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NYGOLAIMINA OF INDIA

By

MAQSOOD AHMAD & M. S. JAIRAJPURI

Section of Nematology, Dept. of Zoology,
Aligarh Muslim University, Aligarh, India.

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INTRODUCTION

The members of the order Dorylaimida (De Man, 1876) Pearse, 1942 possess either an axial spear or a mural tooth. The mural tooth is subventrally or subdorsally located on the wall of the pharynx. The nematodes belonging to the superfamily Nygolaimoidea De Coninck, 1965 possess a subventral mural tooth while it is subdorsally located in the genus *Campydora* Cobb, 1920 (family Campydoridae (Thorne, 1935) Clark, 1961) which was raised to superfamilial rank by Jairajpuri *et al.* (1976). Recently, Ahmad & Jairajpuri (1979) have brought Nygolaimoidea and Campydoroidea together and proposed the suborder Nygolaimina for their reception.

Cobb (1913) proposed the genus *Nygolaimus* based on a single immature female of *N. pachydermaias.* Later on, three more species, vig, *N. denticulatus, N. menzli, N. smadini* were added by Cobb (1922,) Micoletzsy (1925,) Filipjev (1928) respectively. Thorne (1930) described ten species of *Nygolaimus* with notes on its morphology and biology. He (l.c) split *Nygolaimus* into two subgenera, viz., *Nygolaimus* and *Nygolaimium* and also proposed another genus *Sectonema.* Thorne (1935) proposed the subfamily Nygolaiminae under Dorylaimidae De Man, 1876 for *Nygolaimus* and *Sectonema* and in 1939 added two more genera *Oionchus* Cobb, 1913 and *Enoplocheilus* Kreis, 1932 to this group. He (l.c.) also described two more species of *Nygolaimus viz., N. laevis* and *N. rapax* and proposed the genus *Nygellus* closely related to *Nygolaimus.* He, however, placed *Nygellus in* the family Belondiridae Thorne, 1939 because of its having a spiral muscle sheath around the oesophagus. Loose (1949) proposed the genus *Nygolaimellus,* but kept it in Belondiridae near *Nygellus.*

T. Goodey (1951) and Hopper & Cairns (1959) accepted the classification proposed by Thorne (1939). Hopper & Cairns (1959) also included *Bathyodontus* Fielding, 1950 in the subfamily Nygolaiminae and regarded *Miroloimus* Andrassy, 1956 as its synonym. Meyl (1961) elevated Nygolaiminae to the rank of a family and proposed the genus *Nygolaimoides.* Clark (1961) recognized two subfamilies Nygolaiminae and Nygolaimellinae under Nygolaimidae. He removed *Nygellus* and *Nygolaimellus* from Belondiridae and placed them in Nygolaimidae, respectively in Nygolaiminae and Nygolaimellinae and also proposed the family Bathyodontidae under the superfamily Mononchoidea (Chitwood, 1937) Clark, 1961 for *Bathyodontus, Mirolaimus* and *Oiochus.* Baker (1960) followed Meyl (1961) but also included *Stephanium* Rahm, 1938 under Nygolaimidae. Williams (1962)

proposed the genus *Aetholaimus* and kept it in the family Nygolaimidae. Jairajpuri (1964) proposed Nygellidae with two subfamilies ; Nygellinae Andrassy, 1958 for *Nygellus* and Nygolaimellinae for *Nygolaimellus* respectively. He included only *Nygellus*, *Sectonema*, *Stephanium* and possibly *Nogolaimoides* in the family Nygolaimidae. Thorne (1964) accepted Jairajpuri's (1964) classification, proposed the superfamily Belondiroidea, and kept Nygellidae under it. Jairajpuri (1964) first placed *Aetholaimus* in the family Actinolaimidae (Thorne, 1939) Meyl, 1960, but in 1965 transferred it to a separate subfamily Aetholaiminae under Nygolaimidae De Coninck (1965) gave superfamilial rank to the family Nygolaimidae. Heyns (1964). removed *Sectonema* from Nygolaimidae and placed it in the family Aporcelaimidae. Siddiqi (1968) elevated Nygolaimellinae to familial rank in the superfamily Belondiroidea and kept *Nygolaimellus* and *Nygellus* under it. Heyns (1968) made several changes in the classification of Nygolaimidae and Nygolaimellidae, he also did not accept Nygollidae and kept *Nygellus* in Nygolaiminae, and also Aetholaiminae under Nygolaimidae. He (l c.) split the genus *Nygolaimus* into ten subgenera based on the shape of lip region, tooth and tail etc Loof and Coomans (1970) raised the subgenus *Paravulvus* proposed by Heyns (1968) to generic level chiefly on the basis of arrangement of oesophageal gland nuclei and their orifices. Ferris (1971) accepted the classification proposed by Heyns (1968), but she accepted Nygellidae as valid and placed *Nygellus* in Belondiroidea. Loof (1973) placed *Nygolaimium* under Aporcelaimidae. Thorne (1974) raised all the subgenera of genus *Nygolaimus* proposed by Heyns (1968) to generic ranks. Heyns (1968) and Thorne (1974) did not accept Nygolaimoidea as was proposed by De Coninck (1965). Recently Andrassy (1976) has accepted Nygolaimoidea and recognized two families under it, viz., Nygolamidae and Aetholaimidae. He placed the genara *Nygolaimellus*, *Sectonema*, *Scapidens* and *Aporcelaimoides* in Nygolaimellinae under Aporcelaimidae and also proposed another subfamily Nygolaimlinae for *Nygolaimus* under Nygolaimidae.

Cobb (1920) proposed the genus *Campydora* for *C. demonstrans*. Thorne (1935) proposed the subfamily Campydorinae for this genus. In 1939, he provided detailed morphological ob ervations on this species and doubtfully placed Campydorinae under Leptonchidae Thorne, 1935. Clark (1961) raised Campydorinae to the rank of a family but also included in it the genera *Tyleptus* Thorne, 1939 and *Aulolaimoides* Micoletzky, 1915. Goodey (1963) followed Clark (1961) but Jairajpuri (1964) took out *Aulolaimoides* from this group, proposed a separate family Aulolaimoididae for it, shifted *Tyleptus* to Leptonchidae and left only *Campydora* under Campydoridae. Khera (1970) suppressed Campydoridae to the level of a subfamily, but Ferris (1971) followed the classification of Jairajpuri (1964).

Recently Andrassy (1976) kept Campydoridae in the superfamily Leptonchoidea (Thorne, 1935) Ferris, 1971. Jairajpuri *et al.*, (1976) raised Campydoridae to the rank of a superfamily.

A detailed study of morphology and taxonomy of nygolaims immediately reveals that although included under Dorylaimina (De Man, 1876) Pearse, 1942, they widely differ from the typical dorylaims in a number of important characters. First and the foremost is the presence of a non-axial mural tooth. The other differences are in the form of pharynx and oesophagus. Most of the nygolaims usually possess three cardiac glands at the junction of oesophagus and intestine. All are predatory in habit. So it appears quite logical and justified that the two superfamilies Nygolaimoidea and Campydoroidea, which basically bear a mural tooth should be united. Consequently, Nygolaimoidea were removed from the suborder Dorylaimina and were given a full subordinal rank by Ahmad & Jairajpuri (1979). As a result of this elevation, some other taxonomic categories are also being proposed here to bring the classification of nygolaims atpar with Dorylaimina which in the recent years has been considerably reviewed and raised (of Siddiqi, 1969 ; Ferris, 1971 ; Andrassy, 1976). The location of mural tooth, subdorsally or subventrally, on the wall of the pharynx and the shape of pharynx itself are important characters of fundamental value in the classification of Nygolaimina.

An outline classification of the suborder Nygolaimina is provided in Table I, followed by the diagnoses of various new and already proposed taxonomic categories.

The specimens were fixed in hot 4% formalin, transferred into glycerine alcohol (5 parts glycerine and 95 parts 30 alcohol), dehydrated slowly in a desiccator at room temperature and mounted in dehydrated glycerine.

The authors are thankful to the Head, Department of Zoology, Aligarh Muslim University for providing necessary laboratory facilities. The first author also thanks C. S. I. R., New Delhi for financial assistance.

DIAGNOSES OF TAXA

NYGOLAIMINA Ahmad & Jairajpuri, 1979

Diagnosis : Mural tooth present, subventrally or subdorsally located on wall of pharynx. Stoma simple or sclerotized. Oesophagus with an anterior slender part and an expanded basal portion Three cardiac glands usually present at junction of oesophagus and intestine. Female reproductive system amphidelphic, rarely mono opisthodelphic. Vulva transverse, rarely longitudinal. Males with ventromedian supplements and two equal spicules. Tails similar in both sexes.

Type superfamily : Nygolaimoidea De Coninck, 1965

Other Superfamily : Campydoroidea Jairajpuri, Ahmed & Bajaj, 1976.

NYGOLAIMOIDEA De Coninck, 1965

Diagnosis (emended) : Mural tooth on left subventral wall of pharynx. Pharynx eversible, in three section, viz; distal, median, proximal. Median and proximal (basal) parts thickwalled ; distal part (vestibulum) thin-walled. Oesophagus with an anterior slender part and an expanded basal portion. Basal expanded part of oesophagus may rarely be bibulbar and is usually enclosed in a thin or a conspicuous sheath forming basal pockets. Three cardiac glands or a cardiac disc present at the junction of oesophagus and intestine. Female reproductive system amphidelphic, rarely mono-opisthodelphic. Vulva transverse, rarely longitudinal. Males with an adanal and ventromedian supplements. Spicules generally massive, gubernaculum present or absent. Lateral guiding pieces present. Prerectum present. Tail variable in shape and size but similar in both sexes.

Type family : Nygolaimidae (Thorne, 1935) Meyl, 1961

Nygolaimidae (Thorne, 1935) Meyl, 1961

Diagnosis (emended) : Cuticle relatively thin with transverse striations on inner, outer or on both layers. Lips usually closely amalgamated, either confluent or offset with bodycontour Mural tooth variable in shape and size. Stoma simple without sclerotization. Pharynx eversible, in three sections. Basal expanded part of oesophagus enclosed in a thin or a conspicuous sheath forming basal pockets. Three well developed cardiac glands present at base of oesophagus. Female reproductive system amphidelphic ; ovaries paired, reflexed. Vulva transverse, rarely longitudinal. Males with ventromedian supplements, well developed spicules and lateral guiding pieces. Gubernaculum present or absent. Tails of variable shapes and sizes, similar in both sexes.

Type subfamily : Nygolaiminae Thorne, 1935

Nygolaiminae Thorne, 1935

Diagnosis : Body small to large sized (0.7-7. 2mm), almost straight to strongly ventrally curved upon fixation. Cuticle and subcuticle with fine transverse striations. Lip region continuous or set off with body contour. Mural tooth large and linear, deltoid or dorylaimoid in shape. Cardiac glands large rounded or ovoid. Vulva transverse. Males with arcuate spicules, ventromedian supplements (2-7) and lateral guiding pieces. Gubernaculum present or absent. Tail varies from short convex-conoid, elongate-conoid, hemispherical, bluntly rounded to clavate.

Solididentinae N. Subfam.

Diagnosis : Body small to medium sized (0.94-3.60 mm) ; almost straight to strongly ventrally curved ('C' or 'S' shaped) upon fixation. Subcuticle with distinct transverse striae. Lip region usually set off from body contour. Mural tooth small, solididentoid or acicular. Cardiac glands small, rounded or ovoid. Vulva transverse. Gubernaculum absent. Ventromedian supplements 1-3, poorly developed. Tails short, bluntly rounded, hemispherical or long with clavate terminus.

Type genus : *Solididens* Heyns, 1968

Paravulvinae N. Subfam.

Diagnosis : Relatively small (1-2 mm) nematodes. Body ventrally curved upon fixation. Cuticle and subcuticle with fine or distinct transverse striae. Lip region continuous or slightly set off by a depression. Mural tooth small. Oesophageal gland nuclei comparatively large and conspicuous. Cardiac glands ovoid with their long axis lying parallel to length of body. Paravulvae present. Vulva longitudinal. Males with massive spicules, slender gubernaculum and well developed ventromedian supplements (7-11). Tails variable in shape, short blunty rounded, dorsally convexconoid to elongate conoid.

Type and only genus : *Paravulvus* Heyns, 1968

Nygellidae (Andrássy, 1958) Jairajpuri, 1964

Diagnosis : Cuticle thin with fine transverse striations. Lip region continuous with body contour. Mural tooth deltoid or linear. Stoma simple, not sclerotized. Pharynx eversible, in three sections. Basal expanded part of oesophagus spirally striated. Three cardiac glands present at base of oesophagus. Female reproductive system monopisthodelphic. Vulva transverse. Tail clavate. Males unknown.

Type and only subfamily : Nygellinae Andrássy, 1958

Nygellinae Andrássy, 1958

Diagnosis (emended) : Body small (usually less than 1 5 mm) almost straight to slightly ventrally curved. Cuticle and subcuticle with fine transverse striations. Lip region continuous with body contour. Mural tooth very small (5-7 μm), linear or deltoid. Basal expanded part of oesophagus surrounded by distinct sheath of spiral muscles. Cardiac glands small, ovoid. Female reproductive system monopisthodelphic. Vulva transverse. Tail short, elongate-clavate. Males unknown.

Type and only genus : *Nygellus* Thorne, 1939

Aetholaimidae (Jairajpuri, 1965) Andrassy, 1976

Diagnosis (emended) : Lip region discoid, distinctly set off from body contour. Mural tooth linear or deltoid. Stoma sclerotized consisting of a bowl-shaped vestibule and inner chamber supported by six small ribs. Pharynx in three sections, walls comparatively thinner. Oesophagus with an anterior slender part and a basal expanded portion. the latter enclosed in sheath. Cardiac glands well developed. Female reproductive system amphidelphic. Vulva transverse, vagina sclerotized. Tail hemispherical or convex-conoid.

Type subfamily : Aetholaiminae Jairajpuri, 1965

Aetholaiminae Jairajpuri, 1965

Diagnosis : Lip region discoid, distinctly set off from body contour. Lips closely amalgamated. Stoma sclerotized. Mural tooth short, deltoid. Guiding ring single. Cardiac glands small, ovoid. Cardia absent. Female reproductive system amphidelphic. Vulva transverse. Males unknown. Tail hemispherical, slightly clavate.

Type and only genus : *Aetholaimus* Williams, 1962

Nygolaimellidae (Clark, 1961) Siddiqi, 1968

Diagnosis (emended) : Cuticle moderately thick with distinct lateral pores. Lip region continuous or distinctly set off by a constriction, often wider than adjoining body. Mural tooth deltoid, located on left subventral wall of the pharynx. Stoma simple. Pharynx eversible, in three sections and with thickened walls, rarely with a rasp-like area. Basal expanded part of oesophagus comparatively longer, bibulbar, enclosed in a thin to moderately developed sheath. Cardiac disc present at junction of oesophagus and intestine. Cardia rounded or bluntly conoid. Female reproductive system amphidelphic. Vulva transverse. Males with well developed ventromedian supplements and lateral guiding pieces. Gubernaculum absent. Spicules with lateral apical thickenings. Tails similar in sexes, conoid.

Type subfamily : Nygolaimellinae Clark, 1961

Nygolaimellinae Clark, 1961

Diagnosis : Cuticle thick with distinct lateral pores. Lip region distinctly set off and wider than adjoining body. Mural tooth deltoid. Pharynx eversible, in three sections with thickened walls. Basal expanded part of oesophagus bibulbar, occupies about two-thirds of oesophageal length. Cardiac disc present at junction of oesophagus and intestine. Female reproductive system amphidelphic. Vulva transverse. Male with

well developed spicules, ventromedian supplements and lateral guiding pieces. Gubernaculum absent. Tails short, conoid.

Type genus : *Nygolaimellus* Loos, 1949

Nygolaimiinae Andrassy, 1976

Diagnosis : Cuticle thick with or without distinct lateral pores. Lip region continuous or set off by a constriction. Mural tooth deltoid. Pharynx eversible, in three sections with a rasp-like area of minute denticles. Basal expanded part of oesophagus occupying about one half or more of oesophageal length. Cardiac disc present at junction of oesophagus and intestine. Cardiac conoid. Female reproductive system amphidelphic. Vulva transverse. Males with well developed spicules, ventromedian supplements and lateral guiding pieces. Tails short, bluntly rounded.

Type genus : *Nygolaimium* (Thorne, 1930) Heyns, 1968

CAMPYDOROIDEA (Thorne, 1935) Jairajpuri, Ahmad & Bajaj, 1976

Diagnosis (emended) : Mural tooth small, located on subdorsal wall of pharynx. Stoma non-sclerotized. Pharynx narrow, tubular. Oesophagus with a long anterior slender part and a distinct basal expanded bulb, with a conspicuous, thick-walled 'triquetrous chamber' Oesophageal lumen very wide. Cardia hemispherical, cardiac glands absent. Excretory pore and excretory duct present. Female reproductive system amphidelphic. Vulva transverse. Prerectum absent. Tail-elongate-conoid with prominent caudal papillae near its middle. Males unknown.

Type and only family : Campydoridae (Thorne, 1935) Clark, 1961

Campydoridae (Thorne, 1935) Clark, 1961

Diagnosis (emended) : Cuticle relatively thin. Lip region slightly set off from body by a depression. Mural tooth subdorsally located on wall of pharynx. Pharynx tubular with thickened walls. Basal oesophageal bulb with a conspicuous and thick-walled 'triquetrous chamber' Oesophageal lumen wide. Excretory pore and duct well developed. Cardia hemispherical. Female reproductive system amphidelphic. Vulva transverse. Prerectum absent. Tail elongate-conoid with prominent caudal papillae near its middle. Males unknown.

Type and only subfamily : Campydorinae Thorne, 1935

Campydorinae Thorne, 1935

Diagnosis (emended) : Small sized (0.48-0.68 mm) nematodes. Body almost straight upon fixation. Cuticle with distinct transverse striations.

Lip region set off by a depression and often wider than adjoining body. Pharynx narrow and tubular. Mural tooth small, hollow, located on sub-dorsal wall of pharynx. Basal oesophageal bulb with a triquetrous chamber. Oesophageal lumen wide. Oesophageal glands three ; one dorsal and two subventrals. Excretory pore and excretory duct cuticularized. Cardia hemispherical. Female reproductive system amphidelphic. Vulva transverse. Prerectum absent. Tail elongate-conoid with prominent caudal papillae near its middle. Males unknown.

Type and only genus : *Campydora* Cobb, 1920

Key to Familial Groups and Genera of NYGOLAIMINA

1. Mural tooth subdorsally located on the wall of pharynx ; basal part of oesophagus small with a well developed triquetrous chamber..... ..... Campydoroidea, Campydoridae, Campydorinae, *Campydora* Mural tooth subventrally located on the wall of pharynx ; basal expanded part of oesophagus long without a triquetrous chamber.....Nygolaimoidea. 2

2. Female reproductive system mono-opisthodelphic..... Nygellidae, Nygellinae, *Nygellus*. Female reproductive system amphidelphic..... 3

3. Stoma sclerotized..... ..... Aetholaimidae, Aetholaiminae, *Aetholaimus* stoma not sclerotized.....4

4. Cuticle very thick ; basal expanded part of oesophagus about two third of oesophageal length ; cardiac disc may be present..... .....Nygolaimellidae 14
   Cuticle relatively thin, basal expanded part of oesophagus about half of oesophageal length ; cardiac glands present.....Nygolaimidae 5

5. Vulva longitudinal ; paravulvae usually present..... ..... Paravulvinae n. subfam ; *Paravulvus* vulva transverse ; paravulvae absent.....6

6. Mural tooth deltoid to linear or dorylaimoid.....Nygolaiminae 7
   Mural tooth solididentoid or acicular.....Solididentinae n. subfam. 12

7. Tail elongate-conoid, ventrally arcuate.....*Afronygus* Tail short, convex-conoid, hemispherical or clavate..... 8

8. Tooth dorylaimoid.....*Laevides*
   Tooth deltoid or linear.....9

9. Lip region set off by constriction..... 10
   Lip region continuous (except in *Aquatides christei*).....11

10. Males without gubernaculum and with weakly developed ventromedian supplements .....*Nygolaimus*
    Males with gubernaculum and well developed ventromedian supplements..... .....*Paranygolaimus*.. .....

11. Tooth linear ; body usually straight ; tail convex-conoid to hemispherical..... .....*Aquatides*.....
    Tooth deltoid to linear ; body ventrally curved ; tail hemispherical to clavate..... .....*Clavicaudoides*.....

12. Body 'C' or 'S'-shaped ; lip region set off by a constriction.....*Solididens*
Body almost straight ; lip region continuous.....13

13. Tail short, bluntly rounded.....*Feroxides*
Tail long with clavate terminus.....*Clavicauda*

14. Pharynx with a rasp-like area of minute denticles.....Nygolaimiinae, *Nygolaimium*
Pharynx without a rasp-like area.....Nygolaimellinae 15

15. Basal expanded part of oesophagus bibulbar, cardiac disc present.....*Nygolaimellus*
Basal expanded part of oesophagus simple ; cardiac disc absent.....16

16. Mural tooth dorylaimoid, long with a dorsal aperture.....*Aporcelaimoides*
Mural tooth small, without a dorsal aperture.....*Scapidens*

Morphology of Nygolaims

Body shape and size :

The body of nygolaims is generally ventrally curved upon fixation, but may assume almost straight to 'J', 'C' or 'S' shape. Species belonging to the genera *Nygolaimus*, *Afronygus*, *Paravulvus*, *Nygolaimellus*, *Aetholaimus* etc., have ventrally curved or C-shaped bodies, *Laevides*, *Aquatides*, *Clavicauda*, *Feroxides*, *Campydora* almost straight, *Solididens* 'S'-shaped, while *Clavicaudoides* may assume 'J' shape upon fixation. Both sexes have similar body postures except that the males have stronger ventrally curved posterior extremities.

The body size of species of nygolaims varies from 0.5 mm (*Campydora demonstrans*) to over 7.0 mm (*Laevides loofi*). However, in majority of the species the body length is in the range of 1-3 mm.

Cuticle :

The cuticle is made up of two principal layers, the inner and outer, the inner layer is usually thin and the outer one is thick. The thickness of the cuticle varies from 1 to 5 mm at midbody, but on tail it may be thicker 6-15 mm The cuticle as well as subcuticle is usually transversely striated, e.g., *Clavicaudoides*, *Solididens*, *Paravulvus*, *Campydora* etc. The radial striae may be present on the tail region in some species of the genus *Nygolaimus* (sensu stricto).

Lip region :

Lips are usually angular or rounded. The lip region may be symmetrical or asymmetrical (*Aquatides*), confluent with body (*Laevides*, *Nygellus*) or distinctly set off (*Nygolaimus*, *Paranygolaimus*, etc.) and is usually equal to width of adjoining body (*Nygolaimus*, *Laevides*, *Solididens*, etc.). Labial papillae may or may not be elevated. The lip region is disc-like in *Aetholaimus*.

En face view :

En face view shows six lips of same size along with sixteen papillae that are arranged in two rows. In *Aetholaimus* the *en face* view is hexagonal with six amalgamated lips each bearing a solitary papilla and inner sclerotization, if present, appearing as ribs. The amphids are usually stirrup-shaped with slit-like apertures occupying about one-third to one half of the corresponding body-width.

Mural tooth :

The possession of a non-axial mural tooth is the chief diagnostic feature of nygolaims. It may be subventrally or subdorsally (Campydoroidea) located on the wall of pharynx. The shape and length of the tooth is greatly variable. It may be deltoid (*Nygolaimus*, *Paranvgolaimus*, *Afronygus*, *Clavicaudoides*, *Paravulvus*), linear (*Aquatides*, *Nygellus*), acicular (*Clavicauda*) or solididentoid (*Solididens*, *Feroxides*). It may be dorylaimoid type showing a dorsal aperture in *Laevides*. The length of tooth also varies from 4·5 μm (*Campydora*) to 29.0 μm (*Aquatides*).

Pharynx :

Coomans (1963) believes that nygolaims are more primitive than the stylet bearing dorylaims. The pharynx of nygolaims is usually eversible (Nygolaimoidea) or a simple narrow tube (Campydoroidea). In Nygolaimoidea, the pharynx is composed of a distal, a median and a proximal (basal) part. The distal part or vestibulum is thin-walled, while the median and proximal parts are thick-walled. Coomans (1963) stated that the guiding ring is formed by the walls of pharynx. It is usually single and weakly developed. The tooth is inserted on a support in the subventral (Nygolaimoidea) or subdorsal (Campydoroidea) wall of pharynx. The proximal or basal part of pharynx is surrounded by oesophageal tissues at base. The pharynx is exhibited by rasp-like area with minute denticles in *Nygolaimium*. In family Aetholaimidae the pharynx is partly sclerotized consisting of an outer bowl-shaped vestibule and inner chamber supported by six sclerotized ribs.

Oesophagus :

The oesophagus of nygolaims usually consists of an anterior slender part and a basal expanded part. The slender part is muscular while the expanded part is glandular in composition. The basal expanded part of oesophagus is usually longer than the anterior slender part (Nygolaimoidea) or it is a short basal bulb (Campydoroidea). The basal bulb in Campydoroidea possesses a well developed triquetrous chamber with cuticular walls. Basal expanded part of oesophagus in Nygolaimoidea is usually surrounded

by a sheath, which may be thin or very conspicuous, forming basal pockets. In *Nygellus* this sheath is spirally striated as in belondirid nematodes. In Nygolaimellidae the basal expanded part of oesophagus is sometime bibulbar, enclosed in a thin to moderately developed sheath. Five (Nygolaimoidea) or three (Campydoroidea) oesophageal gland nuclei are located in the basal part of oesophagus ; one dorsal and the others subventral in position. In *Paravulvus*, *Aquatides*, *Aetholaimus* the gland nuclei are exceptionally large in size. The lumen of oesophagus is triradiate at all levels. It may be narrow (Nygolaimoidea) or wide (Campydoroidea).

Cardia and cardiac glands: The oesophago-intestinal junction characteristically possesses three cardiac glands. These may be poorly (*Solididens*, *Feroxides*, *Clavicauda*) or well developed (*Aquatides*, *Paravulvus*, *Nygolaimus*) or may be absent (*Nygolaimellus*, *Campydora*). The shape of cardiac glands varies from rounded (*Aetholaimus*, *Nygellus*) to ovoid (*Nygolaimus*, *Aquatides*, *Paravulvus*) and lie with their long axis perpendicular to the length of body, except *Paravulvus* in which their long axis is parallel to the length of body. In Nygolaimellidae, a disc is present at the junction of oesophagus and intestine. In majority of the nygolaims cardia is less developed, but it is very well developed in *Campydora*. However, below the cardiac glands a large glandular chamber is present in the lumen of intestine in *Paravulvus*.

Intestine :

The intestine of nygolaims is usually oligocytous and contains more than ten cells. It is tubular and composed of a single layer of epithelial cells.

Prerectum :

The prerectum is present in all nygolaims except *Campydora*. It is tubular and is about 2-7 anal body-widths long. The beginning of prerectum is marked by a constriction in the lumen of the intestine. The cells of prerectum are almost similar to those of intestine.

Rectum :

The rectum is dorsoventrally flattened, separated from the prerectum by a coustrietion. In some species of *Clavicaudoides*, the prerectum dorsally. The rectum opens to the exterior through the anus.

Females reproductive system :

All members of the suborder Nygolaimina are amphidelphic with the exception of Nygellidae which possesses only a posterior reproductive branch. Each reproductive branch consists of an ovary, oviduct, uterus. According to Coomans (1954) the reproductive organs of nygolaims are less developed as compared to other dorylaims.

The ovary is reflexed lying dorsally or ventrally ; oocytes area few to many, arranged in a single or multiple rows except at the tip where the proliferation of germ cells takes place. The ovary is connected to the oviduct subterminally. Oviduct consists of a distal narrow and an enlarged proximal part. The latter is irregular in outline and may not contain ova. The uterus and oviduct area separated by a well developed sphincter except in *Campydora* in which it is obscure. The uterus is the most variable part of the female reproductive system. It also has a narrow distal and an expanded proximal part which may contain ova. The shell of the ova of nygolaims may be chitinous. The vagina is narrow and extends from one-third to one-half of vulval body-width. It is non-sclerotized but in *Aetholaimus* cuticularized pieces are present. The vulva is usually transverse in all nygolaims except *Paravulvus* in which it is longitudinal. In the latter genus the pores anterior and posterior to vulva are transformed into special organs for which Heyns (1968) has coined the term 'paruvulvae'. These are longitudinal depressions on the cuticle leading to clear kidney-shaped areas. The number of these paravulvae anterior and posterior to vulva varies and may be diagnostic.

Male reproductive system :

The male reproductive system consists of two testes, seminal vesicle, vas deferens and cloaca. The testes are paired and opposed, the anterior one may be reflexed (*Aquatides*). From each testis a seminal vesicle arises which leads to a common vas deferens and then finally into an ejaculatory duct. The seminal vesicle is filled with sperm. Each sperm is elliptical with a large nucleus. Vas deferens is a narrow tube and is common for both the testes. It proceeds posteriorly as an ejaculatory duct which has thick muscular walls and a narrow lumen opening into the cloaca.

Copulatory apparatus :

These include spicules, lateral guiding pieces, gubernaculum and the ventromedian supplements. The spicules are paired, massive and arcuate. The size of the spicules is greatly variable, from 15 μm (*Clavicaudoides*) to about 100 μm (*Laevides*). The proximal end of the spicules is narrower than the main shaft while the distal end tapers and curves ventrally to end bluntly towards the cloacal opening. Gubernaculum may or may not be present. Previously it was thought (*cf.* Thorne, 1939) that nygolaims do not possess gubernaculum, but later studies have shown that in some genera it is very well developed (*Aquatides, Laevides*). Heyns (1968) stated the presence of gubernaculum depends on the number of ventromedian supplements. Those which possess a series of supplements have well developed

gubernaculum (*Aquatides*, *Laevides*, *Paravulvus*) and those which have only one or rudimentary supplements, lack a true gubernaculum (*Clavicaudoides*, *Solididens*). Lateral guiding pieces are tongue-shaped, cephalated. The size of lateral guiding pieces also varies from 5 μm (*Calvicaudoides*) to 20 μm (*Laevides*). The supplements consist of an adanal pair and 2 (*Clavicaudoides*, *Solididens*) to 11 (*Paravulvus*) ventromedians which are regularly or irregularly spaced.

Tail :

The length and shape of tail in nygolaims is greatly variable. The majority of the genera possess hemispherical, convex-conoid or rounded tails (*Nygolaimus*, *Aquatides*, *Laevides*, etc). The tails of *Clavicaudoides*, *Nygellus* and *Laevides* are clavate. In *Paravulvus* and *Nygolaimellus*, the tails are short, arcuate and conoid while in *Afronygus*, *Clavicauda* and *Campydora* these are elongate with clavate or minutely rounded or acute terminus. Tails of both sexes are similar except that the males have tails that are more ventrally curved. Two to four caudal pores are present on each side of the tail but in *Campydora* a pair of prominent caudal papillae is present near the middle of tail.

Genus **Nygolaimus** Cobb, 1913

Diagnosis : Small to large sized (L=1−4 mm) nematodes. Cuticle and subcuticle finely striated. Mural tooth deltoid, usually less than, rarely equal to, width of lip region. Lip region rounded, distinctly set off from the body contour. Basal expanded part of oesophagus usually long, surrounded by a thin sheath. Cardia small. Cardiac glands well developed, rounded. Vulva transverse. Female reproductive system amphidelphic. Males with arcuate spicules and small lateral guiding pieces. Gubernaculum absent. Ventromedian supplements weakly developed, rudimentary, or absent altogether. Prerectum usually less than two anal body-widths long. Tails similar in both sexes, convex-conoid or conical with two to four caudal pores on each side.

Type species : *Nygolaimus pachydermatus* Cobb, 1913

Other species : *Nygolaimus acridens* Thorne, 1974
N. amphigonicus Thorne, 1930
N anneckei (Heyns, 1968) n. comb.
N. brachyuris Thorne, 1930
N. butteus Thorne, 1974
N. captiviiatis (Heyns, 1968) n. comb.
N. curvidens (Heyns, 1968) n. comb.

N. cylindricus Thorne, 1974
N. directus (Heyns, 1968) n. comb.
N. dorotheae (Heyns, 1968) Thorne, 1974
N. europaeus (Heyns, 1968) n. comb.
N. gobabiensis (Heyns, 1968) n. comb.
N. harishi Ahmad & Jairajpuri, 1980
N. hyans Thorne, 1974
N. macrobrachyuris (Heyns, 1968) Thorne, 1974
N papillicaudatus (Heyns, 1968) n. comb.
N. papilloides Thorne, 1974
N. parabrachyuris (Heyns, 1968) Thorne, 1974
N. paratenuis Thorne, 1974
N. parvus Thorne, 1974
N. scalprum (Heyns, 1968) n. comb.
N. tenuis Thorne, 1930
N. obtusus Thorne, 1930

Key To Species Of **Nygolaimus**

1. Basal expanded part of oesophagus somewhat constricted near its middle..... *captivitatis*
   Basal expanded part of oesophagus without a constriction... 2
2. Sheath surrounding basal expanded part of oesophagus very conspicuous and spirally striated... *europaeus*
   Sheath weakly to moderately developed, not spirally striated... 3
3. V = 45 or less... 4
   V 50 or more... 5
4. Body length 1.21—1.45 mm ; V = 45... *anneckei*
   Body length 1.09—1 23 mm ; V 40—41... *harishi*
5. Cuticle on tail very thick ; V 66... *pachydermatus*
   Cuticle not so thick on tail ; V Less than 66... 6
6. Protoplasmie core of tail reaching surface dorsally just before tail terminus... *brachyuris*
   Protoplasmic core of tail mostly evenly rounded... 7
7. Tail with a prominent terminal or subterminal papilla... *papillicaudatus*
   Tail without a terminal papilla... 8
8. Body length about 1 mm ; tail conical... *gobabiensis*
   Body length more than 1 mm ; tail dorsally convex-conoid or conoid... 9
9. Tooth dorsally curved... *curvidens*
   Tooth not dorsally curved... 10
10. Tooth with a dorsal anterior oblique plane ... *scalprum*
    Tooth without a dorsal anterior oblique plane... 11

11. Body length more than 2.5 mm..... 12
Body length less than 2.5 mm..... 17

12. Body straight when relaxed... ....*obtusus*
Body distinctly ventrally curved..... 13

13. Tail with elongated core... .....*parabrachyuri*
Tail without elongated core... 14

14. Tooth very slender, acute ... .*acridens*
Tooth broad, deltoid... 15

15. Body length about 3.5 mm ... ...*macrobrachyuris*
Body length less than 3.0 mm... 16

16. Tail hemispheroid... ...*papilloides*
Tail dorsally convex-conoid... ...*butteus*

17. Tooth slightly longer than half of lip-width... 18
Tooth about two-thirds of lip-width..... ...19

18. Lateral chords very narrow, males not known to occur ... .*tenuis*
Lateral chords not very narrow ; males are of frequent occurrence..... *amphigonicus*

19. Body straight when relaxed... ...20
Body arcuate, twisted ... .22

20. Body length 1.3 mm... ...*hyans*
Body length more than 1.3 mm 21

21. Two pairs of caudal papillae present... .....*cylindricus*
One pair of caudal papillae present... ...*directus*

22. Body length about 1.3 mm ... ...*parvus*
Body length more than 1.5 mm... 23

23. Tooth broad, deltoid... .....*paratenuis*
Tooth slender, acute ... .*dorotheae*

Nygolaimus harishi Ahmad & Jairajpuri, 1980

(Text. fig. 2, A-D)

Nygolaimus harishi Ahmad & Jairajpuri, 1980, *Revue Nematol.* 3 : 41—50.

Dimensions :

Females (4) : L=1.09 – 1.23 mm ; a=48 – 53 ; b=3.7 – 4.2 ; c=64 – 77 ; V=40 – 41 ; G_1=4 – 5 ; G_2=6 – 7 ; tooth=6 – 7 μm ; oesophagus=290 – 305 μm ; rectum=21 – 25 μm ; prerectum=24 – 30 μm ; tail=16 – 19 μm ; ABD=16 – 17 μm.

Description :

Female : Body almost straight upon fixation, tapering towards both extremities. Cuticle 2 μm thick at midbody and 2-3 μm on tail, marked with fine transverse striations. Lateral chords narrow, about one—third of body-width near midbody.

Lip region distinctly set off from body contour by a constriction ; Lips rounded and labial papillae not elevated. Amphids cup-shaped with slit-like apertures ; amphidial apertures 4—6 μm wide or about half the width of lip region. Tooth deltoid, 6—7 μm long or about two-thirds of lip-width. Expanded part of oesophagus occupying about 52% of oesophageal length. Sheath surrounding basal expanded part of oesophagus inconspicuous. Nerve ring surrounding the anterior slender part of oesophagus at 75-85 μm from anterior end. Cardia small, conoid, 6-7 μm long. Cardiac glands small, rounded, 4-5 × 6 — 7 μm in size. Dorsal oesophageal gland exceptionally large. Location of oesophageal gland nuclei and their orifices as given in **Table II.**

Vulva a transverse slit, vagina about half vulval body-width. Female reproductive system amphidelphic. Anterior reproductive branch reduced in all specimens ; ovaries rudimentary. Ovaries reflexed with a few oocytes arranged in a single row except at tip. Sperm not seen in any part of reproductive branch. Distinct sphincter at oviduct-uterus junction. Prerectum about 1.5-1.7 anal body-widths long. Rectum about one anal body-width long. Tail straight-conoid with blunt terminus, 16-19 μm or about one anal body-width long with two caudal pores on each side.

Male : Not found

Habitat and locality: Soil around roots of *Phaseolus mungo* from Sirsa, Haryana State.

Genus **Clavicaudoides** Heyns, 1968

Diagnosis : Body length usually less than 2.0 mm. Cuticle marked with distinct transverse striations. Mural tooth varies from deltoid to linear. Lip region rounded, either continuous or set off from body. Sheath around basal expanded part of oesophagus relatively thin. Cardiac glands ovoid or rounded. Female reproductive system amphidelphic. Vulva transverse. Males with small spicules and few rudimentary supplements. Rectum usually more than one anal body-width long. Prerectum about 2-4 anal body-widths long. Tail of both sexes similar, clavate to hemispherical.

Type species : *Clavicaudoides clavicaudatus* (Altherr, 1953) n. comb.

Other species : *Clavicaudoides altherri* (Heyns, 1968) n. comb.

C. caudatus (Heyns, 1968) n. comb.
C. liberiensis (Heyns, 1968) n. comb.
C. longidens Ahmad & Jairajpuri, 1980
C. tenuicaudatum n. sp.
C. trophurus (Heyna, 1968) n. comb.

Key To Species Of **Clavicaudoides**

1, Cuticle on tail more than 8 *um* thick ... ... *trophurus*
Cuticle on tail less than 4 *um* thick... 2

2. Vulva equatorial (V=50) ; oesophagus long (b=3.0) .... *liberiensis*
Vulva pre-equatorial (V=39—47) ; oesophagus short(b=3.5—4.7) 3

3. Tooth linear... ... ...*caudatus*
Tooth deltoid... 4

4. Tail long ; clavate... ... ... *clavicaudatus*
Tail short ; hemispherical 5

5. Body length 1.3—1.4 mm ; tail long (C=58-62) ... ...*altherri*
Body length 1.0 mm or Less ; tail short (c=70-102) 6

6. Cardiac glands ovoid ; (c=70-75...) ... ... *longidens*

Clavicaudoides Clavicaudatus (Altherr, 1953) N. Comb.

(Text-fig. 3)

Nygolaimus calvicaudatus **Altherr, 1953,** *Bull. Soc. vaud. Sci. nat.* **66 : 429-460.**
Nygolaimus Calvicaudatus **Meyl, 1951, Quelle & Meye, Leipzig : 1-273.**
Nygolaimus (Clavicadoides) clavicaudatus **(Altherr, 1953) Heyns, 1968, Ent. Mem.** *No. 19, Pl Protect Res. Inst.* **Pretoria. S. Afr , : 1-44.**

Dimensions :

Kotdwara, Uttar Pradesh Population :

Females (9) : L=0.87-0.99 mm ; a=34-41 ; b=3.4-3.9 ; c=45-58 ; V=42-47 ; G_1=7-9 ; G_2=7-9 : tooth=8-11 μm ; oesophagus=230-260μm ; rectum=11-16 μm ; prerectum=21-38 μm ; ABD=14-15 μm.

Males (2) : L=0·85-0,92 mm ; a=34-41 ; b=3,2-3.5 ; c=45-50 ; T=67 ; tooth=10-11 μm : spicules=15-19 μm ; oesophagus=259-260 μm ; rectum=17μm ; prerectum=35-36 μm ; tail=18-19 μm.

Dalhousie, Himachal Pradesh population :

Females ($^{(4)}$: L=0 79-0.88 mm ; a=32-36 ; b=3.2-3.5 ; C=47-59 : V=44-49 ; G_1=7-8 ; G_2=4-8 ; tooth=9-12 μm ; oesophagus=238-245 μm ; rectum=13-15 μm ; prerectum=28-38 μm ; tail=15-18 μm ; ABD= 14-15 μm.

Kulu, Himachal Pradesh population :

Females (5) : L=0 78-1.02 mm ; a=34-42 ; b=3.6-4.1 ; c=42-58 ; V=41-47 ; G_1=6-8 ; G_2=6-9 ; tooth=9-10 μm ; oesophagus=215-245 μm ;

rectum=13-16 μm ; prerectum=32-40 μm ; tail=17-20 μm ; ABD=14-16 μm.

Khajjiar, Himachal Pradesh population :

Females (5) : L=1.00-1.22 mm ; a=41-51 ; b=3.6-4.4 ; c=53-61 ; V=40-46 ; G_1=5-7 ; G_2=6-7 ; tooth=8-10 ; oesophagus=260-281 ηm ; rectum=14-16 μm ; prerectum=41-56 μm ; tail=19-22 μm ; ABD= 13-15 μm.

Male : L=1 08 mm ; a=47 ; b=3.8 ; c=57 ; T=53 ; tooth=9μm ; spicules=16 μm ; oesophagus=280 μm ; rectum=14 μm ; prerectum=42 μm ; tail=19 μm.

Manali Himachal Pradesh population :

Female : L=0 84 ηm ; a=35 ; b=3.3 ; c=44 ; V=46 ; G_1=7 ; G_2=8 ; tooth=11μm ; oesophagus=252 μm ; rectum=13μm ; prerectum =31 ηm ; tail=19 μm ; ABD=14 μm.

Description :

Female : Body upon fixation curved ventrally, more prominently in its posterior region and thus assuming 'J' shape, tapering anterior to base of oesophagus. Cuticle thin, 1.0-1.5 μm at midbody, 2-3 μm on tail, marked with clearly visible transverse striae. Lateral pores invisible.

Lip region continuous with body contour. Labial papillae not elevated. Amphidial apertures slit-like, wider than half the lip-width. Tooth deltoid, 8-12 μm, almost equal to lip-width. Expanded part of oesophagus occupying about 50% of oesophageal length, enclosed in an inconspicuous sheath of muscles. Cardiac glands well developed, elongate-ovoid. Cardia small. Nerve ring surrounding anterior slender part of oesophagus at 85-100μm from anterior end Location of oesophageal gland nuclei and their orifices as in **Table II**.

Vulva a transverse slit ; vagina about one—third or half of vulval body-width. Female reproductive system amphidelphic, ovaries short, reflexed, oocytes few. A distinct sphincter present at oviduct-uterus junction. Rectum about one anal body-width long. Prerectum about 2.0-2.5 anal body-widths long. Tail hemispherical, clavate, about 1 0-1.4 anal body-width long. Two caudal pores present on each side of tail.

Male : Body more strongly curved at caudal end than in females. Supplements consist of an adanal pair and 1-2 ventro-medians. Spicules 15-19 μm along median axis. Gubernaculum absent. Lateral guiding pieces small.

Habitats and localities : Soil around roots of (i) grasses (unidentified) from Kotdwara, District Pauri Garhwal, Uttar Pradesh; (ii) grasses and ferns from Bakrota hills, Dalhousie, Himachal Pradesh ; (iii) mosses and ferns from Kulu, Himachal Pradesh ; (iv) wild grasses (unidentified) from Khajjiar, District Chamba, Himachal Pradesh ; (v) mosses from Manali, District Kulu, Himachal Pradesh.

Remarks : This is the first record of the species from India and also the first ever report of its males It is commonly found on the hills and foothills associated with lower groups of plants. The present specimens closely conform with those described by Altherr (1953) and Heyns (1968) except that they are a bit smaller and have narrower bodies, slightly longer tooth and the vulva is located posteriorly.

Clavicaudoides longidens Ahmad & Jairajpuri, 1980
(Text—fig. 2, E—G)

Clavicaudoides longidens, Ahmad & Jairajpuri, *Revue Nematol.*, 1980, 3 : 41-50.

Dimensions :

Females (6) : L=0.93-0.99 mm ; a=35-39 ; b=3.6-3.9 ; c=70-75 ; V=43-47 ; G_1=5-6 ; G_2=5-7 ; tooth=10-12 μm ; oesophagus=252-267 μm ; rectum=13-15 μm ; prerectum=26-33 μm ; taill=3-14 μm ; ABD=16 μm.

Description :

Female : Body slightly ventrally curved, tapering anterior to base of oesophagus. Cuticle 1.5 μm thick at midbody, 2-3 μm on tail, marked with fine transverse striations. Lateral chords narrow, about one-fourth of body-width near middle of body.

Lip region angular and continuous with body contour, labial papillae elevated Amphidial apertures slit-like, more than half of the lip-width. Tooth deltoid, 10-12 μm or slightly longer than width of lip region. Expanded part of oesophagus occupying about 48-55% of oesophageal length. Nerve ring surrounding the anterior slender part of oesophagus at 95-100 μm from anterior end. The locations of oesophageal gland nuclei and their orifices as given in Table II. Cardiac glands ovoid. 6-7 × 8-9 μm in size. Cardia obscure.

Vulva a transverse slit, vagina about half of the vulval body-width. Female reproductive system amphidelphic. ovaries short, reflexed; with a few oocytes A distinct sphincter present at oviduct-uterus junction. Rectum about one and prerectum about 1.6-2.0 anal body-widths long. Tail

short, hemispherical, slightly clavate, less than one anal body-width long. Two caudal pores present on each side of tail.

Male : Not found.

Habitat and Locality : Soil around roots of wild grasses (unidentified) from Baste village, District Pithoragarh, Uttar Pradesh.

Clavicaudoides tenuicaudatum N. Sp.

(Text — fig. 4)

Dimensions :

Paratype female : L=1.02 mm ; a=45 ; b=4 1 ; c=93 ; V= '3 ; G_1=6 ; G_2=6 ; tooth=11 μm ; oesophagus=250 μm ; rectum=14 μm ; prerectum=34 μm ; tail=11 μm ; ABD=15 μm.

Holotype female : L=1.03 mm ; a=43 ; b=4.2 ; c=103 ; V=43 ; G_1=7 ; G_2=7 ; tooth=10 μm ; oesophagus=245 ηm ; rectum=15 μm ; prectum=33 μm ; tail=10 μm ; ABD=16 μm.

Description :

Female : Body slightly ventrally curved, tapering anterior to base of oesophagus. Cuticle 1.5 μm thick at midbody ; 2.5 μm on tail with fine transverse striations. Lateral chords narrow, about one-fifth to one-fourth of body-width near middle of body. Dorsal, ventral and lateral body pores indistinct.

Lip region continuous with body contour, lips angular. Labial papillae not elevated. Amphidial apertures slit-like, about half of lip-width. Tooth deltoid, 10-11 μm or longer than the width of lip region. Expanded part of oesophagus occupying about 43-44% of oesophageal lenghth Nerve ring surrounding anterior slender part of oesophagus at 98-100 μm from anterior end Location of oesophageal gland nuclei and their orifices as given in Table II. Cardiac glands rounded, 4-5 x 5-6 μm. Cardia obscure.

Vulva a transverse slit, vagina about half vulval body-width. Female reproductive system amphidelphic, ovaries short, reflexed with 10-15 oocytes. A distinct sphincter present at the junction of oviduct and uterus Rectum about 1.2-1.5 anal body-widths long. Prerectum about two anal body-widths long. Tail very short, rounded about 0.6-0 7 anal body-width long. Two caudal pores present on each side of tail.

Male : Not found

Type habitat locality : Soil around roots of ferns from Dharamsala, District Kangra, Himachal Pradesh.

Type specimens : Collected in June 1977 ; holotype and paratype on slide Hp-20/ *Clavicaudoides tenuicaudatum* n. sp./1 : deposited in the Department of Zoology, Aligarh Muslim University.

Differential diagnosis : *Clavicaudoides tenuicaudatum* n. sp. is closest to *C. clavicaudatus* and *C. longidens.* From the former it differs in having a wider body, smaller oesophagus and tail (a=63 ; oesophagus=294 um ; tail=21 um in *C. clavicaudatus*). From *C. longidens* it differs in having narrower but longer body smaller oesophagus, smaller tail and in the shape of cardiac glands (L=0 93-0.99 mm ; a=35-39 ; b=3.6-3.9 ; tail=13-14 um ; cardiac glands ovoid in *C. longidens.*

Genus Aquatides Heyns, 1968

Diagnosis (emended) : Body length usually 1-4 μm. Cuticle and subcuticle finely striated. Tooth linear, usually longer than width of lip region. Lip region truncate or rounded, set off by a slight depression. Basal expanded part of oesophagus surrounded by a conspicuous sheath usually forming basal pockets. Cardiac glands well developed, spherical to ovoid. Cardia well developed. Vulva transverse. Female reproductive system amphidelphic. Males with massive and arcuate spicules, well developed gubernaculum, lateral guiding pieces and ventromedian supplements. Prerectum usually 1-4 anal body-widths long.. Tail bluntly convex-conoid to hemispherical with two or three caudal pores on each side.

Type species : *Aquatides aquaticus* (Thorne, 1930) Thorne, 1974

Other species : *Aquatides christei* (Heyns, 1968) Thorne, 1974
A. christicki n. sp.
A. deconincki Jairajpuri & Coomans, 1977
A. intermedius (Loof, 1961) n. comb.
A. rotundicaudatus Thorne, 1974
A. shadini (Filipjev, 1928) n. comb.
A. smoliki Thorne, 1974
A. thornei (Schneider, 1937) n. comb.

Species inquirenda : *A. kaburakaii* (Imamura, 1931)

Key to Species of Aquatides

1. Lip region slightly set off and distinctly asymmetrical 2
   Lip region confluent and slightly asymmetrical 4

2. Tooth long (26-29 m) ; tail short, rounded.....*deconincki*
   Tooth small (19-24 μm) ; tail long, convex-conoid.....3

3. Body length about 2.0 mm ; spicules 42-55 μm .....*christei*
   Body length 1.5-1.8 mm ; spicules 36-39 μm.....*christicki* n. sp.

4. Pharyngeal bulb conspicuous.....*intermedius*
   Pharyngeal bulb moderately developed.....5

5. Body length more than 3.0 mm.....6
   Body length less than 3.0 mm.....8

6. Body wider, tooth 24-26 μm.....*smoliki*
   Body slender, tooth 20 μm or less.....7

7. Vulva post-equatorial (V=52-55).....*shadini*
   Vulva pre-equatorial (V=44).....*rotundicaudatus*

8. Body length more than 2.0 mm ; tooth 17-22 μm.....*aquaticus*
   Body length less than 2.0 mm ; tooth 12-17 μm.....*thornei*

Aquatides aquaticus (Thorne, 1930) Thorne, 1974

(Text—fig. 5, A—E)

Nygolaimus aquaticus Thorne, 1930, *J. agric. Res. U S. D. A.*, **41** : 445-466.

Ngolaimus aquaticus (Thorne, 1930) Goodey, 1951, *Soil and freshwater nematodes* London, Methuen : 1-544.

Nygolaimus (Aquatides) aquaticus (Thorne, 1930) Heyns, 1968 *Ent. Mem. No. 19, Pl. Protect. Res. Inst. Pretoria, S. Afr.*, : 1-144.

Aquatides aquaticus (Thorne, 1930) Thorne, 1974, *S. Dakota State Univ. Aqr. Exp. Sta. Bul.*, **41** : 1-120.

Dimensions :

Khajjiar, Himachal Pradesh population :

Females (3) : L=2.47-2.96 mm ; a=38-47 ; b=3.9-4.2 ; c=67-78 ; V=48-56 ; G_1=13-14 ; G_2=13-15 ; tooth=16-17 μm ; rectum=30-36 μm ; prerectum=98-125 μm ; oesophagus=625-677 μm ; tail=32-37 μm ; ABD=37-40 μm.

Male : L=2.42 mm ; a=42 ; b=4.0 ; c=67 ; T=65 ; tooth=17 μm ; oesophagus=605 μm ; spicules=58 μm. gubernaculum=10 μm ; lateral guiding pieces=11 μm ; ventromedian supplements=6 ; tail = 36 μm ; ABD=37 μm.

Chamba, Himachal Pradesh population :

Females (3) : L=2.40-2.74 mm ; a=43-46 ; b=4.0 ; c=72-76 ; V=49-50 ; G_1=10-14 ; G_2=11-14 ; tooth=13-15 μm ; oesophagus=590-670 μm ; rectum=29-32 μm ; prerectum=72-105 μm ; tail=35-36 μm ; ABD=36 μm.

Male : L=2.12 mm ; a=44 ; b=3.6 ; c=66 ; T=70 ; tooth=13 μm ; oesophagus=585 μm ; spicules=50 μm ; gubernaculum=9 μm ; lateral guiding pieces=13 μm ; ventromedian supplements=5 ; tail=36 μm ; ABD= 38 μm.

Description :

Female : Body straight upon fixation except that the tail region is slightly curved, tapering anterier to base of oesophagus. Cuticle 2-3 μm thick at midbody and 4-6 μm on tail. Subcuticle marked with fine transverse striations. Dorsal, ventral and lateral body pores indistinct.

Lip region continuous with body contour and rather truncate. Labial papillae elevated. Amphidial apertures slit-like, about one-third as wide as lip region. Tooth linear, 13-17 μm or equal to width of lip region. Expanded part of oesophagus occupying about 45-48% of oesophageal length. Nerve ring surrounding the anterior slender part of oesophagus at 150-170 μm from anterior end. Basal part of oesophagus enclosed in a conspicuous sheath which forms basal pockets. Cardiac glands well developed, rounded, 8-10 × 12-15 μm in size. Location of oesophageal gland nuclei and their orifices as given in Table II.

Vulva a transverse slit, vagina about half vulval body-width long. Female reproductive system amphidelphic, overies paired, reflexed with numerous oocytes arranged single row. A well developed sphincter present at oviduct-uterus junction. Rectum about 0.8-0.9 anal body-width long. Prerectum about 2-3 anal body-widths long. Tail shorter than anal body-width, convex-conoid or bluntly rounded. Two caudal pores present on each side of tail.

Male : Supplements consist of an adanal pair and 5-6 ventromedians. Spicules massive, arcuate, 50-58 μm along median axis. Gubernaculum 9-10 μm long. Lateral guiding pieces well developed, 11-13 μm long.

Habitats and localities : (i) Soil around roots of wild grasses (unidentified) from Khajjiar, Distric Chamba, Himachal Pradesh, (ii) Soil around roots of barseen, *Trifolium alexendrinum* L. from Udaipur village, District Chamba, Himachal Pradesh.

Remarks : Aquatides aquaticus is of wide distribution in India. The present description agrees fairly well with those given by Thorne (1930) and Heyns (1968). However, the present specimens have smaller tooth and tail.

Aquatides intermedius (De Man, 1880) N. Comb.
(Text-fig. 5, F-H)

Dorylaimus intermedius De Man, 1880, *Tijdschr. Nederland Dierk. Ver.*, **5** : 1-105.
Nygolaimus intermedius (De Man, 1880) Loof, 1961, *Lab. Fytopath. Wageningen, Meded.*, **190** : 1-86.

Nygolaimus (Aquatides) intermedius (De man, 1880) Heyns, 1968, *Ent. Mem. No. 19, Pl. Protect. Res. Inst. Pretoria, S. Afr.*, : 1-144.

Dimensions :

Females (3) : L=2.00-2.13 mm ; a=41-45 ; b=4.2-4.7 ; c=79-82 ; V=44-46 ; G_1=7-11 ; G_2=10-12 ; tooth=19-20 μm ; oesophagus=445-470 μm ; rectum=24-30 μm ; prerectum=43-50 μm ; tail=25-27 μm ; ABD=29-33 μm ; egg=115 x 30 μm.

Description :

Female : Body almost straight upon fixation, tapering slightly anterior to base oesophagus. Cuticle 2-3 μm thick at midbody and 3-5 μm on tail, marked with fine transverse striae. Lateral chords about one-fourth or one-third of body-width near middle of body.

Lip region continuous with body contour, lips rounded and labial papillae elevated. Amphidial apertures slit-like, about one-third as wide as lip region. Tooth linear, 19-20 μm or equal to width of lip region. Expanded part of oesophagus occupying about 46-48% of oesophageal length. Nerve ring surrounding the anterior slender part of oesophagus at 150-160 μm from anterior end. Basal part of oesophagus enclosed in a very conspicuous sheath forming basal pockets. Cardia hemispherical. Cardiac glands well developed, rounded, 8×9 μm. Location of oesophageal gland nuclei and their orifices as given in Table II.

Vulva a transverse slit, vagina about half of the vulval body-width. Ovaries paired, reflexed with 10-12 oocytes arranged in a single row. A distinct sphincter present at oviduct-uterus junction. Uterine egg 115×30 μm. Rectum about 0.8-0.9 anal body-width long. Prerectum short, 1.4-1.5 anal body-widths long. Tail convex-conoid, shorter than anal body-width with two caudal pores on each side.

Male : Not found

Habitat and locality : Soil around roots of onion, potato and chillies from Bajaura, District Kulu, Himachal Pradesh.

Remarks : This species was described by De Man (1880) as *Dorylaimus intermedius* from Leiden, The Netherlands. Loof (1961) designated a male

as neotype and considered it as *Nygolaimus intermedius*. This is the first record of the species from India. These specimens agree fairly well with the description of species as given by Loof (1961) and Heyns (1968) except in the shape of lip region and position of vulva (lips are rounded and vulva anteriorly located in the Indian specimens).

Aquatides deconincki Jairajpuri & Coomans, 1977

Aquatides deconincki Jairajpuri & Coomans, 1977, *Indian J. Nematol.*, **5** (1975): 234-246.

Dimensions :

Females (7) : L=1.60-1.94 mm ; a= 33-49 ; b=3.8-4.4 ; c=65-82 ; V= 47-50 ; G_1=9-15 ; G_2=8-16 ; tooth=24-27 μm ; oesophagus=550-665 μm ; rectum=29-33 μm ; prerectum=79-92 μm ; tail=32-37 μm ; ABD= 32-39 μm.

Males (5) : L=2.30-2.80 mm ; a=40-48 ; b=3.8-4.4 ; e=64-69 ; T=59-66 ; tooth=24-26 μm ; oesophagus=575-670 μm ; spicules=55-63 μm ; gubernaculum=10-12 μm ; lateral guiding pieces=14-15 μm ; ventromedian supplements=5-7 ; rectum=40-42 μm ; prerectum=100-120 μm ; tail=35-40 μm ; ABD=36-40 μm.

Description :

Female : Body slightly ventrally curved in posterior part, tapering anterior to base of oesophagus. Cuticle 2-3 ηm thick at midbody, 4-7 μm on tail, marked with fine transverse striations. Lateral chords narrow, about one-fourth to one-third of body-width near middle of body. Dorsal, ventral and lateral body pores indistinct.

Lip region asymmetrical and continuous with body contour ; the dorsal side is distinctly higher than the ventral ; labial papillae elevated. Amphids cup-shaped, their apertures slit-like about 5-7 μm wide. Tooth linear, slightly curved at its middle, 24-26 μm or slightly longer than the width of lip region. Expanded part of oesophagus occupying 55% of oesophageal length, enclosed in a very conspicuous sheath forming large basal pockets Nerve ring surrounding the anterior slender part of oesophagus at 200-220 μm from anterior end. Cardia small, elongate-conoid. Cardiac glands well developed, rounded, 5-6 x 8-9 μm. Location of oesophageal gland nuclei and their orifices as given in Table II.

Vulva a transverse slit, vagina about half of the vulval body-width Female reprouctive system amphidelphic ; ovaries reflexed with 15-25

oocytes arranged in a single row ; uteri filled with large conspicuous sperm. A distinct sphincter present at oviduct-uterus junction. Prerectum about 2.2-3.0 anal body widths long. Rectum slightly smaller than one anal body-width. Tail convex-conoid or hemispherical, 32-37 μm long with 2-3 caudal pores on each side.

Male : Supplements consist of an adanal pair and 5-7 irregularly spaced ventromedians, beginning well above the spicular range. Spicules arcuate, massive, 55-63 μm along median axis. Lateral guiding pieces tongue-shaped, 14-15 μm long. Gubernaculum trough-shapen, 9-12 μm long.

Habitat and locality : Meadow soil around roots of wild grasses from Mari, District Kulu, Himachal Pradesh (Altitude approx. 3,000 m).

Remarks : These specimens are from a place near its type locality. They agree well with the description and dimensions of the species as given by Jairajpuri & Coomans (1977) except for their smaller tooth (tooth=26-29 μm in type specimens) and slightly smaller oesophagus and prerectum.

Aquatides thornei (Schneider, 1937) N. Comb.

(Text—fig. 6)

Nygolaimus thornei Schneider, 1937, *Arch. Hydrobiol.*, (Suppl.). **15** : 30-108.

Nygolaimus thornei (Schneider, 1937) Thorne, 1939, *Capita zool.*, **8** : 1-261.

Nygolaimus (Aquatides) thornei (Schneider, 1937) Heyns, 1968, *Ent. Mem. No. 19, Pl. Protect. Res. Inst. Pretoria, S. Afr.*, : 1-144.

Dimensions :

Female : L=1.62 mm ; a=32 ; b=4.1 ; c=60 ; V=49 ; G_1=9 ; G_2=11 ; mural tooth=15 μm ; oesophagus=388 μm ; prerectum=65 μm ; rectum=27 μm ; tail=27 μm ; ABD=30 μm.

Male : L=1.42 mm ; a=32 ; b=3.9 ; c=54 ; T=49 ; mural tooth=13 μm ; oesophagus=360 μm ; spicules=43 μm ; lateral guiding pieces=10 μm ; gubernaculum=8 μm ; ventromedian supplements=5 ; copulatory muscles=25 ; tail=27 μm ; ABD=29 ηm.

Intersex : L=1.60 mm ; a=31 ; b=4.4 ; c=59 ; V=49 ; G_1=8 ; G_2=12 ; T=15 ; mural tooth=13 μm ; oesophagus=360 μm ; spicules=27 μm ; lateral guiding pieces=7 μm ; ventromedian supplements=6 ; copulatory muscles=28 ; tail=27 μm ; ABD=29 μm.

Description :

Female : Body almost straight upon fixation, tapering anterior to base of oesophagus. Cuticle 2 μm thick at midbody and 5 μm on tail. Lateral chords narrow, about one-third of body-width near middle of body. Dorsal, ventral and lateral body pores indistinct.

Lip region continuous with body contour ; lips rounded and labial papillae not elevated. Amphidial apertures slitlike, about two-thirds of lip-width. Tooth linear, 13 μm or equal to width of lip region. Expanded part of oesophagus surrounding anterior slender part of oesophagus at 130 μm from anterior end. Basal expanded part of oesophagus enclosed in a conspicuous sheath forming basal pockets. Cardia hemispherical. Cardiac glands rounded, 7 x 9 μm in size. Location of oesophageal gland nuclei and their orifices as given in **Table II.**

Vulva a transverse slit, supported by vulval muscles, vagina about half vulval body-width long. Female reproductive system amphidelphic. Ovaries paired, reflexed with many oocytes arranged in multiple rows. A distinct sphincter present at oviductuterus junction. Posterior uterine egg 86 × 40 μm. Prerectum 65 μm or about two anal body-widths long. Rectum 27 μm or about 0.9 anal body-width long. Tail hemispheroid, slightly clavate, 27 μm or about 0.9 anal-width long with two caudal pores on each side.

Male: Supplements consist of an adanal pair and five ventromedians. Spicules massive, ventrally curved, 43 μm or about 1.6 anal body-widths along median axis. Lateral guiding pieces tongue-shaped, 10 μm long. Gubernaculum slender, 8 μm long. Copulatory muscles 25. extending a little short of last vetromedian supplement. Tail hemispherical.

Intersex : Body shape and size same as in normal sexes. Female reproductive system amphidelphic. Vulva transverse, supported by vulval muscles. Anterior ovary outstretched, degenerate with only a few germinal cells posterior ovary reflexed, normally developed with oocytes arranged in multiple rows.

Male reproductive system with genital ducts poorly developed. Testes rudimentary, one reflexed and the other outstretched. Poorly developed germinal cells present at the tip of each testis. Spicules straight, 27 μm or about one anal body-width along median axis. Supplements consist of an adanal pair and six well developed ventromedians. Lateral guiding

pieces small 7 μm long Gubernaculm absent. Copulatory muscles 28, extending a little short of the last ventromedian supplement. Tail hemispherical.

Habitat and locality: Soil arround roots of paddy *Oryza sativa* L., from Magadh University Campus, Bodh Gaya, Bihar.

Remarks: The present specimens conform with the description of the species as given by Heyns (1968). The intersex possesses dominating female characteris. It has normal female gonad except that the anterior gonad is a little degenerate with few germinal cells. The anterior ovary is short and outstretched while the posterior ovary is fully developed. The male reproductive system is degenerate and perhaps non-functional. Testes are very small and without spermatocytes. Only a few poorly developed germinal cells are present at the tip of each testis. The spicules are smaller than in the normal male and also of a different shape with pronounced narrowing towards the tip. Lateral guiding pieces small and gubernaculum is absent. However, the ventromedian supplements and the copulatory muscles are as well developed as in the normal male. In fact, the number of ventromedian supplements and the copulatory muscles are a little more in number in the intersex than in the normal male.

Aquatides christicki N. Sp.

(Text-fig. 7)

Dimensions:

Paratype females (7): L=1.66-183 mm; a=34-41; b=3.8-4 3; c=56-78; V=43-50; G_1=7-12; G_2=7-12; tooth=19-23 μm; oesophagus=411-475 μm; prerectum=35-50 μm; rectum=22-26 μm; tail=22-28 μm; ABD=26-30 μm.

Holotype female: L=1.5 mm; a=31; b=3 8; C=64; V=47; G_1=12; G_2=12; tooth=19 μm; oesophagus=400 μm; prerectum=38 μm; rectum=23 μm; tail=24 μm; ABD=μm.

Paratype males (3): L=1.70-1.77 mm; a=36-38; b=3.8-3.9; c=69-71; T=60-63; tooth=19-22 μm; oesophagus=440-450 μm; prerectum=40-50 μm; rectum 23-25 μm; spicules 36-39 μm; lateral guiding pieces=8-10 μm; gubernaculum 6-9 μm; ventromedian supplements 3-4; tail 24-25 μm; ABD 30-31 μm.

Description:

Female: Body slightly ventrally curved upon fixation, tapering anterior to base of oesophagus. Cuticle 2-3 μm thick at midbody and 4-5

μm on tail ; subcuticle with fine transverse striations. Lateral chords about one-fourth to one-third of body-width near middle of body. Dorsal, ventral and lateral body pores indistinct.

Lip region asymmetrical, the dorsal side is higher than the ventral. Labial papillae not elevated. Amphidial apertures slit-like, about one-third of lip-width. Tooth linear, 19-23 μm or equal to width of lip region. Expanded part of oesophagus occupying about 48-50% of oesophageal length. Nerve ring surrounding the anterior slender part of oesophagus at 150-175 μm from anterior end. Basal expanded part of oesophagus enclosed in a conspicuous sheath forming basal pockets. Cardiac glands ovoid, 6-8 × 10-12 μm. Cardia not distinct. Location of oesophageal gland nuclei and their orifices as given in Table II.

Vulva transverse, vagina about half of the vulval body-width. Female reproductive system amphidelphic. Ovaries reflexed with 15-20 oocytes arranged in a single row. A distinct sphincter present at oviduct-uterus junction. Uterine eggs measuring 100-105 × 30-35 μm. Prerectum 35-50μm or about 1.3-1.7 anal body-widths long. Rectum 22-26 μm or about 0.8-0.9 anal body-width long. Tail short, hemispherical or dorsally convex-conoid, 22-28 μm or about o.8-0.9 anal body-width long with two caudal pores on each side.

Male : Supplements consist of an adanal pair and 3-4 ventromedians which are irregularly spaced. Spicules massive, slightly arcuate, 36-39 μm or about 1.2 anal body-widths along median axis. Lateral guiding pieces tongue-shaped, 8-10 μm long. Gubernaculum very slender, 6-9 μm long.

Type habitat and locality : Soil around roots of wild grasses (unidenti-)fied) from ajaura, District Kulu, Himachal Pradesh.

Type specimens : Collected in June 1977 ; holotype on slide *Aquatides christicki* n. sp./1 ; paratype females and males on slides *Aquatides christicki* n. sp./2-5 ; deposited in the Department of Zoology, Aligarh Muslim University.

Differential diagnosis : *Aquatides christicki* n. sp. comes close to *Aquatides christei* and *A. deconincki* but differs from both in having a smaller body, smaller tooth and in the shape and size of tail. It further differs from *A. christei* in having a shorter oesophagus and smaller spicules (oesophagus =425-570 μm ; spicules 42-55 μm in *A. christei*). From *A. deconincki* it further differs in the shape of lip region, smaller prerectum and spicules

(lip region less asymmetrical, prerectum 4.5 anal body-widths long spicules =59-63 μm in *A. deconincki*).

GENUS Laevides Heyns, 1968

Diagnosis : Moderate to large sized nematodes. Lip region continuous with body contour and slightly narrower than the adjoining body. Subcuticle with fine transverse striations. Mural tooth variable in shape ; relatively short and broad, with a dorsal anterior oblique plane resembling the dorsal aperture of the spear of Dorylaiminae. Tooth shorter than width of lip region. Sheath surrounding basal expanded part of oesophagus conspicuous and forming basal pockets. Cardia well developed and elongate-conoid. Cardiac glands ovoid or rounded. Female rproductive system amphidelphic, vulva transverse. Males with well developed spicules, lateral guiding pieces and 5-8 ventromedian supplements. Prerectum usually more than to anal body-widths long. Tail short, bluntly-conoid to hemispherical, mostly slightly clavate.

Type species : *Laevides laevis* (Thorne, 1939) Thorne, 1974

Other species : *Laevides asymmetricus* (Andrassy, 1962) n. comb.
L. cuniculus (Altherr, 1950) n. comb.
L. husmanni (Meyl, 195) n. comb
L. imphalus Ahmad & Jairajpuri, 1980
L. loofi (Heyns, 1968) n. comb.
L. microdens Thorne, 1974
L. paraaquaticus (Paetzold, 1958) n. comb.
L. rapax (Thorne, 1939) n. comb.
L. timmi (Heyns, 1968) n. comb.

Key To Species Of Laevides

1. Tooth broad with dorsal longer sector 2
   Tooth slender with equal sectors 4
2. Body length more than 6 mm ..... *loofi*
   Body length less than 5 mm 3
3. Body length more than 3.5 mm ; V=48 ..... *rapax*
   Body length less than 2.5 mm ; V=38-41 ..... *imphalus*
4. Body length more than 7 mm ..... *husmanni*
   Body length less than 4 mm 5
5. Lip region asymmetrical ..... *asymmetricus*
   Lip region symmetrical 6
6. Cuticle on tail not thickened ..... *paraaquaticus*
   Cuticle on tail prominently thickened 7

7. Body length usually less than 2 mm..... .... *laevis*
   Body length more than 2 mm.....8

8. Tail very short (c=80-88) ; vulva pre-equatorical (V=41-45).....9

9. Tooth very small (4-6μm) ; oesophagus shorter (b=4.7-4.9)..... .....*microdens*
   Tooth longer (12-13 μm) ; oesophagus longer (b=3.5-4.0).....*cuniculus*

Laevides laevis (Thorne, 1939) Thorne, 1974

(Text-fig. 8, A-F)

Nygolaimus laevis Thorne, 1939, *Capita zool.*, 8 : 1-261.
Nygolaimus (*Laevides*) *laevis* (Thorne, 1939) Heyns, 1968, *Ent. Mem. No. 19, pl. Protrect. Res. Inst. Pretoria, S. Afr.*, : 1-144.
Laevides laevis (Thorne, 1939) Thorne, 1974, *S. Dakota State Univ. Agr. Exp. Sta. Tech. Bul.*, 41 : 1-120.

Dimensions :

Pithoragarh, Uttar Pradesh population :

Females (12) : L=1.29-1.93 mm ; a=36-43 ; b=3.2-4.0 ; c=57-88 ; c=0.7-0.9 ; V=46-55 ; G_1=7-12 ; G_2=7-12 ; tooth=8-10 μm ; oesophagus=390-520 μm ; prerectum=40-90 μm ; rectum=19-25 μm ; tail=17-29 μm ; ABD=23-28 μm.

Gola Gokarnath, Uttar Pradesh population :

Females (3) : L=1.55-2.10 mm ; a=37-46 ; b=3.8-4.5 ; c=60-78 ; c'=0.9-1.0 ; V=49-51 ; G_1=11-14 ; G_2=11-14 ; tooth=10-12 μm ; oesophagus=405-460 μm ; prerectum=40-60 μm ; rectum=20-25 μm ; tail=26-27 μm ; ABD=26-30 μm.

Males (2) : L=1.68-1.70 mm ; a=38-41 ; b=3.7-3.8 ; c=65 ; c'=0.9-1.0 ; T=62-63 ; tooth=10-12 μm ; oesophagus=445-450 μm ; prerectum=60-70 μm ; rectum=26-29 μm ; tail=25-26 μm ; ABD=26-28 μm ; spicules=35-42 μm ; lateral guiding pieces=9-10 μm ; gubernaculum=6-8 μm ; ventromedian supplements=5.

Joginder Nagar, Himachal Pradesh population :

Females (5) : L=1.42-1.50 mm ; a=36-44 ; b=3.3-44 ; b=3.3-4.0 ; c=52-60 ; c'=0.8-0.9 ; V=53-54 ; G_1=8-11 ; G_2 7-10 ; tooth 9 μm ; oesophagus 430-475 μm ; prerectum 45-65 μm ; rectum 20-22 μm ; tail 25-27 μm ; ABD 25-26 μm.

Mandi, Himachal Pradesh population

Females (5) : L=1.57-1.67 mm ; a=34-38 ; b=3.4-3.5 ; c=61-71 ; c'=0.8-1.0 ; V=50-51 ; G_1=9-12 ; G_2=9-11 ; tooth=8-10 μm ; oesophagus=445-490 μm ; prerectum=50-65 μm ; rectum=20-23 μm ; tail=23-26 μm ; ABD=24-30 μm.

Manali, Himachal Pradesh population :

Females (3) : L=1.78-1.82 mm ; a=41-42 ; b=3.4-3.6 ; c=57-59 ; c'=0 9-1.0 ; V=53-55 ; G_1=8-9 ; G_2=9-10 ; tooth=8-9 μm ; oesophagus=495-510 μm ; prerectum=60-100 μm ; rectum=23-26 μm ; tail=30-32 μm ; ABD=29-32 μm.

Imphal, Manipur population :

Females (10) : L=1 47-1.64 mm ; a=41-43 ; b=3.4-3.6 ; c=66-80 ; c'=0.8-0.9 ; V=50-52 ; G_1=8-11 ; G_2=8-11 ; tooth=9-10 μm ; oesophagus=420-450 μm ; prerectum=40-50 μm ; rectum=20-22 μm ; tail=19-24 μm ; ABD=24-26 μm.

Description :

Female : Body almost straight upon fixation, tapering anterior to base of oesophagus. Cuticle 1-3 μm thick at midbody and 2-5 μm on tail with fine striations. Lateral chords about one-fourth to one-third body-width near middle of body.

Lip region continuous with body contour. Lips rounded and labial papillae not elevated. Amphids stirrup-shaped, their apertures slit-like. Tooth dorylaimoid, less than the width of lip region, 8-13 μm long, dorsal aperture visible, about one-fourth of its length. Expanded part of oesophagus occupying 45-48% oesophageal length which is enclosed in a conspicuous sheath forming small basal pockets. Nerve ring surrounding anterior slender part of oesophagus at 180-200 μm from anterior end. Cardiac glands rounded, 7-8 × 10-12 μm. Cardia small, hemispherical. Location of oesophageal gland nuclei and their orifices as given in Table II.

Vulva a transverse slit. Vagina about two-thirds to half of vulval body-width. Female reproductive system amphidelphic. Ovaries reflexed with 15-20 oocytes. A distinct sphincter present at oviduct-uterus junction. Prerectum 30-100 μm or about 1.3-3 0 anal body-widths long. Rectum 19-29 μm or about 8.0-1.0 anal body width long. Tail hemispherical to convex-conoid, slightly clavate ; 17-32 μm or about 0.8-1.0 anal body-width long with 2-3 caudal pores on each side.

Male : Supplements consist of an adanal pair and five ventromedians which are irregularly spaced. Spicules arcuate, 35-42 μm along median axis. Lateral guiding pieces 9-10 μm long. Gubernaculum small, 5-6 μm long.

Habitats and localities : Soil around roots of (i) wild grasses (unidentified) and wheat from Pithoragarh, Uttar Pradesh ; (ii) mosses and grasses from Gola Gokarnath, District Lakhimpur Kheri. Uttar Pradesh ; (iii) wild grasses (unidentified) from Joginder Nagar, District Mandi, Himachal Pradesh ; (iv) guava from Pathankot-Mandi Road, Mandi, Himachal Pradesh ; (v) apple from Tourist Bungalow, Manali, District Kulu, Himachal Pradesh ; (vi) pineapple from Imphal, Manipur state.

Remarks : *Laevides laevis* is consmopolitan in distribution and of common occurrence in India. The present specimens agree fairly well with those described by Thorne (1939) and Heyns (1968) except in having a slightly longer tooth, differently shaped tail and in having posterior vulva.

Laevides timmi (Heyns, 1968) N. Comb.

(Text-fig. 8, G-I)

Nygolaimus (Laevides) timmi **Heyns**, 1968, *Ent. Mem. No. 19, Pl. Protect. Res. Inst. Pretoria, S. Afr.,* : 1-144.

Dimensions :

Males (2) : L=3.7-4.0 mm ; a=71-76 ; b=4.8-4.9 ; c=94-99 ; T=57-73 ; tooth=11-12 μm ; oesophagus=765-800 ηm ; prerectum=125-140 μm ; rectum=40-46 μm ; tail=37-42 μm ; ABD=37-39 μm ; spicules=58-63 μm ; gubernaculum=8-10 μm ; lateral guiding pieces=13-15 μm ; ventromedian supplements=5-6.

Description :

Male : Body ventrally curved, more at its posterior end. Cuticle 2-3 μm thick at midbody and 4-5 μm on tail with fine transverse striations. Lateral chords about one-third of body-width near middle of body.

Lip region continuous with body contour and slightly wider than adjoining body. Lips rounded and labial papillae not elevated. Amphidial apertures slit-like, about half of lip-width. Tooth very slender, 11-12μ m long or about two-thirds of lip-width. The dorsal aperture is obvious. Expanded part of oesophagus occupying 47-49% of the oesophageal length. Nerve ring surrounding the anterior slender part of oesophagus at 170-

180 μm from anterior end. Cardia hemispherical. Cardiac glands well developed, ovoid, 9-12×11-15 μm in size. Location of oesophageal gland nuclei and their orifices as given in Table II.

Supplements consist of an adanal pair and 5-6 ventromedians which are irregularly spaced. The first one beginning well above the spicular range. Spicules massive, arcuate, 58-63 μm along median exis. Lateral guiding 13-15 μm, cephalated. Gubernaculum 8-10 μm. Prerectum about 3.4-3.8 anal body-widths long. Rectum about 1.0-1.2 anal body-widths long. Tail convexconoid, bluntly rounded, 37-42 μm or about one anal body-width long with two caudal pores on each side.

Female : Not found

Habitat and locality : Soil around roots of weeds and grasses (unidentified) from Gulaba Army Camp, Manali, District Kulu Himachal Pradesh.

Remarks : Only males of *Laevides timmi*, which are reported here for the first time, were found. The description and dimensions of the males agree fairly well with the females of this species described by Heyns (1968). The males have little longer and narrower body, and a longer prerectum. The lengths of mural tooth, oesophagus and tail correspond well those of females described by Heyns.

Laevides imphalus Ahmad & Jairajpuri, 1980

(Text-fig. 2, H-J)

Laevides imphalus **Ahmad & Jairajpuri, 1980,** *Revue Nematol.*, **3 : 41-50.**

Dimensions :

Females (8) : L=2.05-2.30 mm ; a=49-54 ; b=4.3-4.7, c=71-92 ; V=38-41 ; G_1=6-8 ; G_2=7-8 ; tooth=10 μm ; oesophagus=450-250 μm ; prerectum=61-72 μm ; rectum=22-26 μm ; tail=24-29 ; ABD=26-30 μm.

Description :

Female : Body slightly ventrally curved upon fixation, tapering anterior to base of oesophagus. Cuticle 1-2 μm thick at midbody and 3-5 μm on tail ; subcuticle with fine transverse striations. Lateral chords about one-third of body-width near midbody.

Lip region continuous with body contour ; lips angular and labial papillae elevated. Amphidial apertures slit-like, about half of lip-width.

Tooth 10 μm long or about the width of lip region, broad, the dorsal sector is much longer than the ventral (*rapax*-type). Dorsal aperture of the tooth indistinct. Expanded part of oesophagus occupying about 50-52% of the oesophageal length which is enclosed in a thin sheath. Nerve ring surrounding the anterior slender part of oesophagus at 150-160 ηm from anterior end. Cardia well developed and hemispherical. Cardiac glands rounded, measuring 6-7 × 4-5 μm. Location of oesophageal gland nuclei and their orifices as given in Table II.

Vulva a transverse slit, vagina about half vulval body-width. Female reproductive system amphidelphic, ovaries reflexed with 10-15 oocytes arranged in a single row. A distinct sphincter present at uterus-oviduct junction. Prerectum 61-72 μm or about 2.3-2.4 anal body-widths long. Rectum 22-26 μm or about 0.8-0.9 anal body-width long. Tail hemispherical, clavate, about one anal body-width long with three caudal pores on each side.

Male : Not found.

Habitat and localitv : Soil arouud roots of grasses (unidentified) from Langthabal Kunja, District Imphal, Manipur state.

Genus **Solididens** Heyns, 1968

Diagnosis (emended) : Small-sized nematodes, usually less than 2.5 mm. Body ventrally curved, C-shaped or twisted in the form of letter 'S'. Lateral body pores indistinct. Subcuticle with distinct transverse striae. Lip region distinctly set off from the body contour. Tooth solid with a slender, sharply pointed distal portion, always less than one lip-width long. Sheath enclosing basal expanded part of oesophagus inconspicuous. Cardiac glands small, ovoid. Female reproductive system amphidelphic. Vulva transverse. Males with few ventromedians and rather small lateral guiding pieces. Gubernaculum absent. Tail in both sexes similar ; short-conoid to bluntly-conoid or hemispherical.

Type species : *Solididens bisexualis* (Thorne, 1939) Thorne, 1974

Other species : *Solididens australis* (Heyns, 1968) n. comb.

S. capensis (Heyns, 1968) n. comb.
S. spirals (Loos, 1946) n. comb.
S. trichodorus (Andrassy, 1965) n. comb.
S. vulgaris (Thorne, 1930) Thorne, 1974
S. xosorum (Heyns, 1968) n. comb.

Key To Species Of Solididens

1. Tail hemispherical 2
   Tail dorsally convex-conoid 3
2. Cuticle slightly thickened around tail ; Vulva equatorial ..... *trichodorus*
   Cuticle much thickened around tail ; vulva post-equatorial ..... *xosorum*
3. Basal two-thirds of tooth hollow ; vulva at 62 percent ..... *spiralis*
   Basal half or less of tooth hollow ; vulva at 58 percent or less 4
4. Tail sharply conoid and longer 5
   Tail bluntly convex-conoid and shorter 6
5. Basal third of tooth hollow ; body twisted ..... *vulgaris*
   Basal half of tooth hollow ; body not twisted ..... *australis*
6. Basal third of tooth hollow ; body not twisted ..... *bisexualis*
   Basal half of tooth holow ; body twisted ..... *capensis*

Solididens vulgaris (Thorne, 1930) Thorne, 1974

(Text-fig. 9, A-F)

Nygolaimus vulgaris Thorne, 1930. *J. agric. Res. U.S. D. A.*, 41 : 445-466.

Nygolaimua vulgaris (Thorne, 1930) Thorne, 1939 *Capita zool.*, 8 : 1-261.

Nygolaimus vulgaris (Thorne, 1930) Williams, 1959, *Maurit. Sug. Ind. Res. Inst. Occ. Pap.*, 3 : 1-28.

Nygolaimus (Solididens) vulgaris (Thorne, 1930) Heyns, 1968, *Ent. Mem. No.* 19, pl. *Protect. Res. Inst. Pretoria, S, Afr.*, : 1-144.

Solididens vulgaris (Thorne, 1930) Thorne, 1974. *S. Dakota State Univ. Agr. Exp. Sta. Tech. Bul.*, 41 : 1-120.

Nygolaimus (Solididens) australis Heyns, 1968, *Ent. Mem. 19. Pl. Protect. Res. Inst. pretoria, S. Afr. :* 1-144.

Dimensions :

Pithoragarh, Uttar Pradesh Population :

Females (5) : L=1.20-1.53 mm ; a=33-41 ; b=3.0-3.4 ; c=49-59 ; V=49-56 ; G_1=5-6 ; G=4-6 : tooth=9-10 μm ; oesophagus=390-445 μm ; prerectum=20-27 μm ; rectum=16-20 μm ; tail=24-27 μm ; ABD= 20-22 μm.

Chamba, Himachal Pradesh Population :

Females (10) : L=1.27-1.37 mm ; a=41-43 ; b=2.9-3.4 ; c=44-53 ; V=53-59 ; G_1=6-11 ; G_2-6-10 ; tooth=8-9 μm ; oesophagus=400-445 μm ; prerectum=22-32 μm ; rectum=19-22 μm ; tail=24-31 μm ; ABD=19-20 μm.

Bajaura, Himachal Pradesh Population :

Females (6) : L=1.21-1.47 mm ; a=40-56 ; b=3.2-3.7 ; c=43-57 ; V=50-58 ; G_1=6-8 ; G_2=6-8 ; tooth=8-9 μm ; oesophagus=370-405 μm ; prerectum=25-30 μm ; rectum 19-20 μm ; tail=23-32 μm ; ABD= 20-25 μm.

Kulu, Himacal Pradesh Population :

Females (9) : L=1.15-1.25 mm ; a=33-38 ; b=2.7-3.3 ; c=52-53 ; V=56-60 ; G_1=6-8 ; G_2=7-8 ; tooth=8-9 μm ; oesophagus=380-420 μm ; prerectum=23-30 μm ; rectum=16-20 μm ; tail=22-25 μm ; ABD= 16-20 μm.

Imphal, Manipur Population :

Females (5) : L=1.26-1.37 mm ; a=44-47 ; b=2.6-3.3 ; c=49-57 ; V=56-58 ; G_1=5-7 ; G_2=5-8 ; tooth=8-9 μm ; oesophagus=405-505 μm ; prerectum=22-29 μm ; rectum=19-20 μm ; tail=22-27 μm ; ABD=19-20 μm.

Description :

Female : Body ventrally curved forming 'C' or 'S' shape upon fixation. Cuticle 1-2 μm thick at midbody and 3-4 μm on tail. Subcuticle with distinct transverse striations. Lateral chords about one-third of body-width near middle.

Lip region distinctly set off from body contour by a constriction ; lips rounded. Tooth solid, posterior third hollow, 8-10 μm or about one lip-width long. Expanded part of oesophagus occupying about 63-66% of oesophageal length. Nerve ring surrounding anterior slender part of oesophagus at 100-110 μm from anterior end. Cardia indistinct. Cardiac glands ovoid, measuring 5-6×6-8 um. Location of oesophageal gland nuclei and their orifices as given in Table II.

Vulva transverse slit, vagina about half of vulval body-width. Female reproductive system amphidelphic. Ovaries reflexed with 10-15 oocytes. A distinct sphincter present at oviduct-uterus junction. Prerectum 19-30 μm or about 1.0-1.5 anal body-widths long. Rectum 16-22 μm or about 0 8-0.9 anal body-width long Tail elongate-conoid or convex-conoid with blunt terminus, 22-32 μm or about 1.0-1.6 anal body-widths long with 2-3 caudal pores on each side.

Male : Not found.

Habitats and localities : Soil around roots of (i) apricot from Raih village, District Pithoragarh, Uttar Pradesh ; (ii) paddy from Chuari Khas, Disctrict Chamba, Himachal Pradesh ; (iii) *Acacia* sp. from plant Nurseries, Bajaura, District Kulu, Himachal Pradesh ; (iv) *Piccia* from Kulu, Himachal Pradesh ; (v) unidentified plants from Khongjan hills, Imphal, Manipur State.

Remarks : *Solidid ns vulgaris* is consmopolitan in distribution and of common occurrence in India. Thorne (1930. 1974) and Heyns (1968) reproted it from various localities in U.S.A., Mauritius and South Africa. Thorne (1974) reported a single male of this species from Colarado, North and South Dakota, U. S. A. The present specimens closely fit in the description of species as given by Heyns (1968) and Thorne (1930, 1974) except that these have posteriorly located vulva and smaller gonads.

Solididens australis (Heyns, 1968) N. Comb.

(Text-fig. 9, G-L)

Nygolaimus (Solididens) australis Heyns, 1968. *Ent. Mem. 19, Pl Protect. Res. Inst. Pretoria. S. Afr.* : 1-44.

Dimensions :

Lansdowne, Uttar Pradesh Population :

Famales (7) : L=1.40-1.51 mm ; a=39-42 ; b=3.0-3.6 ; c=41-47 ; V=53-55 ; G_1=6-7 ; G_2=6-8 ; tooth=10-11 μm ; oesophagus=420-460 μm ; prerectum=26-30 μm ; rectum=19-22 μm ; tail=32-36 μm ; ABD=18-22 μm.

Jhoolaghat, Uttar Pradesh Populaiion :

Females (2) : L=1.4-1.67 mm ; a=38-43 ; b=3.0-3.5 ; c=44-51 ; V=54-59 ; G_1=6-8 ; G_2=6-8 ; tooth=11-12 μm ; oesophagus=460-475 μm ; prerectum=29-30 μm ; rectum=22-23 μm ; tail=32-33 μm ; ABD=22 μm.

Male : L=1.53 mm ; a=39 ; b=3.2 ; c=53 ; T=46 ; tooth=10 μm ; oesophagus=475 μm ; prerectum=30 μm ; rectum=23 μm ; tail=29 μm ; ABD=23 μm ; spicules=30 μm.

Pithoragarh, Uttar Pradesh population :

Females (5) : L=1.34-1.51 mm ; a=37-38 ; b=3.2-3.4 ; c=47-66 ; V=50-56 ; G_1=5-7 ; G_2=4-7 ; tooth=8-10 μm ; oesophagus=390-445 μm ; prerectum=29-32 μm ; rectum=17-20 μm ; tail=23-29 μm ; ABD=20-22 μm.

Bashing, Himachal Pradesh population :

Females (4) : L=1.41-1.70 mm ; a=36-44 ; b=3.1-3.7 ; c=48-51 ; V=51-54 ; G_1=6-8 ; G_2=6-8 ; tooth=8-10 μm ; oesophagus=375--460 μm ; prerectum=25-30 μm ; rectum=19-23 μm ; tail=29-33 μm ; ABD=22-23 μm.

Manali, Himachal Pradesh population :

Females (3) : L=1 44-1.54 mm ; a=42-44 ; b=3.2-3.4 ; c=48-51 ; V=53-55 ; G_1=7-10 ; G_2=5-9 ; tooth=9-10 μm ; oesophagus=445-460 μm ; prerectum=26-29 μm ; rectum=19-20 μm ; tail=30-32 μm ; ABD=18-22 μm.

Male : L=1.54 mm ; a=44 ; b=3.4 ; c=48 ; T=49 ; tooth=9 μm ; oesophagus=455 μm ; prerectum=29 μm ; rectum=20 μm ; tail=32 μm ; ABD=23 μm ; spicules=36 μm ; ventromedian supplements=2 .

Neuri, Himachal Pradesh population :

Females (5) : L=1.37-1.55 mm ; a=44-54 ; b=2.8-3.1 ; c=43-46 ; V=54-56 ; G_1=6-8 ; G_2=6-8 ; tooth=9-10 μm ; oesophagus=480-490 μm ; prerectum=26-30 μm ; rectum=16-20 μm ; tail=30-36 μm ; ABD=17-19 μm.

Description :

Female : Body ventrally curved upon fixatlon, assuming the shape of letter 'C', tapering on both extremities. Cuticle 2-3 μm thick at midbody and 3-5 μm on tail. Subcuticle with distinct transverse striations. Lateral chords about one-third of body-width near middle. Lateral pores indistinct.

Lip region distinctly set off from body contour by a constriction ; lips rounded and labial papillae elevated. Amphidial apertures slit-like, about half of lip-width. Tooth solid, 9-11 μm long. Expanded part of oesophagus

occupying about 55-60% of oesophageal length. Nerve ring surrounding anterior slender part of oesophagus at 140-150 μm from anterior end. Cardia indistinct. Cardiac glands small, ovoid 6-7 × 8-10 μm. Location of oesophageal gland nuclei and their orifices as given in Table II.

Vulva a transverse slit, vagina about half of vulval body-width. Female reproductive system amphidelphic, ovaries short, reflexed with 12-15 oocytes arranged in a single row. A distinct sphincter present at oviduct-uterus junction. Prerectum 25-32 μm or about 1.3-1.6 anal body-widths long. Rectum 16-23 μm or about 0.8-1.0 anal body-width long. Tail 23-36 μm or about 1 3-1.6 anal body-widths long, elongate-conoid or bluntly-conoid with two caudal pores on each side.

Male : Supplements consist of an adanal pair and 2-3 poorly develop-ventromedians. Spicules straight, 30-36 μm along median axis. Lateral with guiding pieces 5-5 μm long. Gubernaculum absent.

Habitats and localites : Soil around roots of (i) mosses from Lansdowne, District Pauri Garhwal, Uttar Pradesh ; (ii) wild fruit trees (unidentified) on the bank of Kali River, Jhoolaghat (India-Nepal border), District Pithoragarh, Uttar Pradesh ; (iii) apricot from Madh village, District Pithoragarh, Uttar Pradesh ; (iv) *Riccia* sp. from Bashing, District Kulu, Himachal Pradesh ; (v) barley from Vashisht hot springs, Manali, District Kulu, Himachal Pradesh ; (vi) phylloclade plants (unidentified) from Neuri village, District Kulu, Himachal Pradesh.

Remarks : Heyns (1968) described *S. australis* from South Australia based on females only. The males are reported here for the first time. The present specimens closely fit in the description of this species as given by Heyns (1968) except that these have longer tooth, oesophagus and posteriorly located vulva.

Genus **Clavicauda** Heyns, 1968

Diagnosis (emended) : Small sized nematodes usually less than 1.5 mm. Body almost straight upon fixation. Subcuticle with distinct transverse striations. Lip region distinctly set off from body contour. Tooth acicular with a furcate base, smaller than width of lip region. Cardia inconspicuous. Cardiac glands ovoid. A large glandular organ present at baseof oesophagus. Sheath surrounding the expanded part of oesophagus inconspicuous. Female reproductive system amphidelphic. Vulva transverse. Tail clavate, many times longer than anal body-width. Males unknown.

Type and only species : *Calvicauda symmetricus* (Williams, 1958) n. comb.

Clavicauda symmetricus (Williams, 1958) N. Comb.

(Text-fig. 10, A-E)

Nygellus symmetricus (Willams, 1958) *Maurit. Sug. Ind. Res. Inst, Occ. Pap. 2: 1-9.*

Nygolaimus (Clavicauda) symmetricus (Williams, 1958) Heyns, 1968, *Ent. Mem. No. 19. Pl. protect. Res. Inst. pretoria, S. Afr.,* : 1-144.

Dimensions :

Females (15) : L=1.21-1.41 mm ; a=46-55 ; b=3.0-3.5 ; c=13-17 ; c'=5-7 ; V=46-50 ; G_1=5-9 ; G_2=8-10 ; tooth=7-8 μm ; oesophagus=375-435 μm ; prerectum=28-40 μm ; rectum=18-25 μm ; tail=85-102 μm ; ABD=14-16 μm.

Description :

Female : Body almost straight upon fixation, tapering towards extremities. Cuticle 1-2 μm thick at midbody and 4-6 μm at tail. Subcuticle with fine transverse striations. Lateral chords about one-fourth of body-width near middle. Lateral pores invisible.

Lip region set off from body contour ; lips conoid-rounded. Amphidial apertures slit-like about half of lip-width. Tooth acicular with furcate base, 7-8 μm or less than the lip-width. Expanded part of oesophagus occupies about 62-64% of oesophagus inconspicuous Nerve ring surrounding anterior slender part of oesophagus at 100-110 μm from anterior end. Cardia indistinct. Cardiac glands ovoid, 4-5×7-8 μm. Location of oesophageal gland nuclei and their orifices as given in Table II.

Vulva a transverse slit, vagina about half of vulval body-width. Female reproductive system amphidelphic, ovaries reflexed with 15-20 oocytes. A distinct sphincter present at oviduct-uterus junction. Prerectum 24-40 μm or about 2.0-2.5 anal body-widths long. Rectum 18-25 μm or about 1.3-1.6 anal body-widths long. Tail 85-102 μm or about 5-7 anal body-widths long, irregularly clavate ; anterior two-thirds tapering and posterior one-third distinctly clavate. Two caudal pores present on each side of tail.

Male : Not found.

Habitat and locality : Soil around roots of banana, *Musa paradiasica* from Thoubal, District Imphal, Manipur state.

Remarks : Williams (1958) described this species as *Nygellus symmetricus* from soil around roots of sugarcane in Mauritius based only on two females and one juvenile. Heyns (1968) proposed the subgenus *Clavicauda* for it and reported four females and two juveniles from Mauritius and one female from Congo.

This is the first report of the species from India. The present specimens agree fairly well with the description of species as given by Heyns (1968) except that the lip region is distinctly set off from the body.

Genus **Paravulvus** Heyns, 1968

Diagnosis (emended) : Small sized nematodes, usually less than 2.0 mm. Body ventrally curved, more so in posterior half. Cuticle, subcuticle or both with distinct transverse striations. Lip region continuous with body contour or slightly set off by a depression, usually wider than adjoining body. Tooth usually deltoid, rarely solididentoid in some species, equal to or less than width of lip region. Sheath surrounding basal expanded part of oesophagus inconspicuous. Oesophageal gland nuclei exceptionally large and distinct. Cardia absent, cardiac glands ovoid with their long axis parallel to body length. Large subdorsal organs present at base of oesophagus. Female reproductive system amphidelphic. Vulva longitudinal. The ventral body pores, anterior and posterior to vulva, transformed into special organs called as 'paravulvae' The number of these paravulvae is variable. Males with massive spicules, slender gubernaculum and well developed ventromedian supplements. Tails similar in both sexes, varying from bluntly rounded, short to elongate-conoid and ventrally curved.

Type species : *Paravulvus acuticaudatus* (Thorne, 1930) Thorne, 1974
Syn. *P. neodubius* (Heyns, 1968), new synonymy.

Other species : *Paravulvus andrassyi* (Heyns, 1968) n. comb.
P. hartingii (Thorne, 1929) Thorne, 1974
P. papillatus n. sp.
P. planposae (Altherr, 1942) n. comb.
P. teres (Thorne, 1930) Thorne, 1974

Species inquirendae : *P. luganensis* (Andrássy, 1960)
P. graciloides (Andrássy, 1960)
P. curvistilis (Thorne & Swanger, 1936)

Key To Species Of Paravulvus

1. Tail bluntly rounded.....2
   Tail dorsally convex-conoid to elongate-conoid and ventrally curved.....5
2. Cuticle around tail terminus exceedingly thickened..... *planposae*
   Cuticle around tail terminus normal.....3
3. Outer surface of cuticle with coarse striations.....*teres*
   Outer surface of cuticle smooth.....4
4. Body wider ; vulva posterior ; bisexual.....*papillatus* **n. sp.**
   Body narrower ; vulva anterior ; monosexual.....*andrassyi*
5. Lip region continuous ; tail elongate-conoid.....*hartingii*
   Lip region set off : tail dorsally convex-conoid.....*acuticaudatus*

Paravulvus acuticaudatus (Thorne, 1930) Thorne, 1974

(Text-fig. 11)

Nygolaimus acuticaudatus Thorne, 1930. *J. agric. Res. U.S D.A*, **41** : 445-466.

Nygolaimus acuticaudatus (Thorne, 1930) Thorne, 1939, *Capita zool.*, **8** 1-261.

Nygolaimus (*Paravulvus*) *acuticaudatus* (Thorne, 930) Heyns, 1968 *Ent. Mem. No. 19, Pl. Protect. Res. Inst Pretoria, S. Afr*, : 1-144.

Paravulvus acuticaudatus (Thorne, 1930) Thorne, 1974, *S. Dakota State Univ Agr. Exp. Sta. Tech. Bul.*, **41** : 1-120.

Dimensions :

Females (7) : L=1.55-1.87 mm ; a=49-56 ; b=4.1-5.0 ; c=49-53 ; V=45-46 ; G_1=10-12 ; G_2=11-13 ; tooth=7-8 μm ; oesophagus=360-375 μm ; prerectum=55-70 μm ; rectum=16-23 μm ; tail=30-35 μm ; ABD=20-23 μm.

Males (8) : L=1.41-1.76 mm ; a=47-59 ; b=4.3-5.1 ; c=50-63 ; T=58-64 ; tooth=7-10 μm ; oesophagus=320-370 μm ; prerectum=50-80 μm ; rectum=20-25 μm ; spicules=36-40 μm ; lateral guiding pieces=10-12 μm ; tail=24-30 μm ; ABD=23-30 μm.

Description :

Female : Body strongly ventrally curved, more so in its posterior end, tapering towards both extremities. Cuticle 2-3 μm thick at midbody and 4-5 μm on tail. Subcuticle with distinct transverse striations. Lateral chords about 1/4th-1/3rd of body near middle. Dorsal, ventral pores indistinct.

Lip region set off by a depression and more wider than adjoining body ; lips rounded and labial papillae not elevated. Amphidial apertures slit-like occupying about half of lip-width. Tooth deltoid, 7-10 μm or about four-seventh of lip-width ; broad at base but solid in anterior one-fourth. Expanded part of oesophagus occupying about 45-50% of oesophageal length. Sheath surrounding basal expanded part of oesophagus inconspicuous. Nerve ring surrounding anterior slender part of oesophagus at 120-140 μm from anterior end. Cardiac glands ovoid with their long axis lying parallel to the length of body, 5-8 $\times$ 10-13 μm. Large glandular organs present at base of oesophagus. Location of oesophageal gland nuclei and their orifices as given in Table II.

Vulva longitudinal, vagina slcerotized and slightly less than half the vulval-width. Female repoductive system amphidelphic. Ovaries reflexed with 15-20 oocytes. Number of paravulvae anterior and posterior to vulva vary from 0-2 anterior to vulva and 0-3 posterior to vulva. A distinct sphincter present at oviduct-uterus junction. Prerectum 55-70 μm or about three anal body-widths long. Rectum 16-23 μm or about one anal body-width long. Tail 31-35 μm or about 1.5 anal body-widths long, elongate-conoid, ventrally arcuate with acute terminus. Two caudal pores present on each side of tail.

Male : Supplements consist of an adanal pair and 7-10 ventromedians which are irregularly spaced. Spicules stout, 36-40 μm or about 1.7-1.8 anal body-widths along median axis. Gubernaculum slender, 7-8 μm long. Tail slightly shorter than females, about one anal body-width long with rounded terminus.

Habitat and locality: Soil around roots of mosses and grasses from Mari and Rohtang pass, District Kulu, Himachal Pradesh.

Remarks : Thorne (1930) reported this species from the mountain soil, Utah, U. S. A. Heyns (1968) described six syntypes and topotypes, a male and a female from Switzerland and a female from The Netherlands. This is the first record of the species from India. Males were as frequent as females. These specimens conform well with the description of species as given by Thorne (1930) and Heyns (1968) except that they have either faintly or distinctly visible transverse striations on subcuticle, smaller cardiac glands. The number of anterior or posterior paravulvae vary greatly ; 0-2 anterior to vulva and 0-3 posterior to vulva. However, these are totally absent in one female. The non-protoplasmic part of tail shows considerable variations. *P. neodubius* (Heyns, 1968) Thorne, 1974 falls well within

the range of measurements and conforms with the description of *P. acuticaudatus* and is therefore considered its synonym.

Paravulvus papillatus n. sp.

(Text-fig. 12)

Dimensions :

Paratype females (2) : L=0.94-1.22 mm ; a=30-36 ; b=3.8-4.8 ; c=56-61 ; V=51-53 ; G_1=14-16 ; G_2=12-14 ; tooth=8-9 μm ; oesophagus=250-260 μm ; prerectum=28-36 μm ; rectum=16-20 μm ; tail=17-20 μm ; ABD=19-20 μm.

Holotype Female : L=1.08 mm ; a=36 ; b=4.4 ; c=60 ; V=53 ; G_1=13 ; G_2=12 ; tooth=10 μm ; oesophagus=245 μm ; prerectum=33 μm ; rectum=22 μm ; tail=18 μm ; ABD=20 μm.

Paratype male : L=1.14 mm ; a=38 ; b=4.6 ; c=67 ; T=61 ; tooth=9 μm ; oesophagus=245 μm ; prerectum=39 μm ; rectum=23 μm ; tail=17 μm ; ABD=22 μm ; spicules=30 μm ; lateral guiding pieces=7 μm ; gubernaculum=9 μm ; ventromedian supplements=11.

Description :

Female : Body strongly ventrally curved, more in posterior part, tapering at both extremities. Cuticle 1-2 μm thick at midbody and 3-4 μm on tail. Subcuticle with distinct transverse striations. Lateral chords about one-third of body-width near middle. Dorsal, ventral and lateral pores indistinct.

Lip region slightly set off from body contour by a depression and wider than the adjoining body ; lips rounded and labial papillae not elevated. Amphidial apertures slit-like, about one-third of lip-width. Tooth deltoid, 8-10 μm long or equal to lip-width, broad at base and solid anteriorly. Expanded part of oesophagus occupying about 55-60% of oesophageal length. Sheath surrounding basal expanded part of oesophagus inconspicuous. Nerve ring surrounding anterior slender part of oesophagus at 80-85 μm from anterior end. Cardia absent. Cardiac glands well developed, laying parallel to length of body, 7-8 × 10-12 μm. A large subdorsal glandular organ present at base of oesophagus. Location of oesophageal gland nuclei and their orifices as given in Table II.

Vulva longitudinal, vagina sclerotized and slightly less than half of vulval-width. Female reproductive system amphidelphic, ovaries reflexed with 12-15 oocytes arranged in a single row. Uterus about three anal body-widths long. Paravulvae anterior or posterior to vulva absent. A distinct sphincter present at oviduct-uterus junction. Prerectum 28-36 μm or about 1.5-1.7 anal body-widths long Rectum 16-22 μm or about 0 8-0.9 anal body-width long. Tail short. dorsally convex-conoid with blunt terminus, 17-19 μm or about 0.9 anal body-width long with two caudal pores on each side.

Male : Supplements consist of an adanal pair and 11 ventromedians which are regularly spaced Spicules 30 μm or about 1.4 anal body-widths along median axis. Lateral guiding pieces tongue-shaped. 7 μm long. Gubernaculum slender, 10 μm long. Tail similar to females.

Type habitat and locality : Soil around roots of wild flowering plants (unidentified) from Shamshi, District Kulu, Himachal Pradesh.

Type specimens : Collected in June 1977 ; holotype and one paratype female on slide *Paravulvus papillatus* n. sp./1 ; one male and one female paratype on slide *Paravulvus papillatus* n. sp./2 ; deposited in the Department of Zoology, Aligarh Muslim University.

Differential diagnosis : Because of the total absence of paravulvae the new species, *Paravulvus papillatus* comes very close to *P. andrassyi* and *P. planposae*. It differs from the former in having a wider body, smaller oesophagus and posteriorly located vulva (a=29-32 ; b=5.0-5.6 ; V=45-50 in *P. andrassyi*). From *P. planposae* it differs in having a wider body, smaller oesophagus and longer tooth (a=35 ; tooth=7.5 μm ; oesophagus=350 μm in *P. planposae*).

Genus **Aetholaimus** Williams, 1962

Diagnosis : Lip region discoid, lips closely amalgamated, hexagonal. Cuticle and subcuticle finely striated. Stoma partly sclerotized, consisting of an outer bowl-shaped vestibule with sclerotized thickenings and an inner chamber supported by six sclerotized movable ribs. Pharynx eversible. Oesophagus dorylaimoid, muscular. Basal expanded part of oesophagus is enclosed in a thin sheath which widens at base of oesophagus and encloses three ovoid cardiac glands. Cardia present of absent. Female reproductive system amphidelphic. Vulva transverse. Tail hemispheroid. Males unknown.

Type species : *Aetholaimus bucculentus* Williams, 1962

Other species : *Aetholaimus indicus* Jairajpuri, 1965
A. gracilis Thorne, 1974
A. rotundicauda (De Man, 1880) Coomans & Loof, 1978.

Aetholaimus Indicus Jairajpuri, 1965

(Text-fig. 10, F-H)

Aetholaimus indicus Jairajpuri, 1965, *Proc. helminth. Soc. Wash.*, **32** : 78-81.

Aetholaimus indicus (Jairajpuri, 1965) Heyns, 1968, *Ent. Mem.* No. *19, Pl. Protect. Res. Inst., Pretoria, S. Afr., :* 1-144.

Aetholaimus indicus (Jairajpuri, 1968) Coomans & Loof, 978, *Proc. helminth. Soc. Wash.*, **45** : 82-92.

Description :

Females (2) : L=1.44-1.52 mm ; a=42- 43 ; b=3.1-3.3 ; c=69-70 ; V=53-55 ; G_1=6-7 ; G_2=6-7 ; tooth=13-14 μm ; oesophagus=460-470 μm ; prerectum=32-35 μm ; rectum=20-25 μm ; tail=21-25 μm ; ABD=20-25 μm.

Description :

Female : Body cylindroid, spirally curved in posterior half and tapering anterior to base of oesophagus. Cuticle 2-3 μm thick at midbody and 4-5 μm on tail. Cuticle and subcuticle with fine striations. Lateral chords about one-third of body near middle.

Lip region truncate and set off from body contour, papillae not elevated. Amphidial apertures slit-like and occupying about half of lip-width. Tooth deltoid, 13-14 μm or equal to width of lip region. Stoma consisting of a bowl-shaped strongly sclerotized vestibule and an inner chamber of six sclerotized ribs. Pharyngeal cavity with sclerotized walls. narrowing gradually to join oesophageal luman. Expanded part of oesophagus occupying about 67-68% of oesophageal length. Sheath surrounding basal expanded part of oesophagus relatively thin and encloses three cardiac glands. Cardiac glands ovoid, 7-8×7-9 μm. Nerve ring surrounding anterior slender part of oesophagus at 110-112 μm from anterior end. Cardia visible. Location of oesophageal gland nuclei and their orifices as given in Table II.

Vulva transverse, vagina about half of vulval-width. Female reproductive system amphidelphic, ovaries reflexed with 10-15 oocytes. A distinct

sphincter present at oviduct-uterus junction. Prerectum 32-35 μm or about 1.6 anal body-widths long, Rectum 20-25 μm or about one anal body-width long. Tail hemispherical, slightly clavate, about one anal body-width long with two caudal pores on each side.

Male : Not found.

Habitat and locality : Soil around roots of weeds and grasses from near Gulaba Army Camp, Manali, District Kulu, Himachal Pradesh.

Remarks : Jairajpuri (1965) described this species from soil around roots of grasses from Nainital, India based on three females. The present specimens are from another locality but they also fit well with the description of this species as given by Jairajpuri except that they have a smaller body, tooth and prerectum.

Genus Nygellus Thorne, 1939

Diagnosis : Body straight or slightly ventrally curved upon fixation. Cuticle and subcuticle finely striated. Lips closely amalgamated, rounded, continuous with body contour. Tooth deltoid or linear, usually less than the width of lip region. Basal expanded part of oesophagus surrounded by a conspicuous sheath with spiral muscles. Cardiac glands ovoid. Cardia present or absent. Vulva transverse. Female reproductive system monoopisthodelphic. Anterior uterine branch present or absent. Males unknown. Tails long, clavate.

Type species : *Nygellus clavatus* Thorne, 1939
Other species : *Nygellus subclavatus* Timm & Ameen, 1960
N. mozammili Jairajpuri, 1965.

Remarks : Jairajpuri (1964) reported the type species, *N. clavatus* Thorne 1939 from soil around roots of sugarcane from Jorhat, Assam. In the following the other species, *N. subclavatus* is reported from Cuttack, Orissa. This species was first described from Dacca, Bangladesh. The third species, *N. mozammili* Jairajpuri, 1965 was described from Penang, Malaysia.

Nygellus subclavatus Timm & Ameen, 1960

(Text-fig. 13)

Nygellus subclavatus Timm & Ameen, 1960, *Pakist. J. biol. agric. Sci* , **2** : 1-2
Nygellus subclavatus (Timm & Ameen, 1960) Heyns, 1968, *Ent. Mem No. 19, Pl. Protect. Res. Inst. Pretoria. S. Afr.*, 1-144.

Dimensions:

Female (2): L=1.22-1.30 mm; a=42-48; b=3.2-3.5; c=32-37; V=34-40; G_1=1; G_2=9-15; tooth=8-10 μm; oesophagus=345-400 μm; rectum=25-30 μm; prerectum=30-37 μm; tail=33-40 μm; ABD=13-14 μm.

Description:

Female: Body almost straight upon fixation, tapering anterior to base of oesophagus. Cuticle and subcuticle finely striated, 1-2 μm thick at midbody and 4-5 μm, on tail. Dorsal, ventral and lateral body pores indistinct.

Lip region continuous with body; lips rounded and labial papillae not elevated. Amphidial apertures slit-like, about half as wide as lip region. Tooth linear, 8-10 μm or about one lip-width long. Basal expanded part of oesophagus occupying about 58-62% of oesophageal length. Nerve ring surrounding anterior slender part of oesophagus at 125-140 μm from anterior end. Basal expanded part of oesophagus enclosed in a conspicuous sheath having spiral muscles. Cardiac glands ovoid 6-7×8-10 μm. Location of oesophageal gland nuclei and their orifices as given in Table II.

Vulva transverse; vagina about half vulval body-width long. Female reproductive system mono-opisthodelphic; ovary reflexed with numerous oocytes arranged in a single row. A well developed sphincter present at oviduct-uterus junction. Anterior uterine sac small, 7-15 μm long. Rectum about two anal body-widths long. Prerectum about 2.3-2.6 anal body-widths long. Tail long, clavate, about 2.7-3.0 anal body-widths long with two caudal pores on each side.

Male: Not found.

Habitat and locality: Soil around the roots of unidentified water plants from Cuttack, Orissa.

Remarks: *Nygellus subclavatus* is reported for the first time from India. The present specimens conform well with those described by Timm & Ameen (1960) and Heyns (1968).

Genus **Campydora** Cobb, 1920

Diagnosis: Body small, less than 1 mm. Lip region slightly set off, wider than adjoining body. Mural tooth small, subdorsally located on wall of a narrow and tubular pharynx. Oesophagus comprising of a long anterior slender part and a short distinctly offset basal bulb. The latter

having a well developed and thick-walled 'triquetrous' chamber. The lumen of oesophagus wider specially in basal bulb. Cardiac gland absent. Cardia well developed, hemisperical Female reproductive system amphidelphic. Prerectum absent. Tail elongate with an acute terminus and a prominent caudal papilla near its middle. Males unknown.

Type and only species : *Campydora demonstrans* Cobb, 1920

Campydora demonstrans Cobb, 1920

(Text-fig. 14)

Campydora demonstrans Cobb, 1920, *Contrib. Sci. Nematol.*, **9** : 217-245

Campydora demonstrans (Cobb, 1920) Thorne, 1939, *capita zool*, **8** : 1-261.

Campydora demonstrans (Cobb, 1920) Goodey, 1951, *Soil and freshwater nematodes* London, Methuen : 1-544.

Dimensions :

Srinagar, Jammu & Kashmir population :

Females (10) : L=0.58-0.64 mm ; a=24-27 ; b=2.7-3.0 ; c=6-7 ; V=58-62 ; G_1=6-10 ; G_2=7-11 ; tooth=4-5 μm ; oesophagus=210-215 μm ; tail=90-98 μm ;

Ranikhet, Uttar Pradesh population :

Female (10) : L=0.48-0.58 mm ; a=23-25 ; b=2.7-2.9 ; c=5-7 ; V=55-59 ; G_1=5-10 ; G_2=6-11 ; tooth=4.5-5.0 μm ; oesophagus=175-200 μm ; tail=80-100 μm.

Utah, U.S.A. population

Females (5) : L=0.55-0.60 mm ; a=23-25 ; b=2.6-2.8 ; c=6-7 ; V=58-62 ; G_1=9-10 ; G_2=11-14 ; tooth=4-5 μm ; oesophagus=195-215 μm ; tail=81-86 μm.

Description :

Female : Body almost straight to slightly ventrally curved upon fixation, tapering a little anterior to base of oesophagus but markedly towards tail. Cuticle 1.0-1.5 μm thick at midbody and 2.0-2.5 μm on tail. Subcuticle with distinct transverse striations. Lateral pores indistinct.

Lip region set off from body contour, distinctly wider than adjoining body. Labial papillae prominent. Amphids small, obscure, Mural tooth

TABLE 1 : Outline Classification of the Suborder NYGOLAIMINA AHMAD & JAIRAJPURI, 1979

SUPERFAMILY	FAMILY	SUBFAMILY	GENUS
Nygolaimoidea De Coninck, 1965	Nygolaimidae (Thorne, 1935) Meyl, 1961	Nygolaiminae Thorne, 1935	*Nygolaimus* Cobb, 1913
			Clavicaudoides Heyns, 1968
			Aquatides Heyns, 1968
			Laevides Heyns, 1968
			Paranygolaimus Heyns, 1968
			Afronygus Heyns, 1968
		Solididentinae n. subfam.	*Solididens* Heyns, 1968
			Feroxides Heyns, 1968
			Clavicauda Heyns, 1968
		Paravulvinae n. subfam.	*Paravulvus* Heyns, 1968
	Nygellidae (Andrássy, 1958) Jairajpuri, 1964	Nygellinae Andrassy, 1958	*Nygellus* Thorne, 1939
	Aetholaimidae (Jairajpuri, 1965) Andrassy, 1976	Aetholaiminae Jairajpuri, 1965	*Aetholaimus* Williams, 1962
			Nygolaimellus Loos, 1949
		Nygolaimellinae Clark, 1961	*Aporcelaimoides* Heyns, 1965
	Nygolaimellidae (Clark, 1961) Siddiqi, 1968		*Scapidens* Heyns, 1965
		Nygolaimiinae Andrassy, 1976	*Nygolaimium* Thorne, 1930
Campydoroidea Jairajpuri *et al.*, 1976	Campydoridae (Thorne, 1935) Clark, 1961	Campydorinae Thorne, 1935	*Campydora* Cobb, 1920

TABLE II : Location of Oesophageal Gland Nuclei and Their Orifices in Species of NYGOLAIMINA

SPECIES	DO	DN	DO—DN	S N 1	S O 1	S N 2	S O 2
Nygolaimus harishi	55—58	64—66	6.5—8.5	73—76	72—75	86—89	85—87
Clavicaudoides clavicaudatus	57—59	63—65	4.0—5.5	75—78	74—78	84—87	83—85
Clavicaudoides longidens	54—56	60—63	5.0—6.5	74—77	73—76	85—89	84—89
Clavicaudoides tenuicaudatum n. sp.	55—57	61—63	4.5—5.5	75—78	75—78	87—90	87—89
Aquatides aquaticus	52—55	58—61	5.5—7.0	73—78	74—80	86—90	85—88
Aquatides intermedius	46—49	52—55	5.0—6.5	69—72	70—72	84—87	83—86
Aquatides deconincki	58—60	62—65	4—5	68—71	70—72	82—84	82—84
Aquatides christicki n. sp.	50—53	59—63	8.5—9.0	74—77	75—77	85—88	85—87
Laevides laevis	49—52	55—57	5.0—6.5	69—73	69—73	82—85	82—84
Laevides timmi	50—53	56—59	5—6	73—76	72—75	85—88	85—88
Laevides imphalus	50—52	57—60	6—7	72—75	71—74	84—87	84—86
Aquatides thornei	50—52	55—60	4—5	65—70	67—70	82—85	82—85
Solididens vulgaris	47—50	50—53	3—4	54—60	54—60	90—92	90—93
Solididens australis	48—51	51—54	3—4	55—61	54—61	92—95	92—95
Clavicauda symmetricus	47—50	52—55	4—5	57—61	58—62	78—83	78—83
Paravulvus acuticaudatus	57—60	65—69	7—8	75—79	74—80	86—89	85—90
Paravulvus papillatus n. sp.	50—53	53—59	6—7	73—77	73—77	79—84	79—84
Nygellus subclavatus	54—56	57—59	3—4	68—70	70—71	75—77	75—77
Aetholaimus indicus	52—55	57—60	5.5—6.0	71—75	71—73	81—83	80—82
Campydora demonstrans	82—84	85—88	3—4	90—93	91—95	—	—

hollow, small, 4-5 μm or about equal to height of lip region. Pharynx narrow, tubular, 18-23 μm long. Basal bulb of oesophagus with a well developed, thick-walled triquetrous chamber, 25-32 × 17-24 μm or occupying about 14-15% of oesophageal length. Nerve ring surrounding anterior slender part of oesophagus at 80-100 μm from anterior end. Excretory pore and a cuticularized excretory duct present at 62-75 μm from anterior end. Oesophageal glands three, one dorsal and two Subventrals. Location of oesophageal gland nuclei and their orifices as given in Table II. Cardia bluntly-conoid, 7-10 μm long, cardiac glands absent.

Vulva a transverse slit, vagina thick-walled. Female reproductive system amphidelphic ; ovaries reflexed, sometimes beyond vulva ; 5-6 oocytes arranged in a single row except at tip. Oviduct and uterus not distinctly separated. Uterine eggs 40-55 × 13-15 μm. Prerectum absent, Rectum 13-17 μm or 0.8-0.9 anal body-width long Tail elongate conoid, 80-100 μm or about 4.7-6.4 anal body-widths long, with acute terminus and prominent caudal papillae near its middle.

Male : Not found.

Habitats and localities : Soil around roots of (i) apple from Kashmir University Campus, Srinagar, Jammu & Kashmir ; (ii) water plants (unidentified) from near Dal Lake, Nishat Gardens, Srinagar, Jammu & Kashmir ; (iii) apple from Ranikhet-Almora road, Ranikhet, Uttar Pradesh ; (iv) *Alfa Alfa* from Holladay, Utah, U.S.A.

Remarks : Jairajpuri (1964) and Jairajpuri *et. al.*, (1976) reported Campydora *demonstrans* Cobb, 1920 from several localities in Jammu & Kashmir, India, but did not provide a detailed description of the species. More specimens of this species were collected from different place in India and also five females were obtained from U.S.D A through the courtesy of Dr. A. M. Golden. The Indian specimens and those obtained from U.S.A. closely conform to the description of species as given by Cobb (1920) and Thorne (1939). However, the wing-like striae which were described by Cobb are absent in these specimens. The gonads in these specimens are clearly amphidelphic. However, both Cobb and Thorne have mentioned that posterior sexual branch is rudimentary and only the anterior sexual branch functional. This appears to be incorrect because all the present specimens have both anterior and posterior sexual branches well developed and functional. In many specimens, however, it was noticed that usually the ovary of anterior branch is more developed extending beyond the vulva and nearly overlapping the other gonad. This might have been the reason why Cobb and Thorne regarded the posterior gonad to be rudimentary.

Moreover, the position of vulva is same in all the specimens from different populations which supports the view that the reproductive system should also be same, i.e, amphidelphic, Goodey, J. B. (1963) had erroneously mentioned the gonad to be single, anterior reflexed ; and posterior represented by a post-vulval sac. This needs to be corrected as mentioned above.

SUMMARY

The present work concerns the nygolaim nematodes belonging to the suborder Nygolaimina Ahmad & Jairajpuri, 1979. A detailed account of the morphology of these nematodes with particular reference to those characters which are of taxonomic importance have been given. This is followed by the systematics of the group and the diagnosis of the suborder Nygolaimina. In this work two superfamilies, viz. Nygolaimoidea De Coninck, 1965 and Campydoroidea Jairajpuri *et al.*, 1976 have been recognized under this suborder. The superfamily Nygolaimoidea is divided into four families, viz. Nygolaimidae, Nygolaimellidae, Nygellidae and Aetholaimidae. Two new subfamilies, viz. Solididentinae and Paravulvinae have been proposed under Nygolaimidae. An outline classification of the suborder Nygolaimina up to genera have also been provided. Descriptions of a large number of species of Nygolaimina from India have been given. The following 20 species grouped under 10 genera have been described and figured : *Nygolaimus harishi* Ahmad & Jairajpuri, 1980 ; *Clavicaudoides clavicaudatus* (Altherr, 1953) n. comb., *C. longidens* Ahmad & Jairajpuri, 1900 ; *C. tenuicaudatum* n. sp. ; *Aquatides aquaticus* (Thorne, 1930) Thorne 1974 ; *A. intermedius* (Loof, 1961) n. comb ; *A. deconincki* Jairajpuri & Coomans, 1977 ; *A. thornei* (Schneider, 1937) n. comb *A. Christicki* n. sp. ; *Laevides laevis* (Thorn, 1939) Thorne, 1974 ; *L. timmi* (Heyns, 1968) n. comb ; *L. imphalus* Ahmad & Jairajpuri, 1980 ; *Solididens vulgaris* (Thorne, 1930) Thorne, 1974 ; *S. australis* (Heyns, 1968) n. comb. ; *Clavicauda symmetricus* (Heyns, 1968) n. comb. ; *Paravulvus acuticaudatus* (Thorne, 1930) Thorne, 1974 ; *P. papillatus* n. sp. ; *Aetholaimus indicus* Jairajpuri, 1965 ; *Nygellus subclavatus* Timm & Ameen, 1960 ; *Campydora demonstrans* Cobb, 1920, Identification keys to species of various genera have been given. Males of *Clavicaudoides clavicaudatus*, *Laevides timmi* and *Solididens australis* have been reported for the first time.

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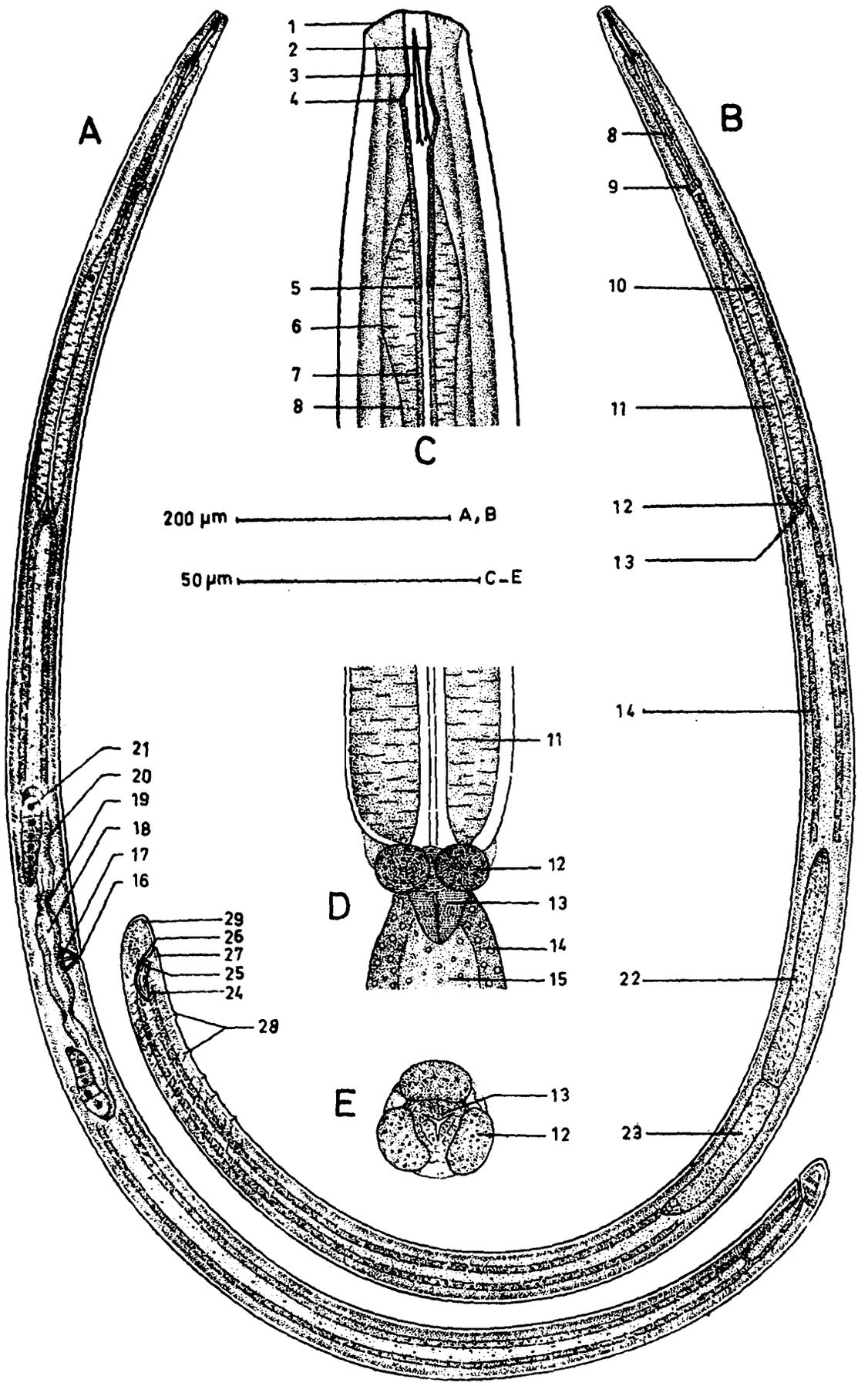
Legend for Text-fig. 1.

Text-fig. 1. Typical nygolaim species (A) Entire female, (B) Entire male, (C) Anterior region, (D) Cardiac region, (E) Cross section through cardiac region (1-lip region ; 2-guiding ring ; 3-mural tooth ; 4-pharynx ; 5-junction of pharynx and oesophagus ; 6-ellipsoidal swelling of oesophagus ; 7-lumen of oesophagus ; 8-anterior slender part of oesophagus ; nerve ring ; 10-dorsal oesophageal gland nucleus ; 11-basal expanded part of oesophagus ; 12-cardiac glands ; 13-cardia ; 14-intestine ; 15-intestinal lumen ; 16-vulva ; 17-vagina ; 18-uterus ; 19-sphincter ; 20-oviduct ; 21-ovary ; 22-anterior testis ; 23-posterior testis ; 24-spicule ; 25-lateral guiding piece ; 26-guberna culum ; 27-adanal supplement ; 28-ventromedian supplements ; 29-posterior region).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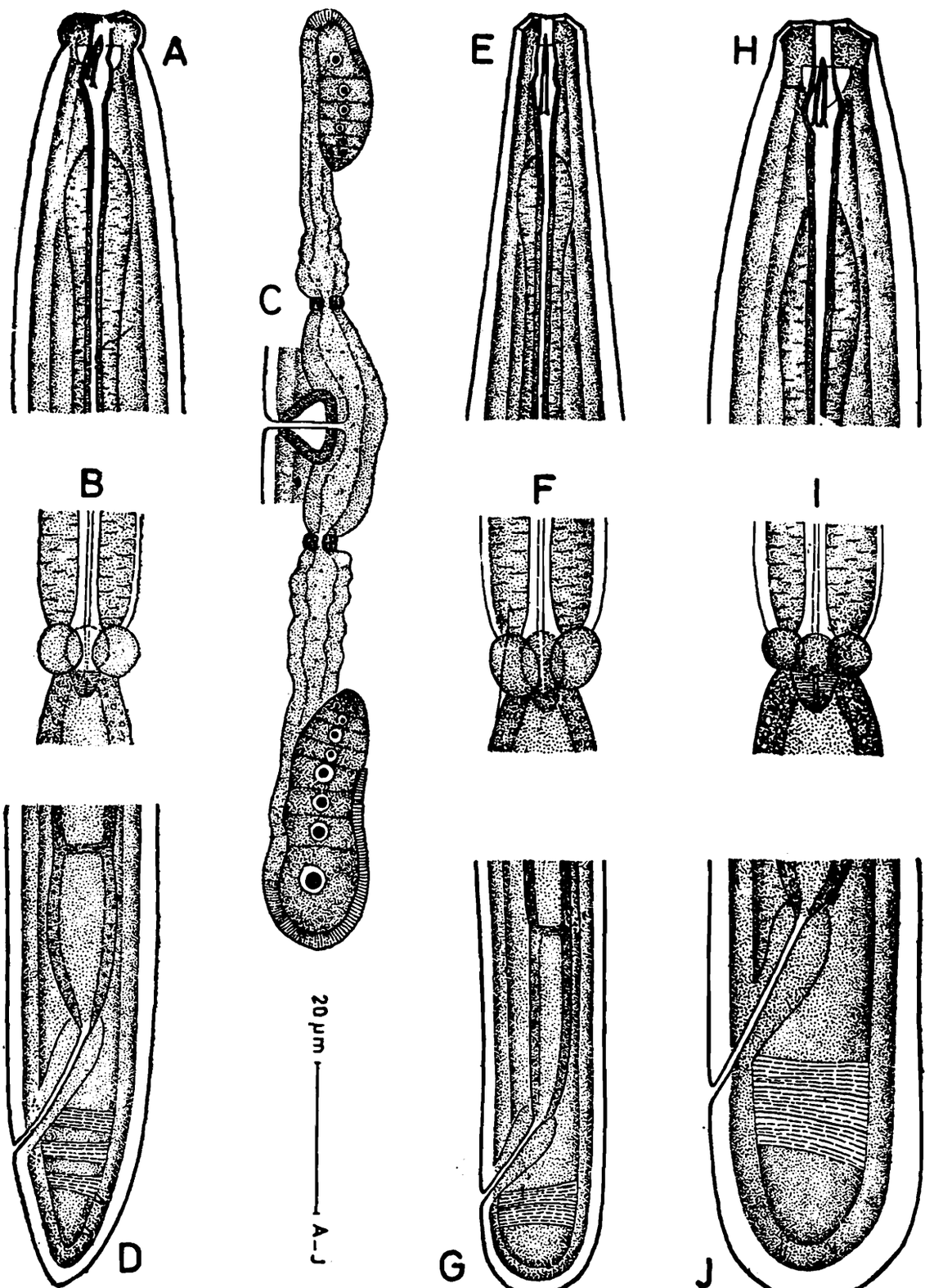
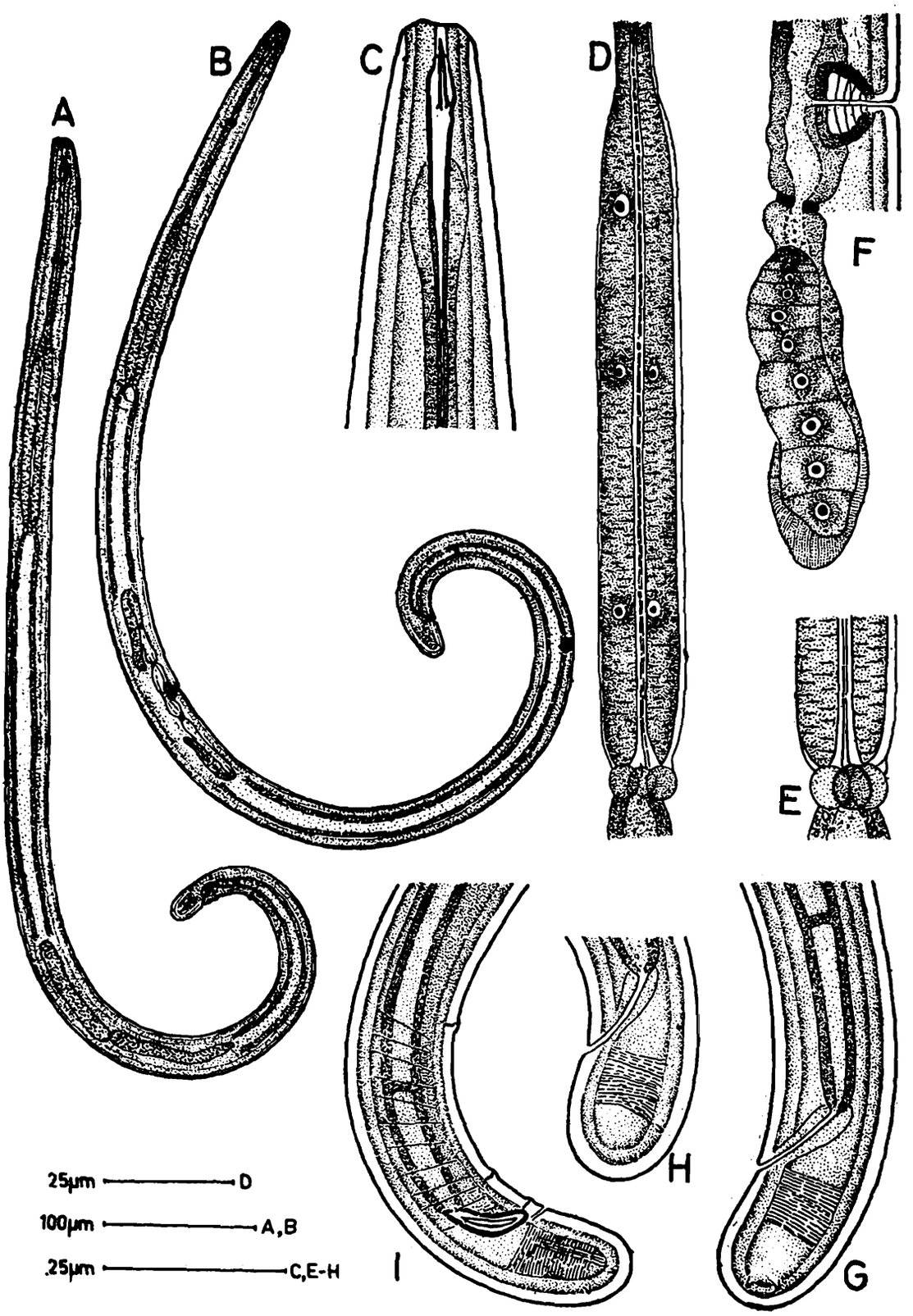
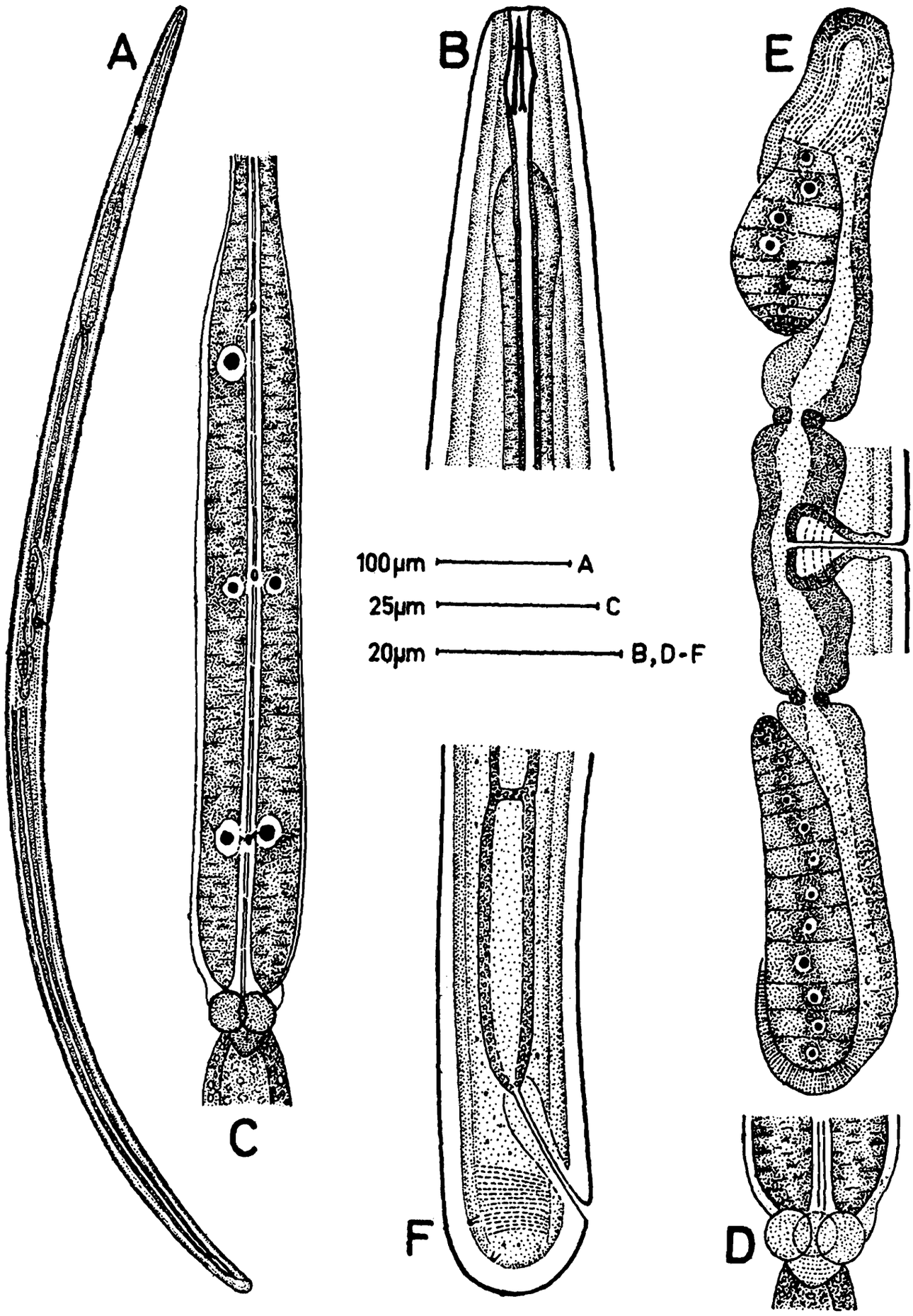
Text-Fig. 1



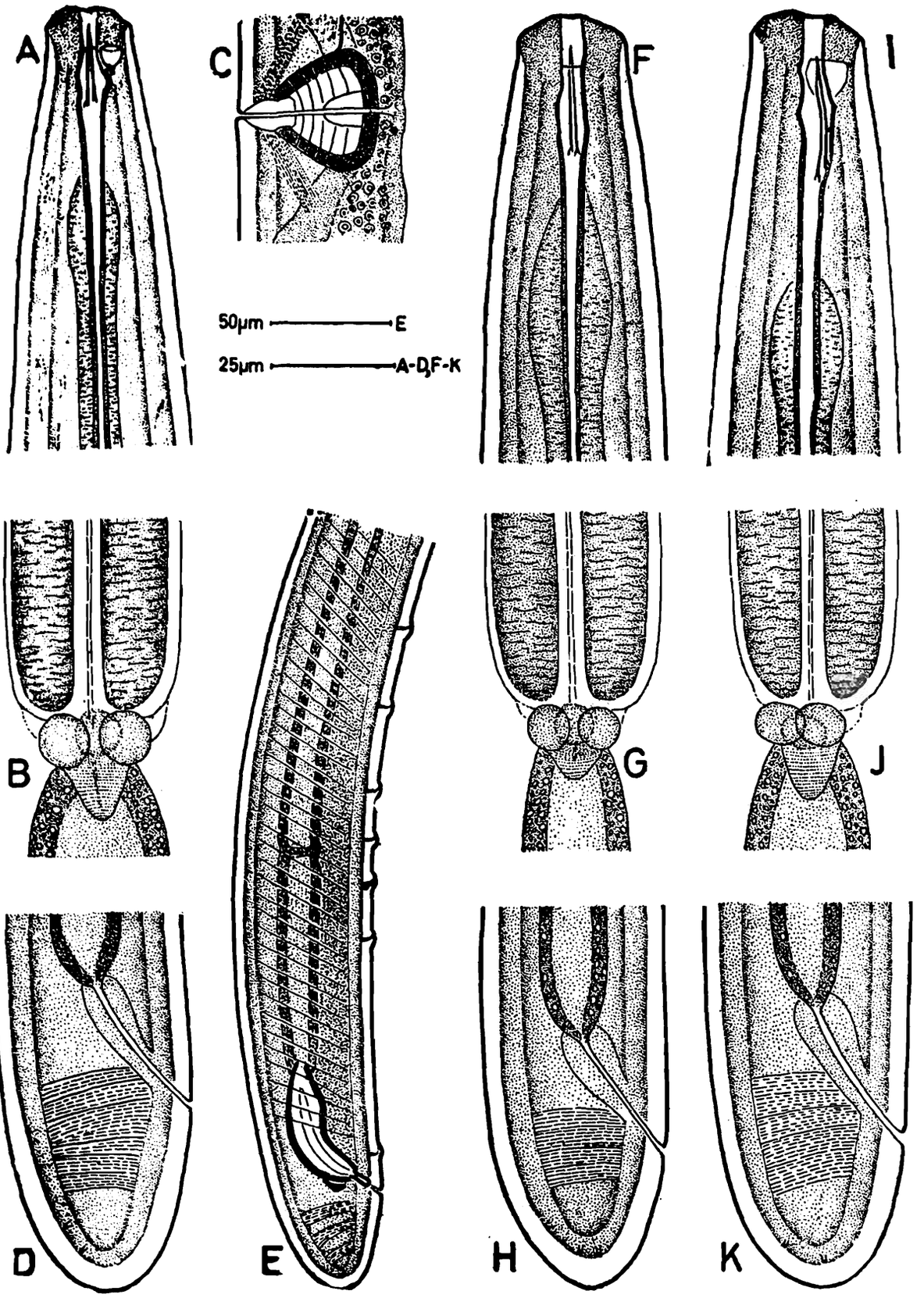
Text-fig 2. A-D *Nygolaimus harishi* (A) Anterior region. (B) Cardiac regi n. (C) Gonad, (D) Posterior region. E-G *Clavicaudoides longidens* (E) Anterior region, (F) Cardiac region, (G) Posterior region. H-J *Laevides imphalus* (H) Anterior region, (I) Cardiac region, (J) Posterior region.



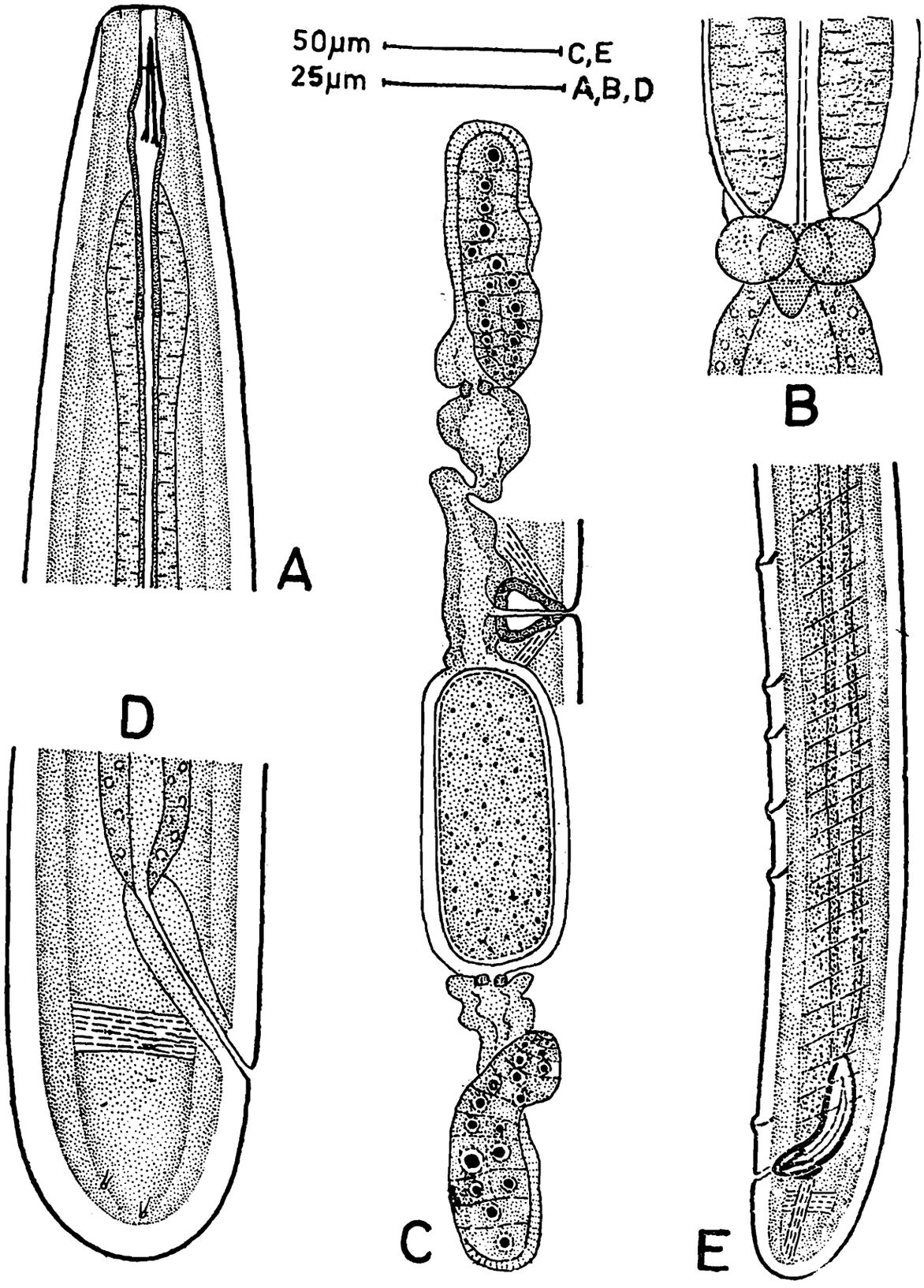
Tex-fiig. 3. *Clavicaudoides clavicaudatus* (A) Entire male, (B) Entire female, (C) Anterior region, (D) Expanded part of oesophagus, (E) Cardiac region, (F) Female genital branch (posterior), (G) Female posterior region, (H) Female posterior end, (I) Male posterior region.



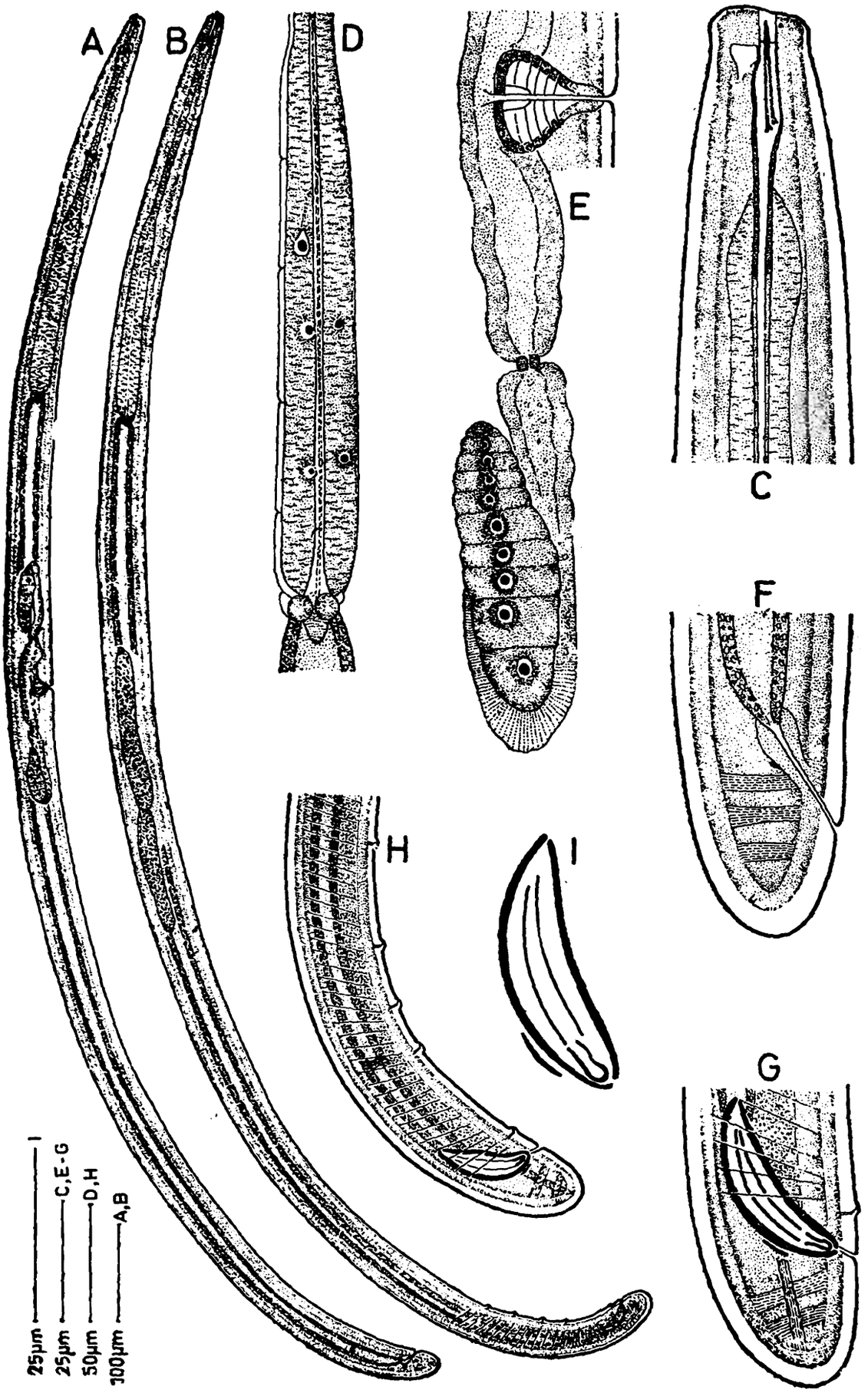
Text-fig. 4 *Clavicaudoides tenuicaudatum* n. sp. (A) Entire female, (B) Anterior region, (C) Expanded part of oesophagus. (D) Cardiac region, (E) Female gonad, (F) Posterior region.



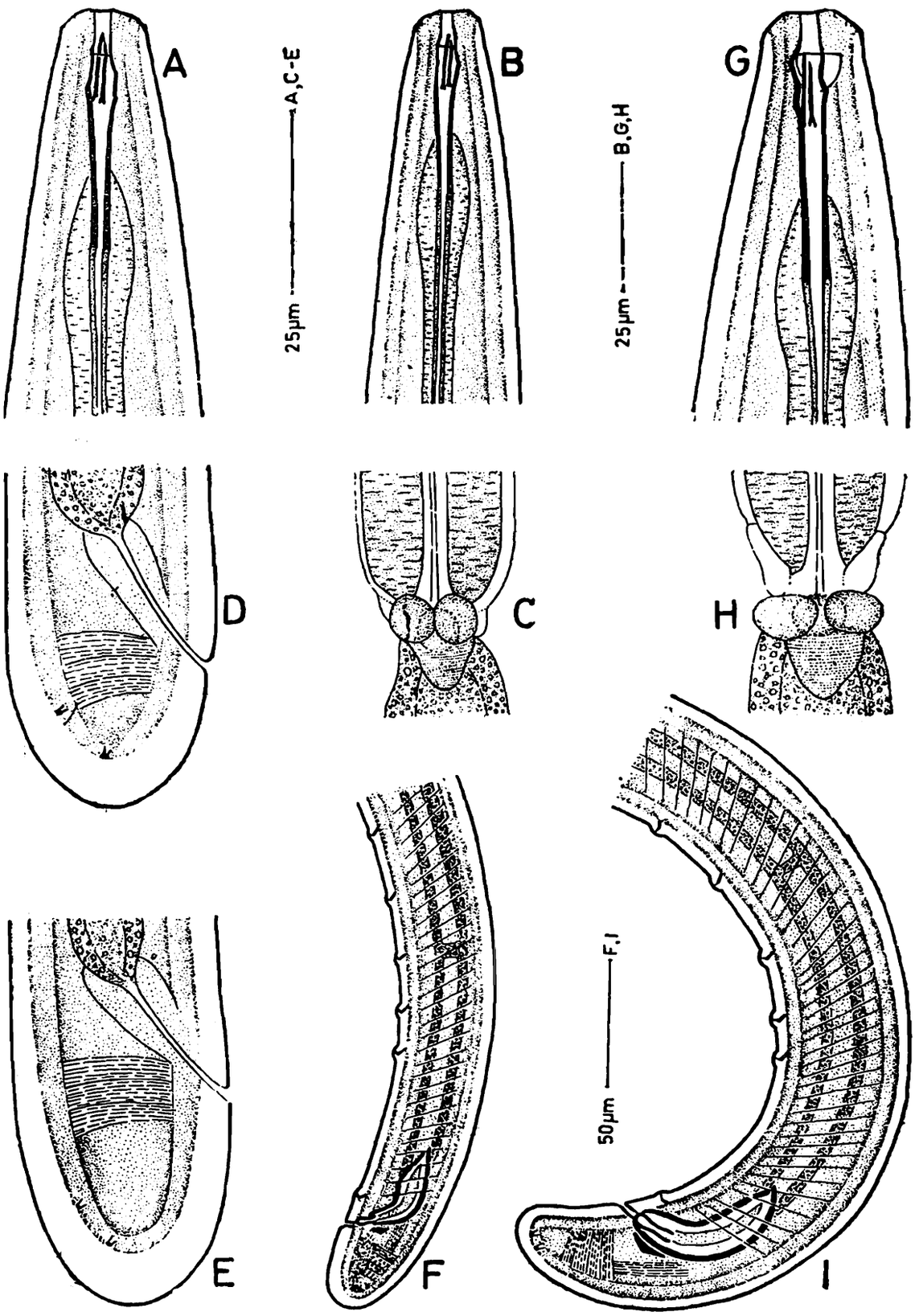
Text-fiig. 5. A-E *Aquatides aquaticus* (A) Anterior region, (B) Cardiac region, (C) Vulva and vagina (lateral), (D) Female posterior end, (E) Male posterior region. F-H *Aquatides intermedius* (F) Anterior region, (G) Cardiac region, (H) Female posterior region, I-K *Aquatides deconincki* (I) Anterior region, (J) Cardiac region. (K) Female posterior end.



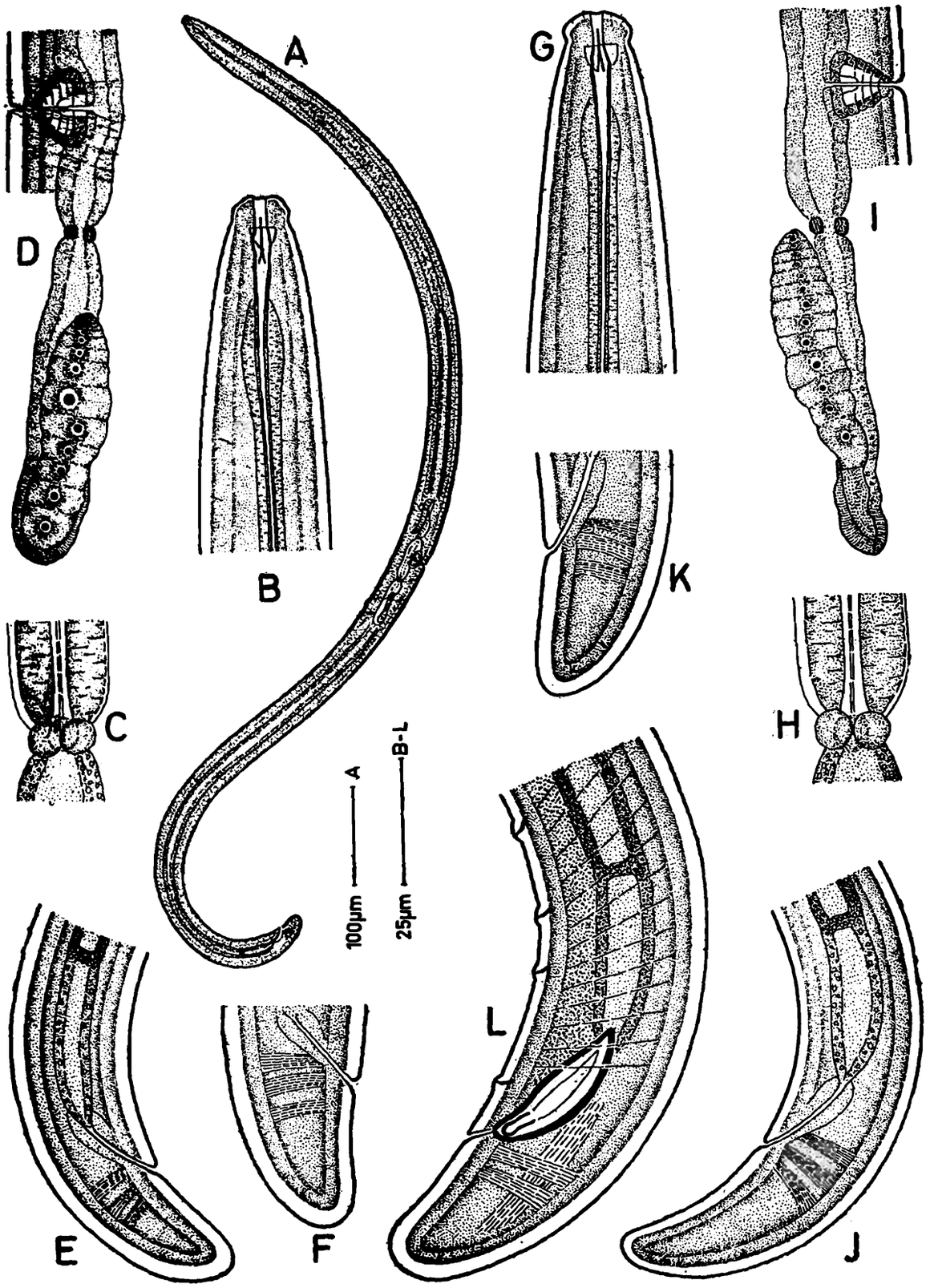
Text-fig. 6. *Aquatides thornei* **(A) Anterior region, (B) Cardiac region, (C) Female gonad, (D) Female posterior end, (E) Male posterior region.**



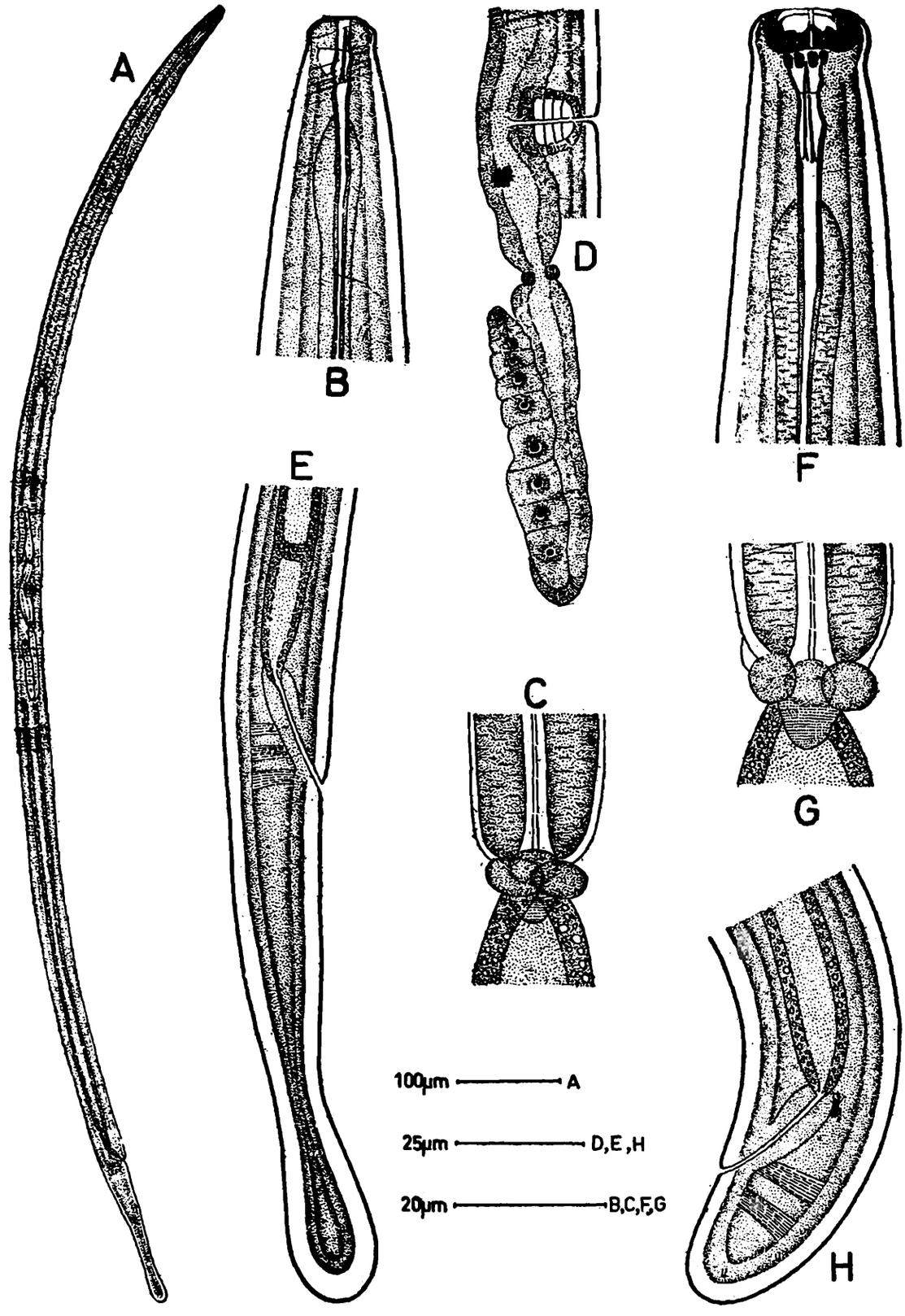
Text-fig. 7. *Aquatides christicki* n. sp. (A) Entire female, (B) Entire male, (C) Anterior region, (D) Expanded part of oesophagus, (E) Female genital branch (posterior), (F) Female posterior end, (G) Male posterior end, (H) Male posterior region, (I) Spicule, lateral guiding piece and gubernaculum.



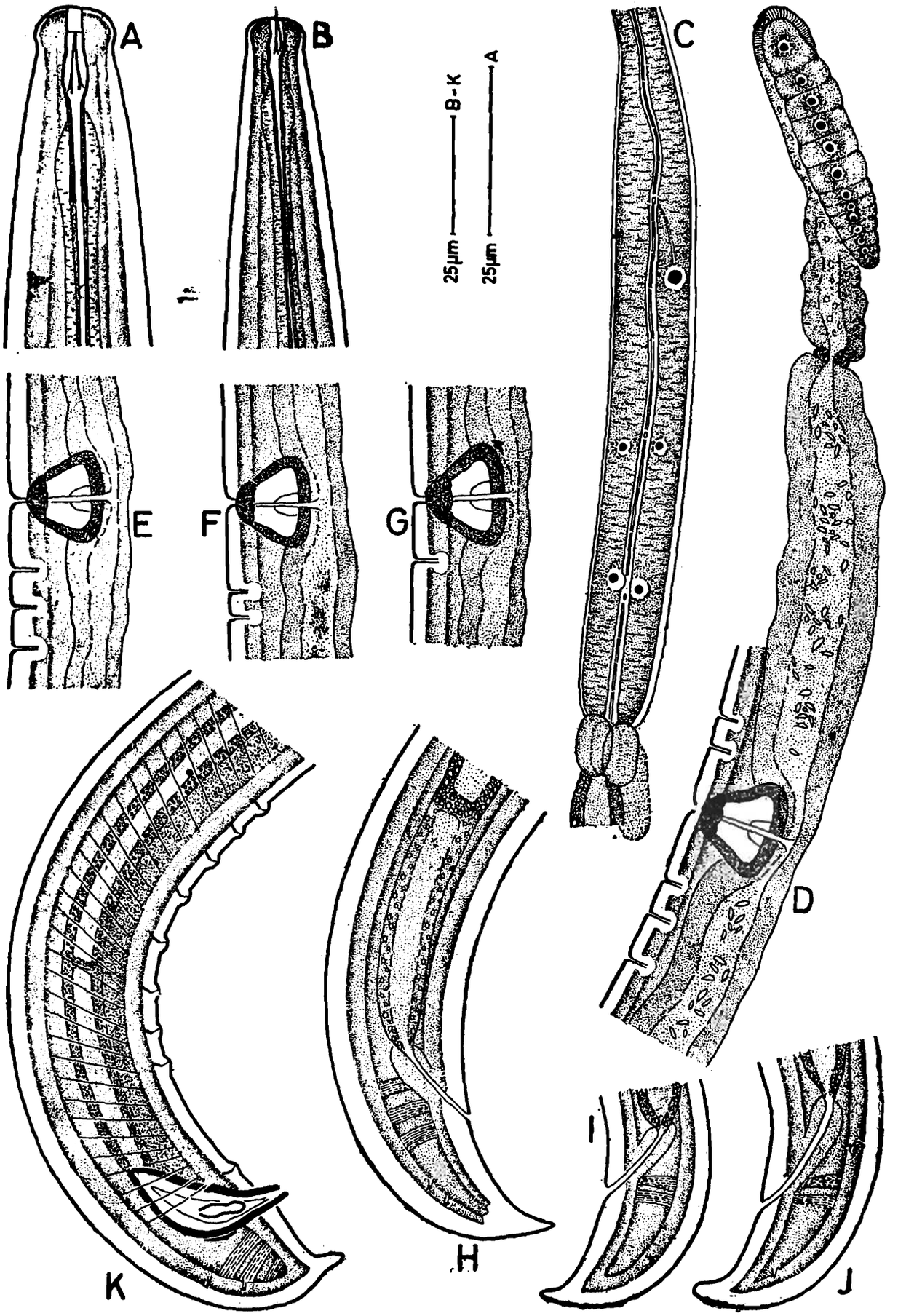
Text-fig. 8. A-F *Laevides laevis* (A & B) Anterior regions, (C) Cardiac region, (D & E) Female posterior ends, (F) Male posterior region. G-I *Laevides timmi* (G) Anterior region, (H) Cardiac region, (I) Male posterior region.



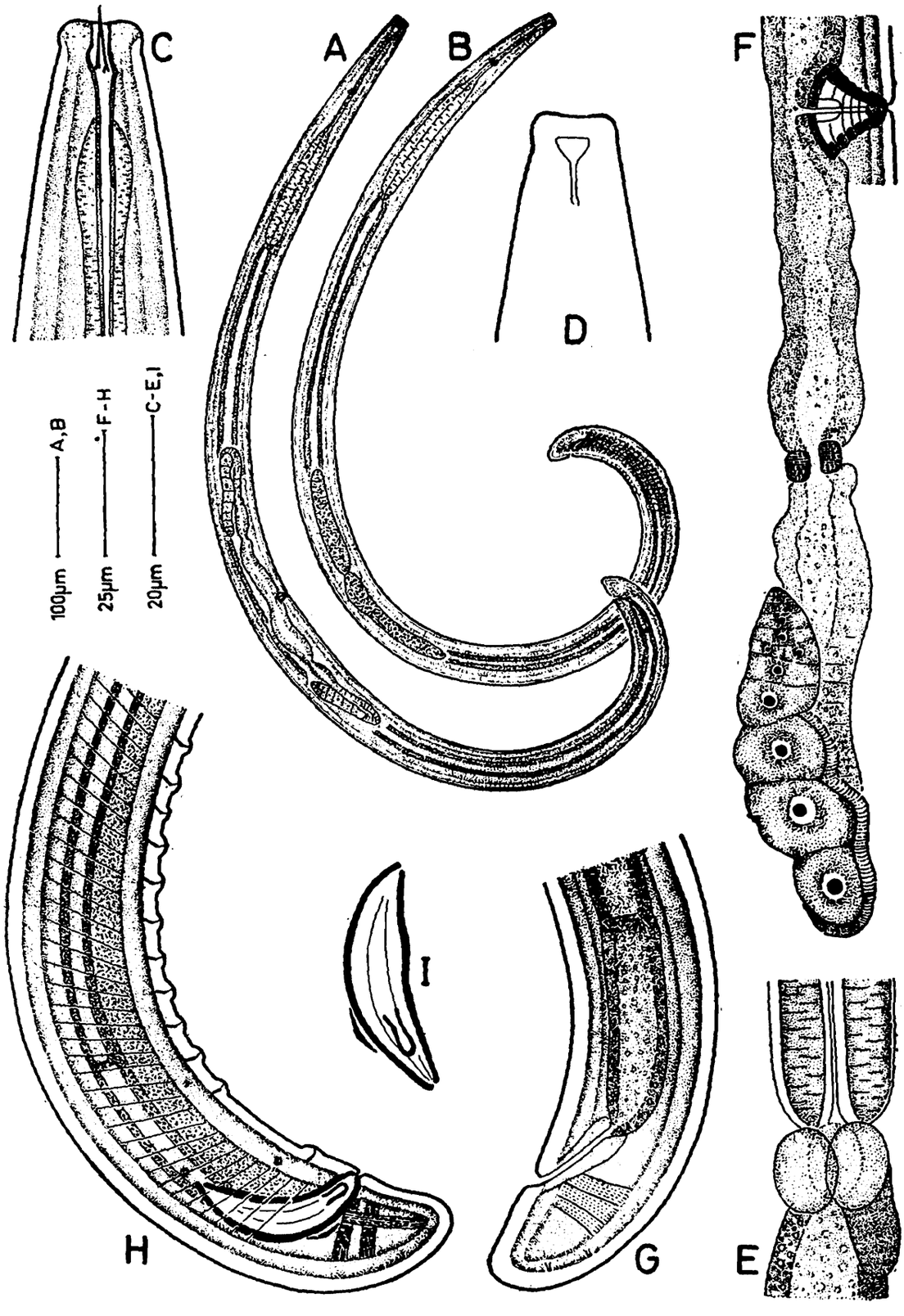
Text-fig. 9. A-F *Solididens vulgaris* (A) Entire female. (B) Anterior region, (C) Cardiac region, (D) Female genital branch (posterior), (E) Posterior region, (F) Posterior end. G-L *Solididens australis* (G) Anterior region, (H) Cardiac region, (I) Female genital branch, (I) Female genital branch (posterior), (J) Female posterior region, (K) Female posterior end, (L) Male posterior region.



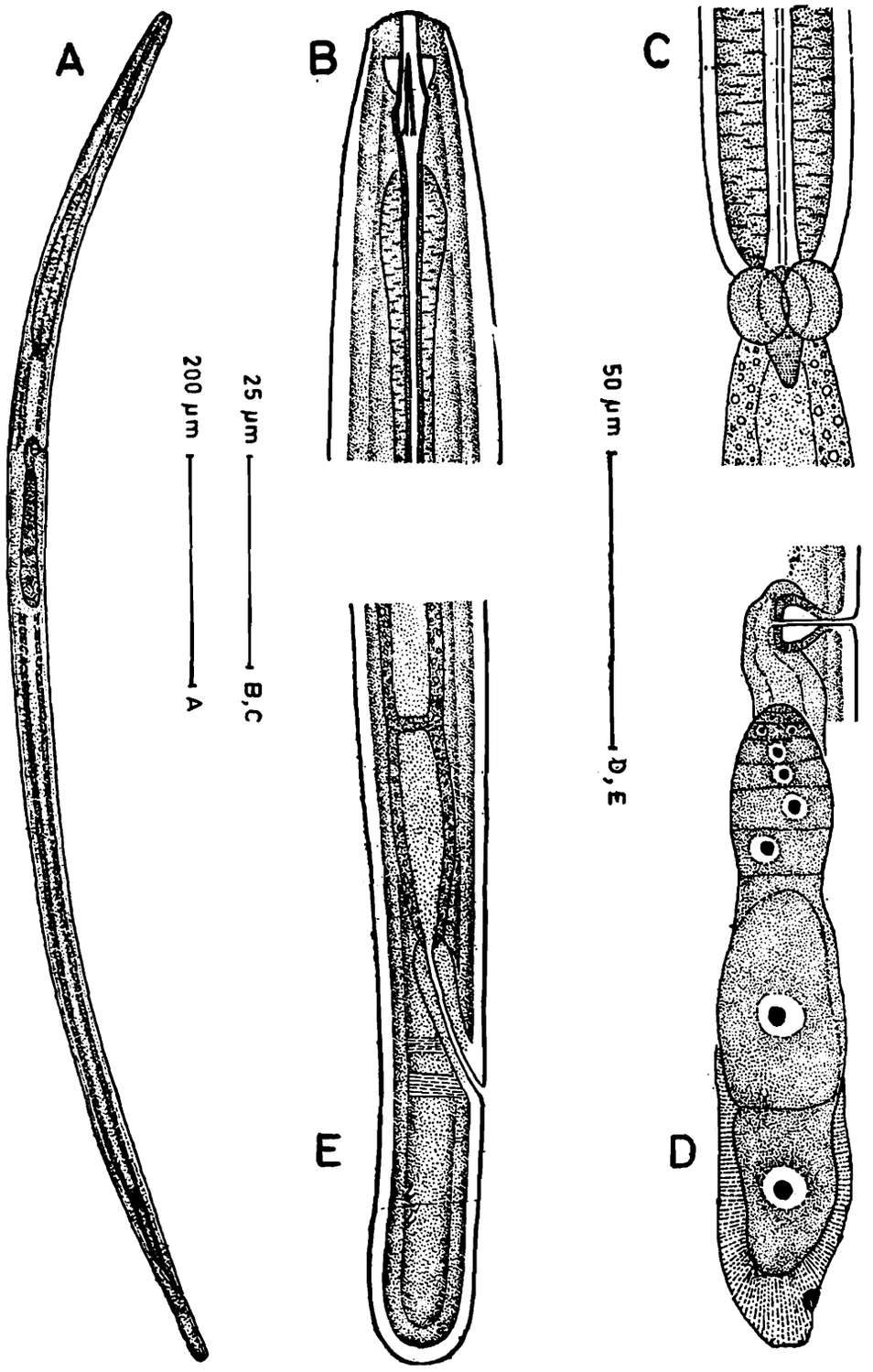
Text-fig. 10. A-E *Clavicauda symmetricus* **(A) Entire female, (B) Anterior region, (C) Cardiac region, (D) Female genital branch (posterior), (E) Posterior region. F-H** *Aetholaimus indicus* **(F) Anterior region, (G) Cardiac region, (H) Posterior end.**



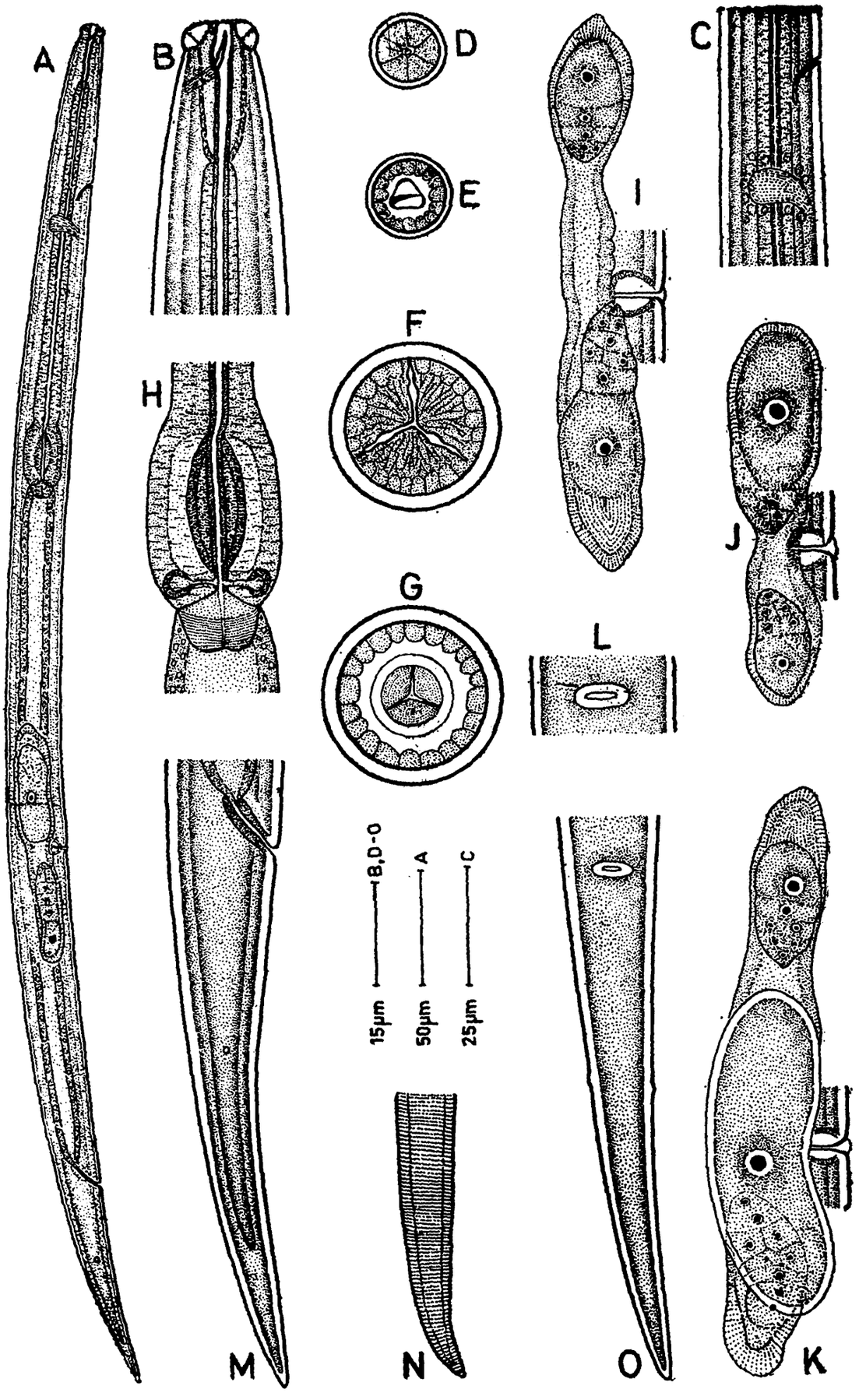
Text-fig. 11. *Paravulvus acuticaudatus* (A & B) Anterior regions, (C) Expanded part of oesophagus, (D) Female genital branch (anterior), (E-G) Vulval regions showing post-vulval paravulvae, (H) Female posterior region, (I & J) Female posterior ends, (K) Male potserior region.



Text-fig. 12. *Paravulvus papillatus* n. sp. (A) Entire female, (B) Entire male, (C) Anterior region, (D) Anterior end showing amphid, (E) Cardiac region, (F) Female genital branch (posterior), (G) Female posterior region, (H) Male posterior region, (I) Spicule, lateral guiding piece and gubernaculum.



Text-fig. 13. *Nygellus subclavatus* **(A) Entire female, (B) Anterior region, (C) Cardiac region, (D) Female gonad, (E) Posterior region.**



Text-fig. 14

Legend for Text-fig 14

Text-fig. 14. *Campydora demonstrans* **(A) Entire female (B) Anterior region, (C) Excretory pore, excretory duct and nerve ring, (D)** *Enface* **view, (E) C. S. body through pharynx, (F) C. S. body through basal oesophageal bulb, (G) C. S. body through cardia, (H) Basal oesophageal bulb, (I & K) Female gonads, (L) Vulva (dorsoventral), (M & N) Posterior ends (lateral), (O) Posterior end (dorsoventral).**