb, 1920 (Fig. 7.110 D)**

*Diagnosis* (modified after Jensen 1978): Microlaimidae. Cuticle strongly annulated, sometimes ornamented with dots. Head not set-off. Cephalic setae close to the front end. Amphideal fovea unispiral or cryptospiral. Buccal cavity strongly sclerotized, with a large dorsal tooth, denticles may be present. Pharynx with anterior peribuccal bulb and posterior oval bulb. Copulatory apparatus strongly sclerotized and with gubernacular apophyses directed dorsally or dorsocaudally.

Number of valid species: 9

Type species *Bolbolaimus pellucidus* Cobb, 1920 (marine)

*B. bahari* Muthumbi & Vincx, 1999 and *B. abebei* Muthumbi & Vincx, 1999 are not characterized by a prominent

anterior peribuccal bulb of the pharynx and thus may not differ significantly from species of the genus *Microlaimus* in this respect.

**Other species:**

*Bolbolaimus abebei* Muthumbi & Vincx, 1999

*Bolbolaimus bahari* Muthumbi & Vincx, 1999

*Bolbolaimus chitwoodi* (Gerlach, 1950) (= *Microlaimus ch.* Gerlach, 1950, = *Microlaimus dentatus* Chitwood, 1937, syn. Jensen, 1978: 162)

*Bolbolaimus crassiceps* (Gerlach, 1953) (= *Microlaimus c.*, syn. Jensen, 1978: 162)

*Bolbolaimus longosetosus* (Jensen, 1985) (= *Chromaspirina l.* Jensen, 1978, syn. Muthumbi et al., 1996: 182)

*Bolbolaimus murinae* (Sergeeva, 1976) (= *Pseudomicrolaimus m.*, syn. Jensen, 1978: 162)

*Bolbolaimus riemanni* Jensen, 1978

*Bolbolaimus teutonicus* (Riemann, 1966) (= *Microlaimus t.* Riemann, 1966, syn. Jensen, 1978: 162)

*Bolbolaimus wieseri* Hopper, 1961 (= *Microlaimus w.* 1961, syn. Jensen, 1978: 162)

**Genus *Caligocanna* Bussau & Vopel, 1999**

**(Fig. 7.110 E)**

*Diagnosis*: Microlaimidae. Cuticle transversally annulated and finely, longitudinally striated. Cephalic setae shorter than outer labial setae. Two testes. No preloacal supplements.

Type species: *Caligocanna mirabilis* Bussau & Vopel, 1999 (marine, deep-sea; assumed to build sediment tubes)

**Genus *Calomicrolaimus* Lorenzen, 1976 (Fig. 7.110 F)**

*Diagnosis*: Microlaimidae. Cervical region elongated. Specialized thick spine-like setae present in cervical region. Amphideal fovea at a distance from the anterior end; often with *corpus gelatum* protruding from the amphideal aperture. Paired ovaries, outstretched. Two testes. Papiloid preloacal supplements and preloacal cuticular thickenings present.

Type species: *Calomicrolaimus rugatus* Lorenzen, 1976 (monospecific, marine)

Lorenzen (1976) stressed three outstanding characters of *Calomicrolaimus*: 1) conspicuous cervical setae; 2) ventral thickenings of the body annules in the preanal region of the males; 3) sexual dimorphism of the amphids (male amphideal fovea smaller than that of females; only male amphid with a protruded rod-like corpus gelatum). Thus, *Calomicrolaimus rugatus* in

shape and structure of narrowed anterior body, narrow and weakly sclerotized stoma, amphids with extended corpus gelatum and situated far posterior to the cephalic setae, is similar to the genera *Ixonema* and *Bathynox*. However, none of the subsequent species described as or transferred to *Calomicrolaimus* has a protruded corpus gelatum. Only three of nine *Calomicrolaimus* species possess any preamphideal cervical setae (*C. pecticauda*, *C. spinosus*, *C. tenuicollis*) and only *C. acanthus* is featured with some modified preanal cuticle in males. Because of the similarity of various species of *Microlaimus* and *Calomicrolaimus*, Kovalyev & Tchesunov (2005) regarded the genus *Calomicrolaimus* Lorenzen, 1976 as a junior synonym of *Microlaimus* De Man, 1880. Here, *Calomicrolaimus* is retained as a valid monotypic genus, whereas all other included species definitely differing from the type *C. rugatus* are returned or transferred to *Microlaimus* (see species list in Kovalyev & Tchesunov 2005).

**Genus *Cinctonema* Cobb, 1920 (Fig. 7.114 G)**

*Diagnosis:* Microlaimidae. Cuticle striated. Buccal cavity narrow and nearly toothless. Pharynx with thick cuticular lining of posterior bulb. One or two testes. Copulatory structures strongly sclerotized; gubernaculum with dorso-caudal apophyses.

Type species: *Cinctonema tenue* Cobb, 1920 (marine)

*Remarks:* Original diagnosis of the type species *Cinctonema tenue* (Jamaica) is made on the basis of only one male and is poor: the brief description is supplemented with drawings of a head and tail tip (Cobb 1920). The second species *C. papillatum* Timm, 1962 (Arabian Sea) was described based on a single female; the genus was there included in the family Linhomoeidae by Timm (1962). Later, in a paper on redescription of N.A. Cobb's nematode species from the Antarctic, Timm (1978) restudied the species *Terschellingia polaris* Cobb, 1914 and followed the opinion of Gerlach (1950) and ascertained its position in the genus *Cinctonema*. Timm (1978) indicated a lack of definable teeth in the buccal cavity and backwardly pointed apophyses of the gubernaculum as characters separating *Cinctonema* from *Microlaimus*. Simultaneously, Jensen (1978) erected the genus *Aponema* (type species *Microlaimus torosus* Lorenzen, 1973) with the main diagnostic character being dorso-caudal gubernacular apophyses. The genera *Cinctonema* and *Aponema* seem hardly distinguishable from one another, but the species of *Cinctonema* are now too poorly known to make a proper generic diagnosis.

**Genus *Crassolaimus* Kreis, 1929 (Fig. 7.110 H)**

*Diagnosis:* Microlaimidae. Cuticle annulated. Buccal cavity short cylindrical, with thickened, moderately sclerotized walls. Testis unpaired. Small papilloid supplements. No apophyses of the gubernaculum.

Number of species: 2

Type species: *Crassolaimus conicaudatus* Kreis, 1929 (marine). *Crassolaimus* is a poorly studied taxon of questionable validity (see also Jensen 1978).

**Genus *Ixonema* Lorenzen, 1971 (Fig. 7.110 I)**

*Diagnosis:* Microlaimidae. Cuticle smooth and may be covered with sediment particles. Anterior end narrowed and elongated. Amphid at a distance from the anterior end; with *corpus gelatum* protruding from the amphideal aperture. Buccal cavity small, with three minute teeth. Testis unpaired. Small papilloid supplements. Each caudal gland with its own outlet on the tail tip. No apophyses of the gubernaculum.

Number of species: 3

Type species: *Ixonema sordidum* Lorenzen, 1971 (marine)

**Genus *Microlaimus* de Man, 1880 (Fig. 7.110 J)**

(= *Microlaimoides* Hoeppli, 1926, = *Paracothonolaimus* Schulz, 1932)

*Diagnosis:* Microlaimidae. Cuticle annulated, in some species also showing punctuations or longitudinal striation. Head slightly set-off. Amphideal fovea close to cephalic setae. Papilloid precloacal supplements may be present. Ovaries paired, outstretched.

Number of species: about 80

Type species: *Microlaimus globiceps* de Man, 1880 (most species marine, a few species occur in brackish waters)

**Genus *Pseudomicrolaimus* Sergeeva, 1976 (Fig. 7.110 K)**

*Diagnosis* (modified after Sergeeva 1976): Microlaimidae. Cuticle strongly annulated. Head truncated, not set-off. Cephalic setae close to the front end. Amphideal fovea unispiral or circular. Buccal cavity rather wide, strongly sclerotized, with a large dorsal tooth, and transversal rows of denticles. Pharyngeal tissue inflated around the buccal cavity, posterior oval bulb present. Copulatory apparatus strongly sclerotized, no dorso-caudal gubernacular apophyses.

Number of species: 3

Type species *P. murinae* Sergeeva, 1976

Jensen (1978) synonymized *Pseudomicrolaimus* with *Bolbolaimus* Cobb, 1920. Kovalyev & Tchesunov (2005)



restored validity of *Pseudomicrolaimus* because it is well distinguished by numerous denticles in stoma.

**Genus *Spirobolbolaimus* Soetaert & Vincx, 1988**  
(Fig. 7.110 L)

*Diagnosis:* Microlaimidae. Cuticle annulated. Cephalic setae shorter than outer labial setae. Amphideal fovea multispiral. Six longitudinal rows of postamphideal setae. Ovaries outstretched. Two testes. No preloacal supplements.

Number of species: 2

Type species: *Spirobolbolaimus bathyalis* Soetaert & Vincx, 1988

**Genus *Lamellipodium* Allgén, 1958**

The type and only species has been poorly described on the base of a sole female (Allgén 1959). Hope & Murphy (1972) considered the genus as doubtful.

### 7.13.2.2 Family Aponchiidae Gerlach, 1963

*Diagnosis* (orig.): Microlaimoidea. Body long, cylindrical, often brownish. Cuticle finely striated or seemingly smooth. Anterior sensilla in pattern six + six + four, inner labial and outer labial sensilla papilliform, and cephalic sensilla setiform. Amphideal fovea rounded, uni- or oligospiral. Buccal cavity narrow, conical and armed with three small but distinct solid teeth, the dorsal one may be the largest. Cheilostoma may have weak longitudinal striation resembling the rugae of chromadorids. Pharynx evenly muscular throughout its length, with a terminal muscular bulb. Ventral pore may be situated on the apex of a conical projection. Ventral gland cell associated with several pear-like cells with similar content (their, however, necks were not traced anteriorly) and one pseudocoelomocyte with more dense cytoplasm. Only one anterior outstretched female gonad; a postvulvar sack (spermatheca) present. There is a series of midventral preanal supplementary papillae in males. Gubernaculum with dorso-caudal apophyses. Marine.

Type genus: *Aponchium* Cobb, 1920 (two genera)

Marine species, very seldom recorded, mainly in tropical and subtropical regions of the North Hemisphere. The aponchiid species live epizoically on the shells of epibenthic invertebrates in shallow waters with submerged vegetation, where they presumably feed on attached algae (Gerlach 1963, Jensen 1989). The species *Synonema cosmopoliticum* Jensen, 1989 has been found once in mass in Moscow marine aquaria, where they dwelled in

filamentous algae (*Cladophora*); these are very impetuously moving nematodes (personal observations).

**Genus *Aponchium* Cobb, 1920 (Fig. 7.111 E–F)**

*Diagnosis* (after Jensen 1989): Aponchiidae. In buccal cavity, dorsal tooth and two subventral teeth almost equal. Spicules elongate.

Type and only species: *A. cylindricolle* Cobb, 1920

**Genus *Synonema* Cobb 1920 (Fig. 7.111 A–D, 7.115 D, F)**

*Diagnosis* (after Jensen 1989): Aponchiidae. In buccal cavity, dorsal tooth larger than the two subventral teeth. Spicules short.

Number of species: 8

Type species: *S. braziliense* Cobb, 1920

### 7.13.2.3 Family Monoposthiidae Filipjev, 1934

*Diagnosis* (orig.): Microlaimoidea. Cuticle thick and coarsely annulated; annules overlap one another slightly, resembling tiles; the annules of the anterior body have anteriorly directed margins, whereas at the level of the anterior midgut to the tail, the direction of margins changes posteriorly. Longitudinal ornamentation as rows of notches extend throughout the body, V-shaped from the head to the anterior midgut and A-shaped from the anterior midgut to the tail. Head annules may fuse, thus forming something like a helmet. Anterior sensilla pattern six + six + four, both inner and outer labial sensilla as papillae or setiform papillae, cephalic sensilla setose. Amphideal fovea circular. Buccal cavity with a dorsal tooth opposed to small ventrosublateral teeth. Pharynx with muscular posterior bulb. Ovaries antidromously reflected, two opposed or one anterior. Testes paired, opposed. Preloacal supplementary papillae and/or thickened preloacal cuticle area may be present. Copulatory apparatus presented by an unpaired gubernaculum partly protrusible; paired weak spicules present or lacking. Tail conical.

Type genus *Monoposthia* de Man, 1889 (largely marine)

Large and solid, the canoe-shaped copulatory organ of *Monoposthia* was interpreted as an unpaired spicule. However, Wieser (1954) supposed this copulatory organ was actually an enlarging gubernaculum, functionally replacing both spicules. A transformational sequence *Rhinema* → *Nudora* → *Monoposthia* shows a gradual reduction of the paired functioning spicules

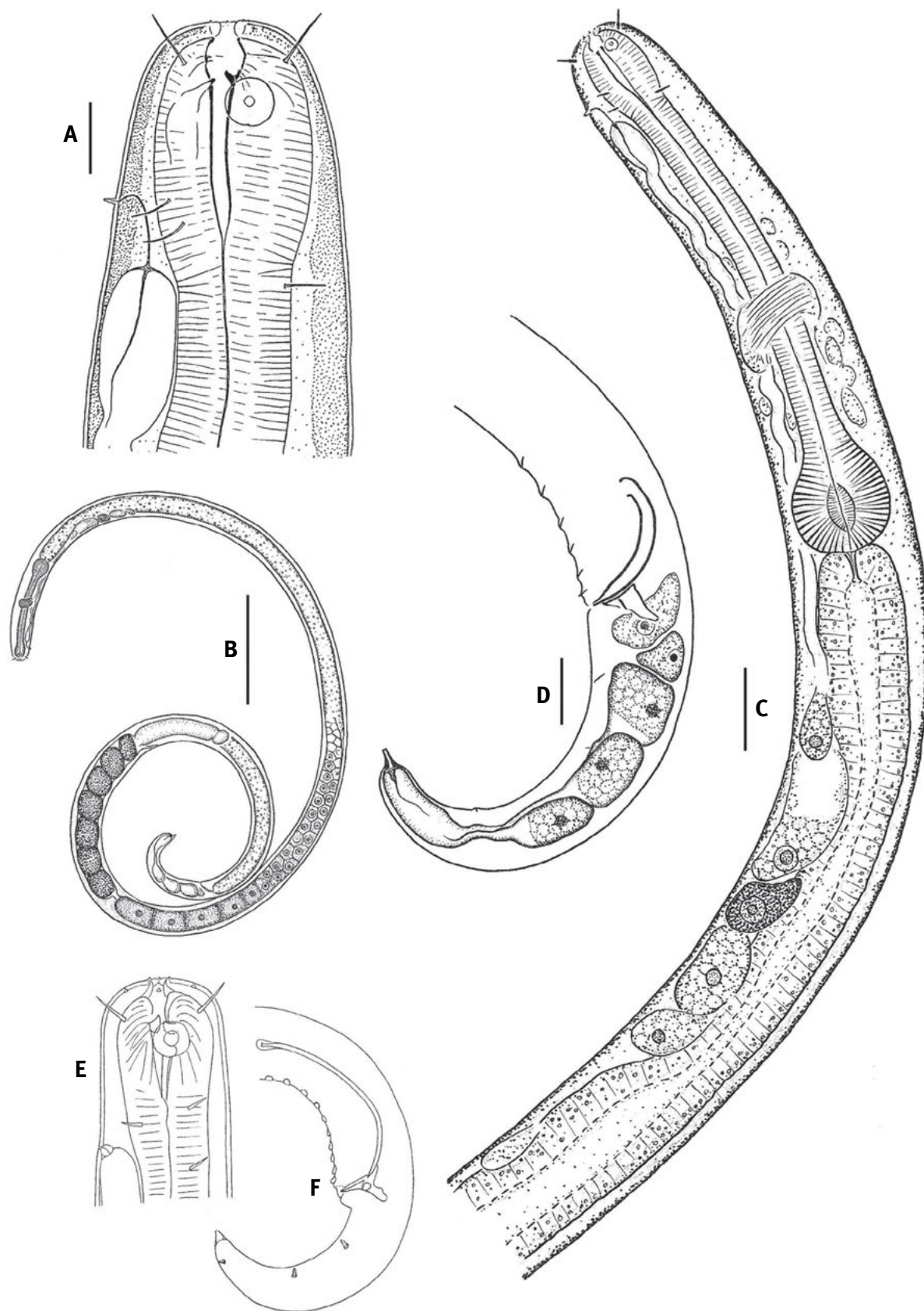


Fig. 7.111: Aponchiidae, examples. A–D: *Synonema cosmopoliticum* (from Tchesunov 2006, Fig. 2.17. B–E); E–F, *Aponchium cylindricolle* Cobb, 1920 (after Gerlach 1963b, Abb. 1).

and their substitution by a slightly protrusible gubernaculum.

**Genus *Monoposthia* de Man, 1889 (Fig. 7.112 A–C)**

*Diagnosis:* Monoposthiidae. Longitudinal alae throughout the body. Single anterior ovary. Spicules lacking; unpaired gubernaculum solid, canoe-shaped, slightly protrusible. Marine.

Number of species: 14

Type species: *Monoposthia costata* (Bastian, 1865)

**Genus *Monoposthioides* Hopper, 1963**

(Fig. 7.112 D–G)

*Diagnosis:* Monoposthiidae. Longitudinal alae absent in the anterior body. Single anterior ovary. No spicules. Unpaired gubernaculum widened proximally.

Number of species: 2

Type species: *Monoposthioides annoposthia* Hopper, 1963

**Genus *Nudora* Cobb, 1920 (Fig. 7.112 H–I, 7.115 C)**

*Diagnosis:* Monoposthiidae. Longitudinal alae throughout the body. Single anterior ovary. Weak curved spicules present. Gubernaculum solid, canoe-shaped.

Number of species: 15

Type species *Nudora lineata* Cobb, 1920 (mostly marine and one freshwater species)

**Genus *Rhinema* Cobb, 1920 (Fig. 7.112 J–L)**

*Diagnosis:* Monoposthiidae. Longitudinal alae throughout the body. Paired ovaries. Spicules and gubernaculum present.

Number of species: 2

Type species: *Rhinema retrorsum* Cobb, 1920

**7.13.2.4 Family Richtersiidae Kreis, 1929  
(a supplement to Desmodorida)**

*Diagnosis:* Desmodorida. Body short and stout, from cylindrical to sacciform. Cuticle finely annulated with longitudinal rows of small spines. Anterior sensilla arranged in six + ten pattern, all the anterior sensilla setose. Amphideal fovea ventrally coiled, uni- to multispiral, or of any other derived shape. Broad mouth opening surrounded with six soft lips and a cuticular collar. Buccal cavity nearly cylindroid, with weakly sclerotized walls. Pharynx short, cylindrical, evenly muscular. Only one anterior

testis. No precloacal supplementary except modified cuticular spines. Strictly marine.

Type genus: *Richtersia* Steiner, 1916 (two genera)

This peculiar nematode taxon was initially established by Kreis (1929) as a subfamily, Richtersiacea, within Chromadoridae s.l. with some remarks on the similarity of *Richtersia* to desmoscolecids (body shape and cuticular spines). Filipjev (1934) placed Richtersiidae close to Cyatholaimidae (Chromadorida) because of the pharynx structure, spiral amphid and punctated cuticle. Other authors (Chitwood & Chitwood 1950, de Coninck 1965, Gerlach & Riemann 1973) have specified the position of Richtersiidae in the Desmodorida. Lorenzen (1981, 1994) included *Richtersia* (the only known richtersiid genus at that time) in the family Selachinematidae (Chromadorida) on the basis of *Richtersia* relating to one of the selachinematid genera, namely *Latronema*, because of similarity in the structure of the labial region, setiform anterior sensilla and faltering cuticular ridges along the body (see also Boucher 1975). Classification of *Richtersia* in the Selachinematidae was widely adopted (e.g., Pastor de Ward & Lo Russo 2007, Neira & Decraemer 2009). However, the cuticular ridges of *Latronema* have no spines and are not similar to those of *Richtersia* (personal observations).

Richtersiidae differs significantly from other families of the Desmodorida in pattern of anterior sensilla, six + ten (all setose) versus six + six + four (only cephalic sensilla setose). Position of the family Richtersiidae within Desmodorida is adopted here conventionally and should be investigated further.

**Genus *Desmotersia* Neira & Decraemer 2009  
(Fig. 7.113 D–G)**

*Diagnosis:* Richtersiidae. Body cuticle with a narrow lateral ridge. Head set-off from the body by a thick sclerotized capsule. Buccal cavity (pharyngostoma) with a dorsal tooth.

Type and only species: *Desmotersia levinae* Neira & Decraemer, 2009

**Genus *Richtersia* Steiner, 1916 (Fig. 7.113 A–C, 7.115 E)**

*Diagnosis:* Richtersiidae. No lateral differentiation of the body cuticle. No head capsule. Buccal cavity unarmed.

Number of species: 19

Type species: *Richtersia collaris* Steiner, 1916



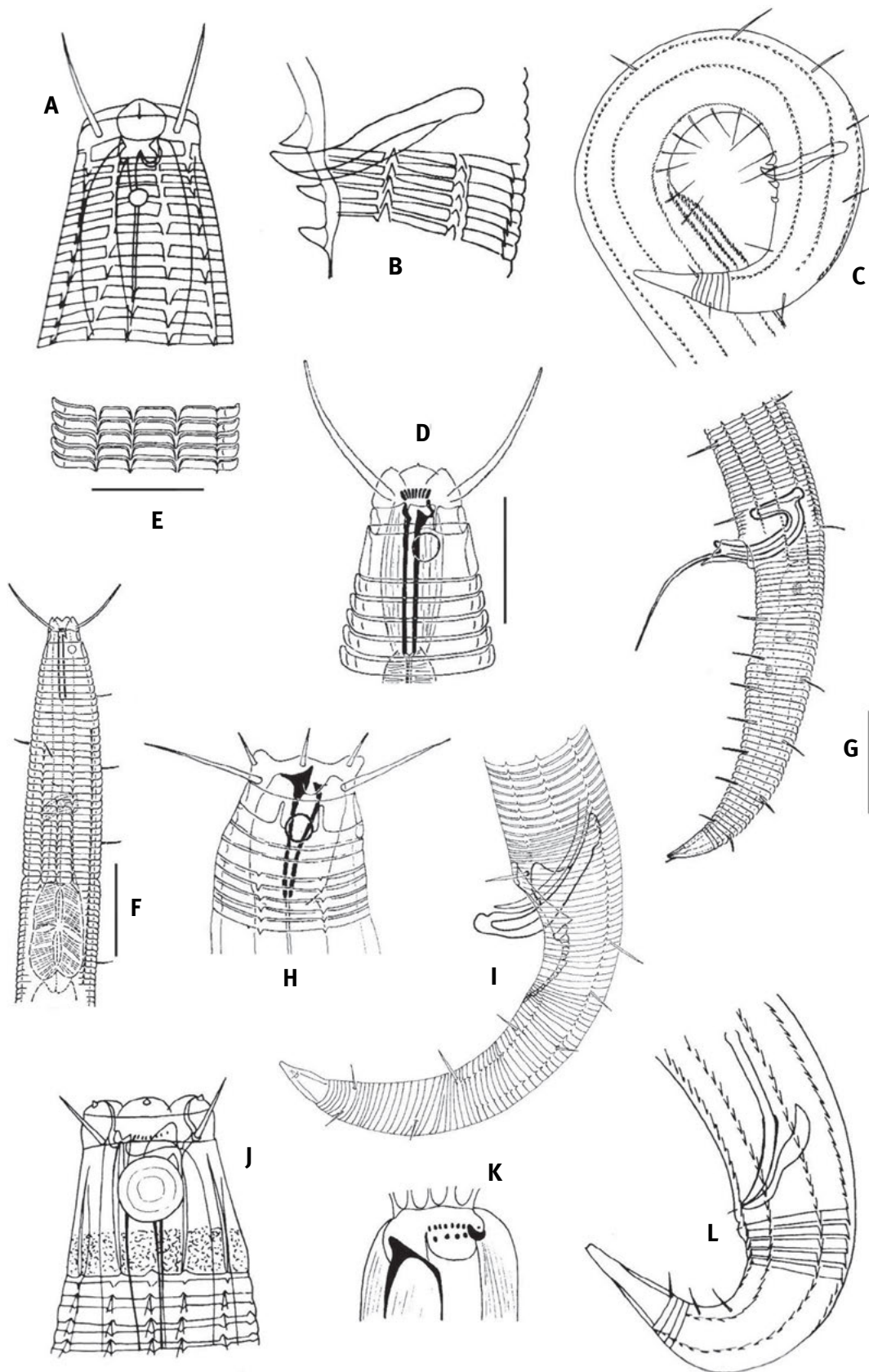
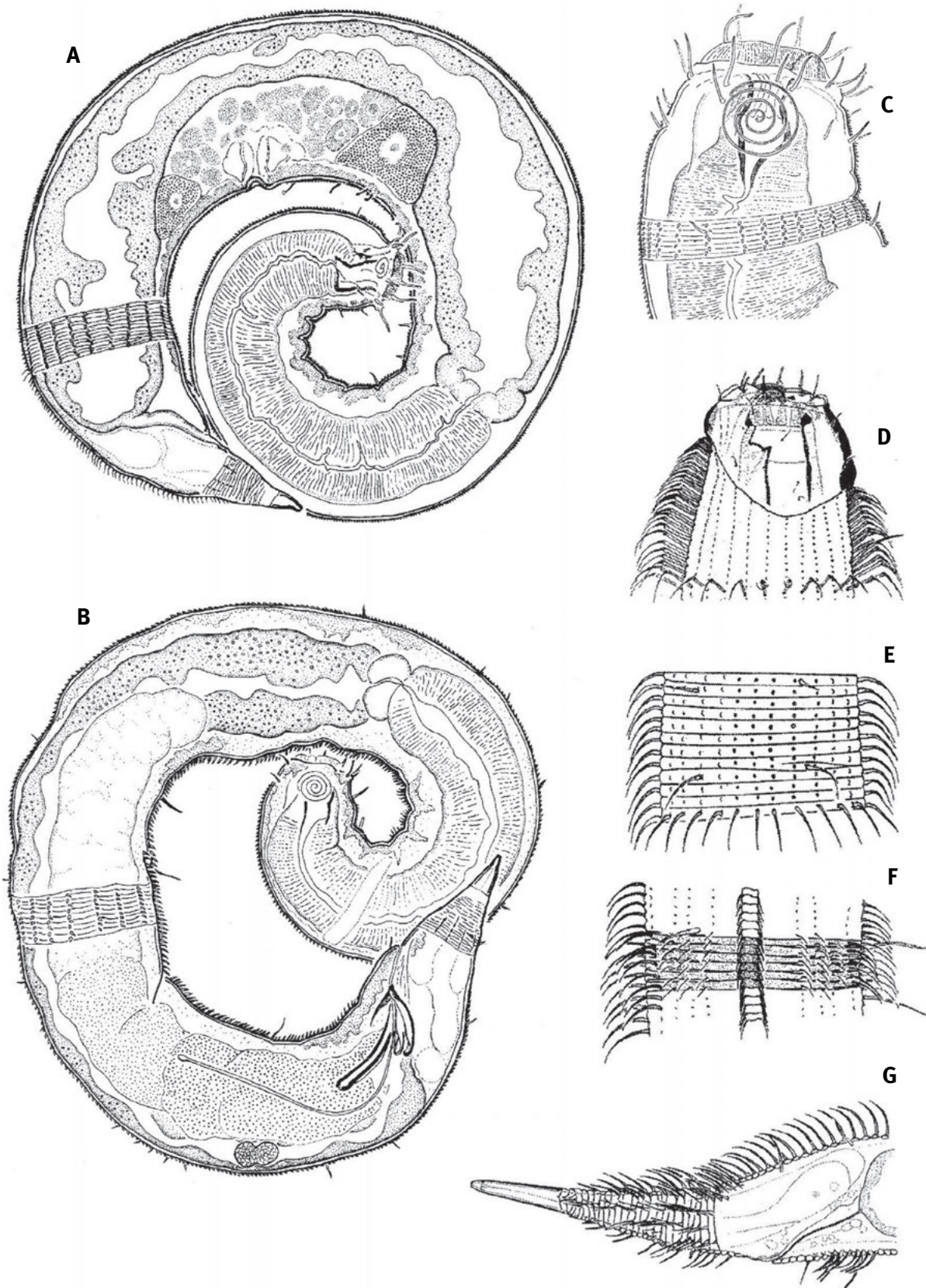
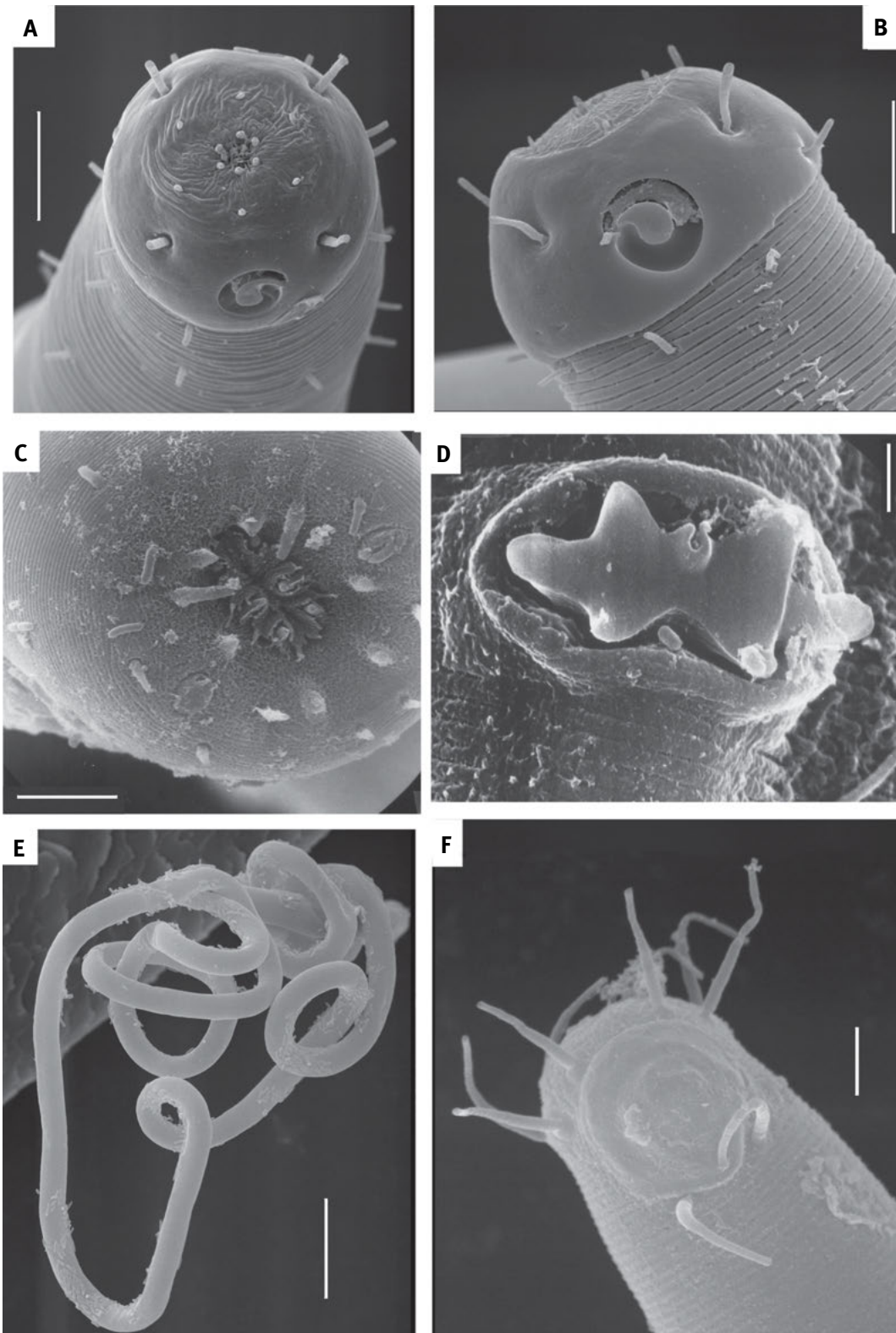


Fig. 7.112: Monoposthiidae, examples. A–C, *Monoposthia costata* (from Gerlach 1963a, Taf. 13, Fig. A–C); D–G, *Monoposthioides anoposthia* (from Hopper 1963, Fig. 11–18); H–I, *Nudora omercooperi* (from Inglis 1965, Fig. 1, 8); J–L, *Rhinema retrorsum* (from Gerlach 1963a, Taf. 13, Fig. D–F).



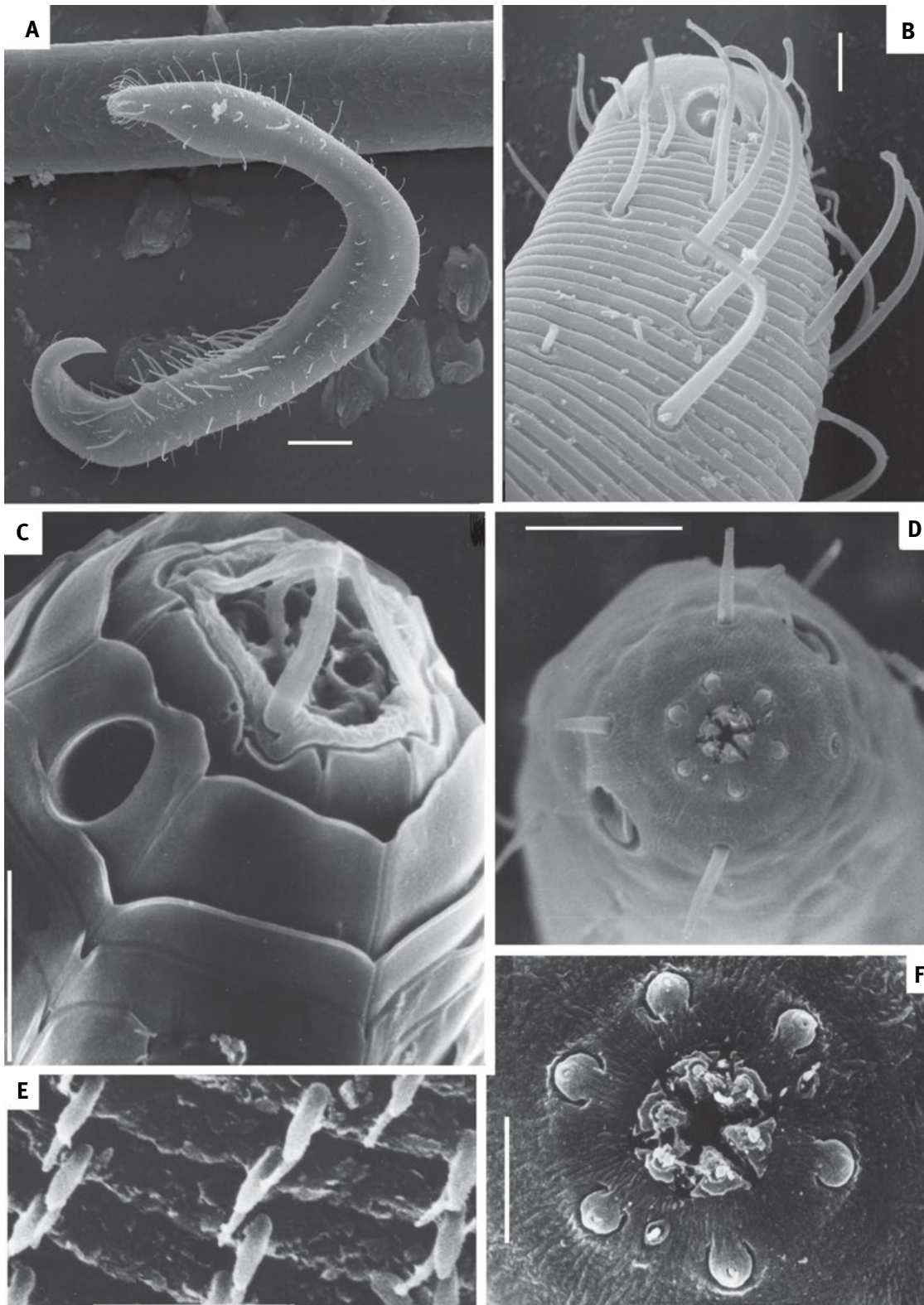


**Fig. 7.113:** Richtersiidae, examples. A–C, *Richtersia inaequale*, White Sea, original drawings of Yu. Okhlopkov (A, entire female; B, entire male; C, male head); D–G, *Desmotersia leviniae* (adapted from Neira & Decraemer 2009) (D, female head; E, cuticle just posterior to neck region; F, cuticle with lateral ridge posterior to the neck region; G, female tail).



**Fig. 7.114.** Desmodoridae, SEM pictures. A, *Desmodora* sp. (Desmodorinae), head apically, hydrothermal site of the north MidAtlantic Ridge. Scale bar: 10  $\mu$ m. B, *Desmodora* sp. (Desmodorinae), head laterally, hydrothermal site of the north MidAtlantic Ridge. Scale bar: 10  $\mu$ m; C, *Chromadoropsis vivipara* (Spiriniinae), labial region, intertidal zone, White Sea. Scale bar: 10  $\mu$ m; D, *Chromadoropsis vivipara* (Spiriniinae), midventral supplementary organ, intertidal zone, White Sea. Scale bar: 3  $\mu$ m; E, *Parabostrichus bathyalis* (Stilbonematinae) with bacterial ectosymbionts, entire, deep-sea canyon in the North Atlantic Ocean. Scale bar: 30  $\mu$ m; F, *Parabostrichus bathyalis* (Stilbonematinae) anterior end laterally, deep-sea canyon in the North Atlantic Ocean. Scale bar: 3  $\mu$ m.





**Fig. 7.115:** Draconematidae, Monoposthiidae, Aponchiidae and Richtersiidae, SEM pictures. A, *Prochaetosoma* sp. (Draconematidae, Chaetosomatinae), male, entire, hydrothermal site of the north MidAtlantic Ridge. Scale bar: 30  $\mu\text{m}$ . B, *Prochaetosoma* sp. (Draconematidae, Chaetosomatinae), head, hydrothermal site of the north MidAtlantic Ridge. Scale bar: 3  $\mu\text{m}$ . C, *Nudora septentrionalis* (Monoposthiidae), head, White Sea. Scale bar: 10  $\mu\text{m}$ . D, *Syonema cosmopoliticum* (Aponchiidae), head, Moscow marine aquarium. Scale bar: 10  $\mu\text{m}$ . E, *Richtersia inaequalis* (Richtersiidae), cuticle, White Sea. Scale bar: 5  $\mu\text{m}$ . F, *Syonema cosmopoliticum* (Aponchiidae), labial region, Moscow marine aquarium. Scale bar: 5  $\mu\text{m}$ .

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