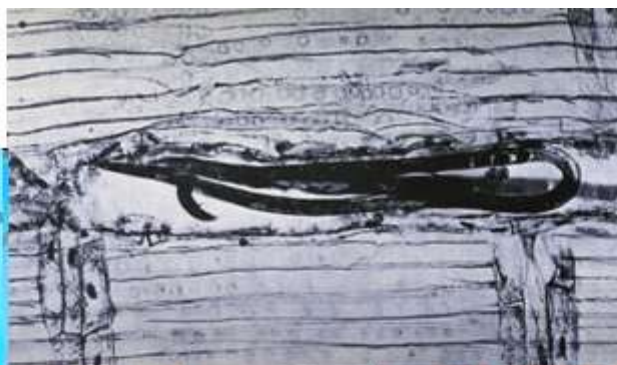


Diagnostic Protocols for Regulated Pests

Pictorial Glossary of Morphological Terms in Nematology



Broken cyst with eggs of
G. pallida.
Plant Protection Service,
NL



B. xylophilus in an
axial resin canal of
Pinus densiflora
Y. Mamiya, Japan



Meloidogyne enterolabii on cucumber roots.
Courtesy: Dr Sebastian Kiewnick, Agroscope Changins-
Wädenswil Research Station (CH)



Cysts of *Globodera rostochiensis*.
FERA, York (GB) - British Crown

Document technique de l'OEPP n° 1056 (rev 3)
EPPO Technical document No. 1056 (rev 3)

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Diagnostic Protocols for Regulated Pests

Pictorial Glossary of Morphological Terms in Nematology

Comment: This document lists all the nematological terms used in all the EPPO diagnostic protocols on plant-parasitic nematodes, and should finally have definitions for each term.

A	
Adanal	Situated in the proximity of the anus.
Ambifenestrate	Form of fenestra in the genus <i>Heterodera</i> where the vulval bridge is slender and the semifenestrae are flattened next to the bridge (Fig. 15 + Fig. 3 in PM 7/89). See Bifenestrate, Circumfenestrate, Semifenestrate.
Amphid (pl. amphids)	Paired lateral chemoreceptors which generally open to the exterior on or near the lip region (Fig. 5).
Amphidelphic	Having two ovaries of similar length, generally one extending anteriorly and the other posteriorly of the vulva (Fig. 6). See Monodelphic, Prodelphic, Didelphic.
Amphidial Aperture (= Amphidial Opening)	The opening leading to the fovea of the amphid (Fig. 3).
Annulate	Comprising or furnished with rings (ringed).
Annulations	Transverse incisions which occur at regular intervals in the cuticle (Fig. 8).
Annule (pl. annules)	The interval between the annulations (Fig. 8). See Annulations.
Anterior	In front. Before. The front position as opposed to the posterior.
Anus	The extremity of the rectum. The posterior opening of the alimentary canal (Fig. 11, 12, 17).
Apex (pl. apices)	A dorsal continuation of the Aphelenchoid spicule base. The tip (Fig. 10).
Appendage	An external organ or limb.
Arch	A structure or form usually curved. In perineal patterns of <i>Meloidogyne</i> females the curved formation of cuticular incisures dorsal to the phasmids (Fig. 17).
Arcuate	Curved like a bow. Arched.
Areolation	The extension of the transverse incisures of the body annuli into the lateral field (Fig. 8).
Axial	Belonging to, or around, in the direction of or along an axis.
B	
Basal Bulb	Muscular or glandular enlargement at the posterior of the pharynx (Fig. 2).
Basal Knobs	See Stylet Knobs.
Basin	See Vulval Basin.
Bifenestrate	Form of fenestra in the genus <i>Heterodera</i> where the vulval bridge is stout and divides the fenestra so that the semifenestrae appear to be two nearly separate holes (Fig. 15). See Ambifenestrate,

	Circumfenestrate, Semifenestrate.
Bifurcate	Divided into two branches. Forked.
Blunt	Rounded.
Body	The nematode frame with its organs. The important and largest part of an organ, as the body of the spicule.
Bulb	See Basal bulb.
Bulla (pl. bullae)	Projection at the base of the cone of some <i>Heterodera</i> species which are the remains of the vagina and musculature. (Fig. 14).
Bursa (pl. bursae) (= Caudal Alae)	Winglike extensions of the lateral cuticle of the male (Fig. 9).
C	
Caudal Alae	See Bursa.
Caudal	Belonging to, or like, a tail. Situated on or near the tail.
Caudal Papillae	Papillae located on the tail.
Central Valve Plates	See Metacarpus Plates.
Cephalated	Having the head set off in some manner.
Cephalic Framework	A rigid supporting (sclerotised) structure that provides form to the head and axially acts as a stylet guide (Fig. 1, 4).
Cephalic Papillae	See Labial Papillae.
Cephalic Region	The lip region with the cephalic framework.
Cervical	Pertaining to, belonging to or situated in, on or near the neck.
Circumfenestrate	Form of fenestra in the genera <i>Globodera</i> , <i>Cactodera</i> and <i>Punctodera</i> , where the vulva is lost when fenestration occurs by the breakdown of the thin cyst wall around the vulva leaving a circular hatching pore (Fig. 15). See Ambifenestrate, Bifenestrate, Semifenestrate.
Circum-Oesophageal	See Circum-Pharyngeal.
Circum-Pharyngeal	About or surrounding the pharynx.
Cloaca	In the male a common chamber lined with cuticle which receives the products of the intestinal and reproductive tracts and empties to the exterior via the anus (Fig. 9).
Coarse	Rough, unrefined. Not a fine surface or texture.
Concave	Incurved, as the inner surface of a curved surface or line.
Condylus	See Apex
Cone	Shape of a body having a circle for its base and terminating in an apex. The posterior region of a female cyst of the genus <i>Heterodera</i> (Fig. 14).
Conoid	Shape of a cone, e.g. both sides of the tail surface tapering at an equal angle to the tail tip.
Constriction	Often used to describe the junction of the head and the cervical region when delimited by a pronounced groove (Fig. 4) but the term may be used for other morphological features as well.
Continuous	Going on or extending without interruption or break. Unbroken (Fig. 4).
Conus	The hollow, proximal part of the stylet.

Convex	A surface or line curved or rounded as the exterior of a sphere or circular form.
Corpus	See Metacarpus, Procorpus.
Crenate	Having a margin formed of rounded scallops. Furrowed.
Crescent	Sickle shaped, like the new moon with convex and concave edges.
Crescentic Plate	See Metacarpus plates.
Cucullus	Dislike projection at the distal end of the spicula (Fig. 10).
Curved	Curving line or surface. Bend.
Cuticle	The noncellular external covering of the nematode and apparently connective tissue of the hypodermis. The cuticle lines the natural openings of the body e.g. the oral cavity, the anal aperture, the vulva, the vagina, the lumen of the pharynx, the rectum, the cervical pore and the cuticular ampulla of the cervical pore.
Cuticular Ridges	Raised lines on the surface of cysts (Fig. 4 in PM 7/40 (2)).
Cyst	At maturity the female body wall of some nematode genera such as <i>Globodera</i> and <i>Heterodera</i> thickens, becomes resistant to decay and turns brown as the worm dies resulting in a protective shelter for the eggs (Fig. 14).
D	
Deirids	Lateral sense organs at the level of the nerve ring.
Delicate	Characteristically slight or thin.
Demarcation	Marked by bounds. Delimited. A separation.
Desiccation	The process of drying up.
Didelphic	Having two gonads (Fig. 6). See Amphidelphic, Monodelphic, Prodelphic.
Digitate	Fingerlike in shape or divided into fingerlike processes.
Dimorphism	Individuals of the same species occur in two distinct forms e.g. vermiform male and swollen female of <i>Globodera</i> , <i>Heterodera</i> or <i>Meloidogyne</i> .
D-Layer	Extra layer of collagen fibrils on the cyst wall cuticle. Arced pattern oriented as helicots (helicoidal layer). Present in <i>Globodera</i> , absent in <i>Heterodera</i> .
Distal	Remote from the point of origin or attachment. See proximal.
Dorsal Gland Orifice (DGO) (= Dorsal Gland Opening)	The dorsal pharyngeal gland opening for Tylenchs and Aphelenchida (Fig. 1, 2).
Dorsal	On the back.
Dorsolateral	The position on the nematode body situated 30° laterally from the dorsomedian line and perpendicular to the anteroposterior axis. Subdorsal.
Dorsoventral	An imaginary line extending from the dorsal to ventral side. The dorsoventral axis. The median line.
Double Flexure	Bended two times, like the genital tract of nematodes in some genera (Fig. 6).
E	

Ellipsoidal	Elliptical. Oval.
Elliptical	Shaped like an ellipse. Oval.
Elongate	To lengthen. To extend
Epiptygma (pl. epiptygmata)	Fine cuticular outgrowths along the anterior and/or posterior vulval lips, which can be inwardly curved or outwardly projecting.
Esophagus	See Pharynx.
Excretory Pore	The ventral opening of the secretory-excretory system in the cuticle by which secretions and the waste products are emitted to the exterior (Fig. 1).
Fenestra (pl. fenestrae)	See Vulval Fenestra.
F	
Filiform	Having the shape or thread of a filament.
Flange	A rib, rim or expansion developed for strength, guiding or attachment to another part or organ; e.g. basal flanges of the odontophore in the genus <i>Xiphinema</i> (Fig. 5).
Flex	To bend, curve.
Fovea	Area immediately behind the amphidial aperture; maybe any shape from a slit to a wide oval.
G	
Gland	An organ or group of cells that produces secretions.
Globose	Being spherical or rounded.
Gonad	Part of the reproductive system that produces eggs or sperms. Gonads in females are ovaries and in males are testis (Fig. 6).
Gonoduct	The tube leading from the gonads to the exterior through which eggs or sperms pass. The gonoduct may consist of an oviduct, one or more sphincters, spermatheca, uterus and post vulval sac.
Granek's Ratio	The distance from the anus to the nearest edge of the vulval basin, divided by vulval basin diameter (Fig. 7 in PM 7/40 (2)).
Gubernaculum	In male nematodes a grooved cuticularized structure, sometimes paired, which guides the spiculum and is formed by sclerotization of the dorsal wall of the spicular pouch, sometimes indistinct or absent (Fig. 9).
Guide Ring	The guiding ring of the stylet (Fig. 5).
Guiding Apparatus	The stomatal lining at the stylet cone region; folded tube between guide ring and odontophore; seem to be homologous with guide rings (Fig. 5).
H	
Head	See Lip Region.
Hemispherical	Half of a sphere or globe.
Hemizonid	A nerve commissure of highly refractive nature, generally biconvex in longitudinal section and which extends ventrally from lateral cord to lateral cord (Fig. 1, 5).
Hyaline	Clear. Transparent. Without color. See Hyaline Part.
Hyaline Part	Thick cuticle at tail end (Fig. 11).
I	

Incisures	The longitudinal cuticular clefts which divide the lateral field (Fig. 8). See Lateral Field.
Intestine (=Gut)	A simple tube composed of a single layer of epithelial cells in which digestion of food takes place (Fig. 1, 9).
Isthmus	The segment between the median bulb and basal bulb of the oesophagus where the nerve ring is located (Fig. 2).
J	
Juvenile	Any immature nematode. Not to confuse with larva (pl. larvae). The latter undergo metamorphosis during development like insects.
K	
Knobs	See Stylet Knobs.
L	
Labial Disc	The more or less circular form of cuticle about the oral opening and delimited posteriorly by the first transverse striation; sometimes fused with submedial lip sectors (Fig. 3).
Labial Papillae	Papillae located on the lips. Sensilla often end in papillae (Fig. 3). See Papilla
Labial Region	see Lip Region.
Labial Sensilla;	Mechano- and/or chemoreceptors in the lip region.
Larva (pl. larvae)	See Juvenile.
Lateral Field	A form of cuticular configuration above the lateral cords; longitudinal incisures in the lateral region (Fig. 8).
Lateral Lines	Longitudinal incisures within the lateral field (Fig. 17) .
Lip Region	The cuticular area from the basal ring forward. The lip region can be continuous with the body contour or more or less offset from the rest of the body by a constriction, or be broader than the adjoining body and therefore expanded (Fig. 3).
Lobe	A generally rounded part of projection of a part or organ separated from neighbouring parts by fissures or constrictions.
Longitudinal Striation	In the cuticle grooves, ridges or incisures parallel to the longitudinal axis, but outside the lateral field.
M	
Median	A midway point in position. Situated in the middle position. A plane of division dividing a bilateral organism into right and left halves.
Median Bulb	See Metacarpus.
Metacarpus	The posterior subdivision of the corpus taking an ovate form and being preceded by a cylindrical anterior segment (Fig. 2). See Procorpus.
Metacarpus Plates	A refractive structure situated in the median bulb and probably functions as a pump during feeding (Fig. 1).
Monodelphic	Having one ovary (Fig. 6). See Amphidelphic, Didelphic, Prodelphic.
Monoprodelphic	Having one ovary directed to the head region.
Morphology	The study of form and structure of organisms.
Morphometry	Measurement of shape.
Mucro	A fine pointed structure at the end of the tail (Fig. 13).

N	
Neck	That portion of the nematode body from the base of the lips to the base of the pharynx.
Nerve Ring	A belt, broad and flat in slender nematodes but narrow in forms with a large pharynx, containing cell bodies of neurons distributed around it. The nerve ring represents the dorsal and ventral connections between the lateral ganglia (Fig. 1, 2).
Notch	A concave or V-shaped cut or indentation. Observed e.g. at the tail end of some <i>Hirschmanniella</i> species.
O	
Obese	Very fat, corpulent.
Odontophore	Supporting structure of the odontostyle in Longidorids and other Dorylaimids, formed by a modification of the anterior pharyngeal region (Fig. 5).
Odontostyle	Hollow protrusible anterior part of a dorylaimid stylet with a dorsal opening and supported by the odontophore (Fig. 5).
Oesophageal Bulb	See Basal Bulb.
Oesophageal Glands	See Pharyngeal Glands.
Oesophageal Intestinal Valve	See Pharyngo-Intestinal Valve.
Oesophagus	See Pharynx.
Oral Aperture	Mouth opening. The entrance into the stoma (Fig. 3).
Orifice	An aperture. Opening of a tube, duct, etc. See Dorsal Gland Orifice.
Outstretched	All segments of the reproductive tube are in a straight line.
Ovejector	Preferred spelling of Ovijector.
Oviduct	A tube which serves for the passage of eggs from the gonads to the uterus (Fig. 7). See Gonoduct.
Ovijector	Part of the female genital system between the end of the uterus and the vulva, modified to aid in the expulsion of the eggs.
Ovoid	Having a shape like an egg.
P	
Papilla (pl. papillae)	Minute elevations of the cuticle. Any small nipplelike projection or part. Often sensilla protrude from the cuticle via a terminal pore on top of a papilla (Fig. 3). See Caudal Papillae and Labial Papillae.
Peloderan	Bursa which envelopes the tail.
Perineal Pattern	Configurations on the cuticle surface of the perineum; they are transformations of the body annulations; specific designs are common to each species of <i>Meloidogyne</i> spp. and may facilitate identification (Fig. 17).
Perineum	The superficial region about the anus and vulva (Fig. 17)
Pharyngeal Glands (= Oesophageal Glands)	Elongated glands that release secretions in the pharynx. There are three in the Tylenchida (some hoplolaims have more than three nuclei, some anguinids have less than three nuclei). The Dorylaimida and Triplonchida have three or five (with three in the Longidoridae and Trichodoridae)w (Fig. 1).
Pharyngo-Intestinal	A muscular structure at the base of the pharynx that opens into the

Valve (= Oesophago-Intestinal Valve)	intestine (Fig. 1).
Pharynx (= Oesophagus, Esophagus)	The muscular tube that leads from the stoma or stylet base to the intestine (Fig. 2).
Phasmids	The lateral caudal sensory organs connected with the lateral precaudal glands. Paired lateral chemoreceptor sensory organs at the anterior part of the nematode (Fig. 12, 17).
Pointed	With a sharp terminus.
Posterior	On or toward the hind end of a body or part.
Postmedian	See Median.
Post-Uterine Sac	The postvulvar uterine branch.
Post-Vulval Sac (Pvs)	A rudimentary extension of the posterior uterus which often functions as a spermatheca.
Process	See Projection.
Procorpus	The anterior subdivision of the corpus taking a cylindrical form and generally being terminated by an oval or circular posterior segment (Fig. 2). See Metacarpus.
Prodelphic	Having one or two ovaries anterior to the vulva (Fig. 6). See Amphidelphic, Didelphic, Monodelphic.
Projection	A part that stands out. A prominence or prolongation of a surface. An outgrowth or extension.
Prominent	Standing out or projecting beyond a surface or line; conspicuous.
Protrude	To extend or project.
Proximal	Closest to a certain centre that has to be specified.
Punctations	Small pits or depressions on the surface of the cuticle; the shape is usually rounded but may vary (Fig. 17).
R	
Rectum	A narrow tube, flattened in dorsoventral direction and separated from the intestine by a sphincter muscle. It is derived as an invagination of the epidermis and is lined by a cuticularized intima. The hindgut (Fig. 9, 11).
Reproductive System	In females consists of an ovary (= gonad) and a gonoduct. It ends in a vagina and a vulva, and between the ovary and the gonoduct is a constriction, the oviduct. The gonoduct may show additional constrictions, separating e.g. the spermatheca from the uterus; the male reproductive system consists of a genital tube (testis, seminal vesicle, vas deferens) ending in the cloaca.
Rosethorn-Shaped	Shape of spicula as in aphelenchid.
Rostrum (pl. rostra)	A beaklike projection ventrated near the proximal end of the aphelenchid spicule, joining the dorsal and ventral spicular shafts (Fig. 10). A ventral process or projection.
S	
Sclerotization	A noncommittal term for hardened, dense, refractive parts of the nematode body.
Semifenestrate	A situation in some species of the genus <i>Heterodera</i> where the vulval bridge divides the fenestra into two parts (Fig. 15). See Ambifenestrate, Bifenestrate, Circumfenestrate.

Shaft	Often present as the main body of the spicula, usually curved and often bearing a thin flange of cuticle termed the velum (Fig. 10). Also called the calomus. Sometimes the term is used for the posterior part of the stylet.
Sinuate	Having a serpentine, undulant or curving form.
Skin	The cuticle.
Slim	Slender. Small in girth in proportion to height or length.
Sperm	The matured and functional sex cell or gamete of the male which unites with the ovum (Fig. 7).
Spermatheca	The enlarged portion of the female reproductive system which functions as a reservoir in receiving and holding sperms from the male (Fig. 7).
Spermatozoon (pl. spermatozoa)	See Sperm.
Spheroid	A body that is almost but not quite a sphere.
Spicule (pl. spicules)	Sclerotised structure forming part of the male copulatory system (Fig. 9, 10).
Spine	A firm sharp pointed projection generally of the cortical and matrix layer of the cuticle.
Spiral	Winding or circling about a central axis in a closing or broadening manner.
Star-shaped	Form of a star, e.g. mucro within <i>Aphelenchoides</i> . (Fig. 13 + Fig. Appendix I in PM 7/39).
Stoma	The mouth cavity. That segment of the digestive tract between the oral opening and the triradiate beginning of the pharynx including the oral aperture and the stoma walls.
Stout	Fat; sturdy in body.
Stria (pl. striae)	An elongate depression or groove. A minute banding (Fig. 8, 17).
Striation	The arrangement of striae.
Stylet	A rather slender, hollow feeding structure; usually axial in the adult. In Tylenchida the stylet consists of an anterior cone with a posterior shaft and knobs (Fig. 2, 5).
Stylet Knobs	Three swellings at the posterior end of the stylet of Tylenchida.
Subcrystalline Layer	A waxy, translucent substance on the cysts of certain <i>Heterodera</i> spp. persisting only for a short time in the soil.
Subcylindroid	Term used to describe a structure, e.g. the tail, where the sides appear to run parallel for most of their length, and end with a hemispherical or subhemispherical tail tip.
Submedian Cephalic Papillae	See Labial Papillae.
Submedian	The position of the nematode body situated 45° from the dorsomedian or ventromedian line and perpendicular to the anteroposterior axis.
T	
Tactoreceptors	Sensory organs of touch.
Tail Terminus	The tail tip (Fig. 9).

Tail	The posterior portion of the nematode body delimited proximally by the anus and distally by the tail terminus (Fig. 11).
Tandem	A set of two or more things or objects arranged one behind another.
Taper	A gradual reduction in breadth of an elongate body.
Thorn-Shaped	An extended mucronate or pointed process like a rosethorne (e.g. spicule of <i>Aphelenchoides</i>).
Titilla (pl. titillae)	Small projections on either side of the distal end of the gubernaculum (Fig. 10)
Transverse Striation	Circular grooves in the nematode cuticle whose plane is perpendicular to the longitudinal axis.
Truncate	Having a squared terminus.
Tubercle	A small knoblike protuberance of cuticle.
U	
Underbridge	The anterior bifurcation of the vagina composed of tough, brown material which may extend across the vulval cone and parallel to the vulval bridge (Fig. 14 + Fig. 2 in PM 7/89).
Uterine	Pertaining to or belonging to the uterus.
Uterine Sac	A thin-walled, muscular sac to which the uterus is joined and into which the vagina opens. It may be obscurely separated from the uterus by a slight constriction or merely by a differentiation of tissue.
Uterus (pl. uteri)	A region of the oviduct modified to function as a place of development (sometimes maturation) of the egg (Fig. 7).
V	
Vagina	A canal lined with cuticle connecting the uterus or the ovijector with the vulva (Fig. 7).
Valve Plates	See Metacarpus Plates.
Valve Apparatus	See Metacarpus Plates.
Velum	A delicate cuticular membrane on the ventral side of the spicule (Fig. 10).
Ventral	The abdominal aspect of a nematode.
Ventrolateral	The position on the nematode body situated 30° laterally from the ventromedian line and perpendicular to the anteroposterior axis.
Vermiform	Having a wormlike shape.
Verrucomicrobial Endosymbionts	Bacterial species of the genus <i>Verrucomicrobia</i> that are obligate endosymbionts and residing in the gametes of some species of <i>Xiphinema</i> .
Vulva	The transverse slit of the female genital opening situated on the ventral line in most genera (Fig. 7, 17, 18).
Vulval Basin	Slight circular depression at the end of the vulval cone comprising the vulval slit and fenestra (Fig. 4 in PM 7/40 (2) + Fig. 2 in PM 7/89).
Vulval Bridge	In some species of <i>Heterodera</i> the vulval slit persists across the fenestra as a bridge creating two semifenestrae (Fig. 2 in PM 7/89).
Vulval Cone	A relatively moderate protuberance at the posterior end of <i>Heterodera</i> cysts (Fig. 14).
Vulval Fenestra	In <i>Globodera</i> and <i>Heterodera</i> a thin-walled transparent region at the top of the vulval cone which may breakdown to form the hatching

	pore (Fig. 15, 16 + Fig. 2 in PM 7/89).
Vulval Flap	A cuticular, membranous structure around the vulva or on the vulval lip (Fig. 2 in PM 7/4).
Vulval Slit	The shape or border of the vulva (Fig. 4 in PM 7/40 (2) + Fig. 2 in PM 7/89).
Z	
Z-Organ	A distinct, highly developed differentiation of the uterus in some species of <i>Xiphinema</i> , except for <i>X. americanum</i> sensu lato. If not so developed or distinct, then is referred to as a pseudo-Zorgan (Fig. 18).

Annex I Abbreviations used for nematode measurements

- a Nematode body length divided by greatest width (usually at mid-body).
- b Nematode body length divided by pharynx length from the lips to pharyngo-intestinal valve.
- b' Nematode body length divided by pharynx length from the lips to end of pharyngeal glands.
- c Nematode body length divided by tail length.
- c' Tail length divided by body width at anus.
- h Length of hyaline part of tail.
- L Length of nematode body.
- Ost Length of odontostyle
- Oph Length of odontophore
- st Length of stylet
- V Distance from the anterior end to the vulva divided by nematode body length (%)

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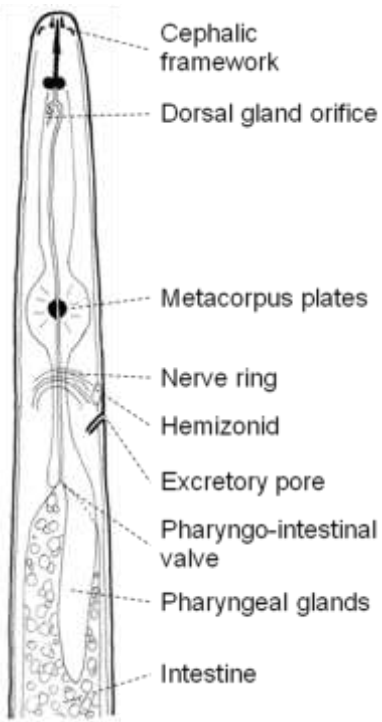


Fig. 1: Anterior end of Tylenchida

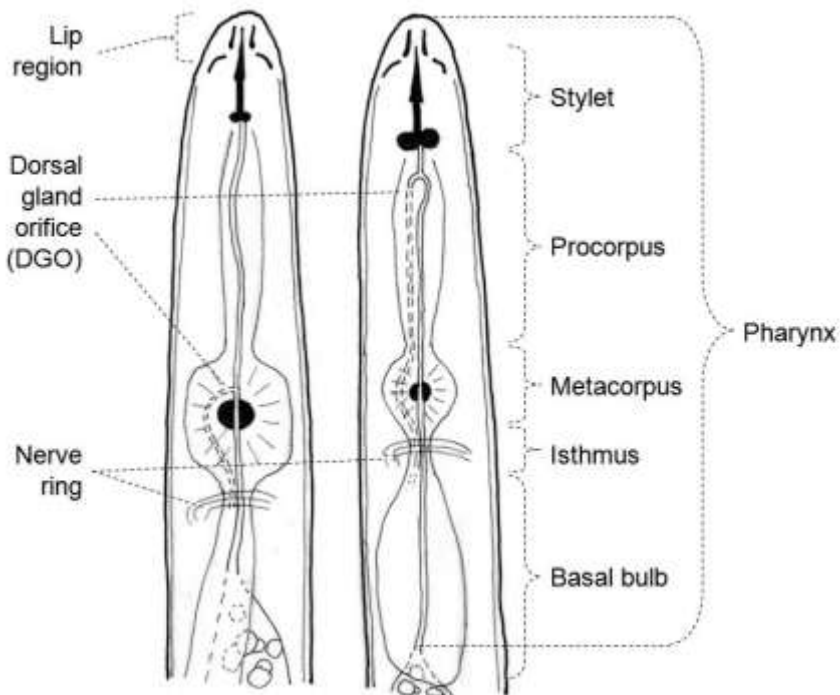


Fig. 2: Anterior end of Aphelenchida and Tylenchida (redrawn after Decker, 1969)

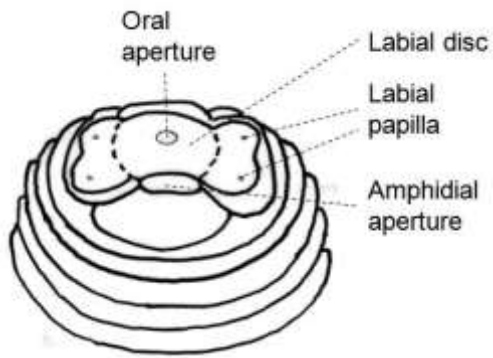


Fig. 3: Lip region

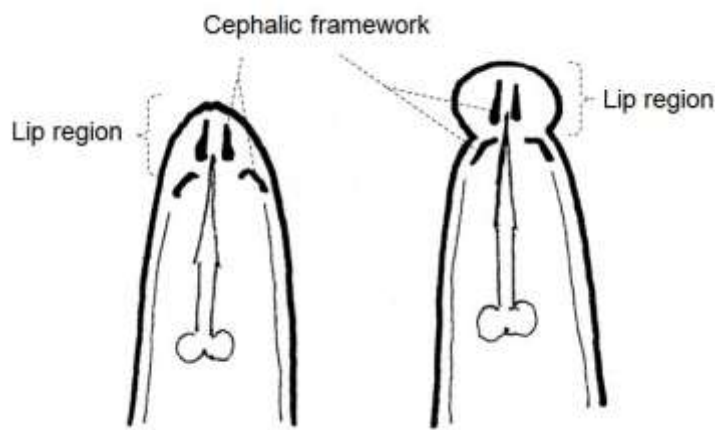


Fig. 4: Lip region continuous (left) and off-set by a constriction (right)

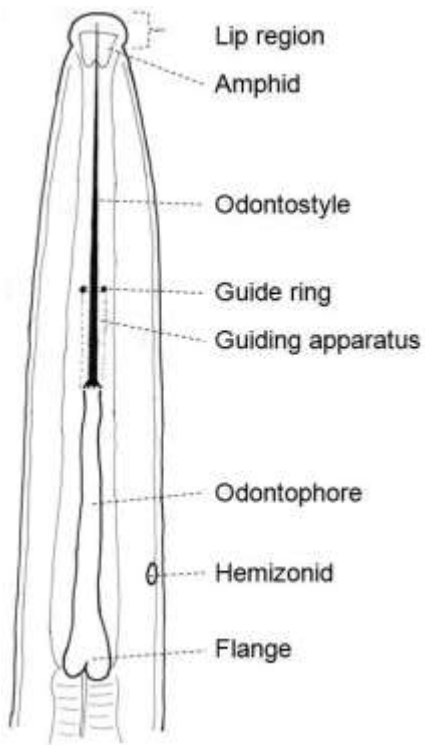


Fig. 5: Anterior end of *Xiphinema*

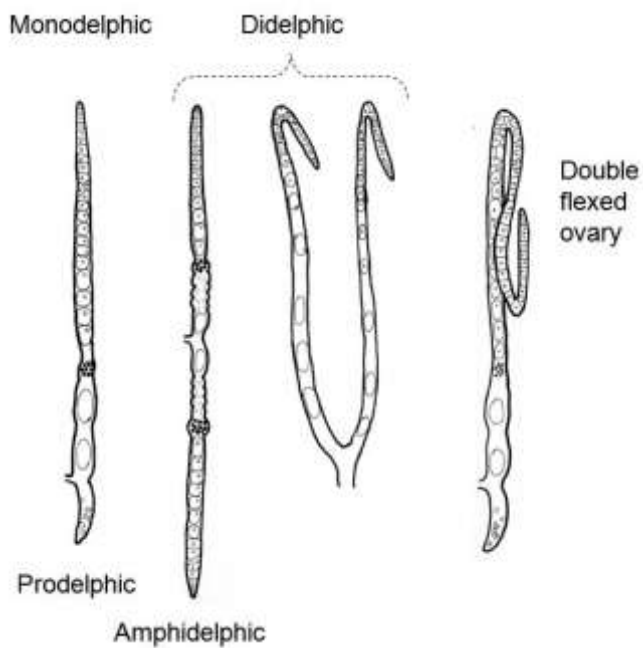


Fig. 6: Female reproductive systems (redrawn after Decker, 1969)

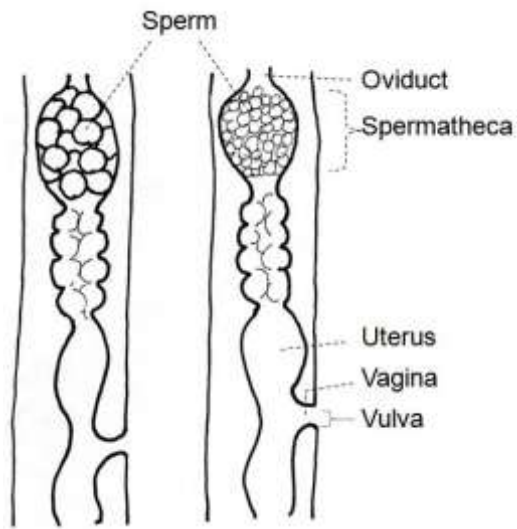


Fig. 7: *Ditylenchus* sp. – sperm „large”; *B. Basiria* sp. – sperm „small” (redrawn after Brzeski, 1998).

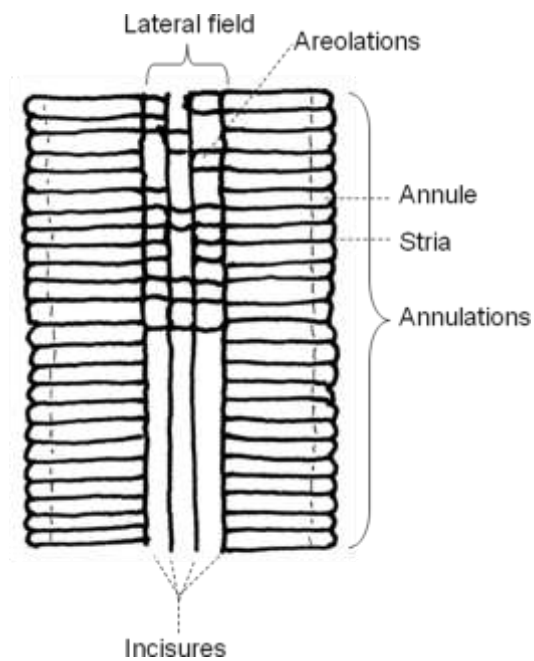


Fig. 8: Nematode cuticle

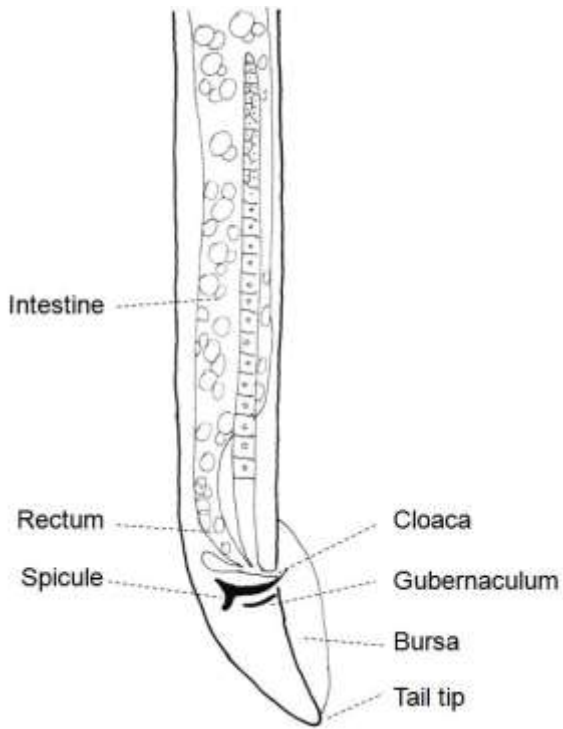


Fig. 9: Posterior region of male (redrawn after Decker, 1969)

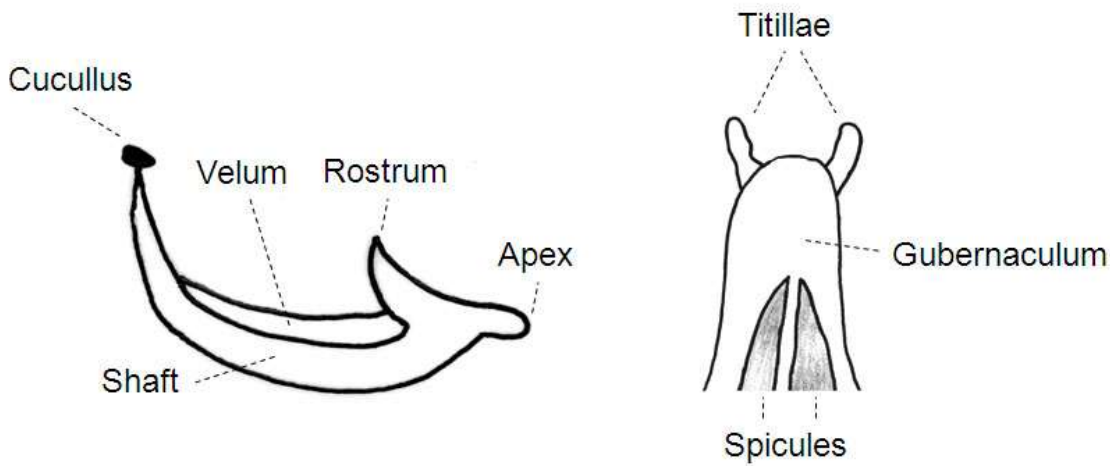


Fig. 10: Left : Male spicule (aphelenchid type) ; Right : Top view of gubernaculum with titillae (e.g. *Radopholus*).

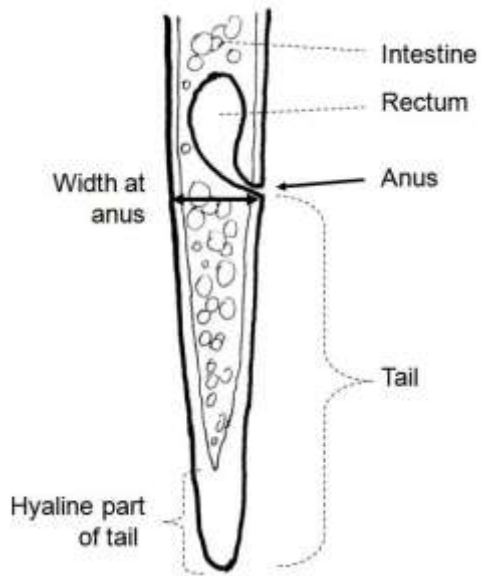


Fig. 11: Tail end of juvenile

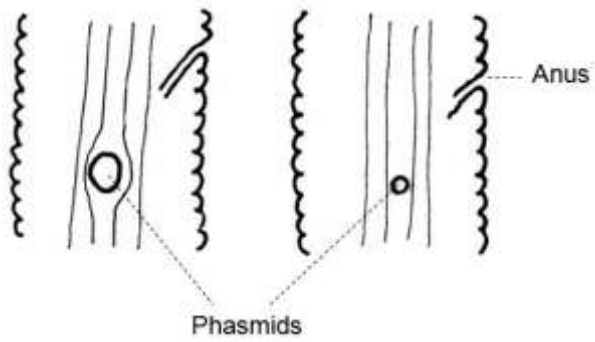


Fig. 12: Phasmids large ("Scutellum") (left) and small (right)

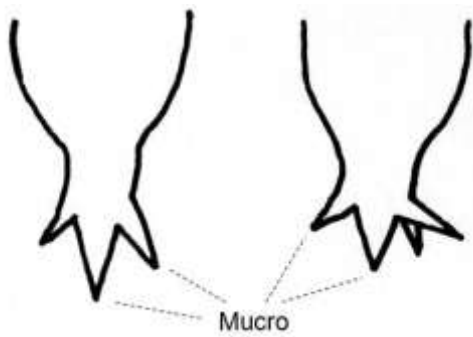


Fig. 13: Tail end of *Aphelenchoides*

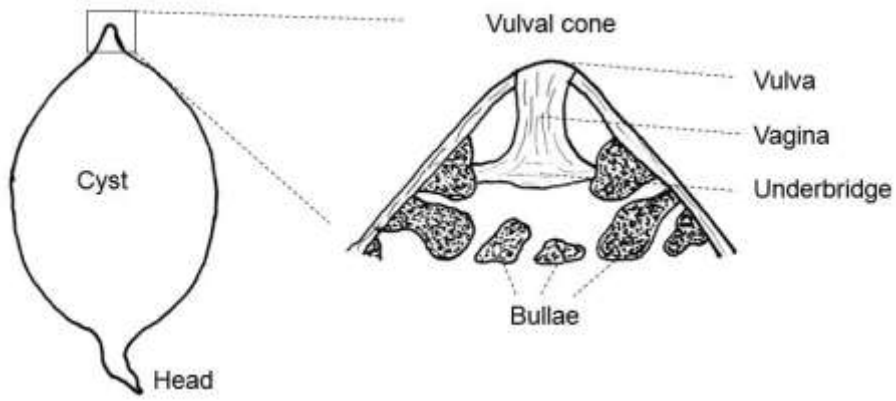


Fig. 14: Vulval cone of *Heterodera* cyst

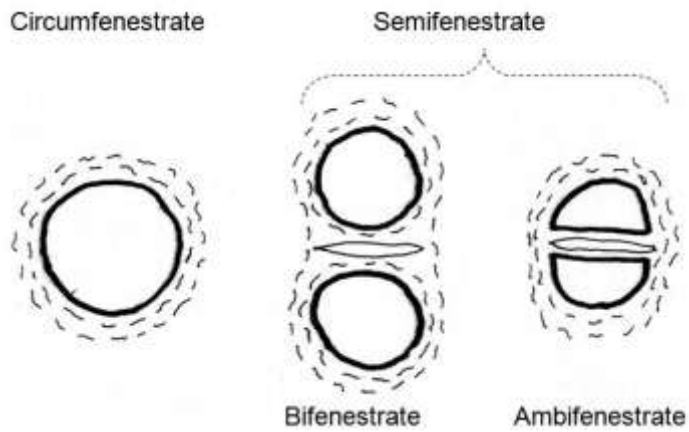


Fig. 15: Vulval fenestra of *Globodera* (left) and *Heterodera* (center, right) cysts

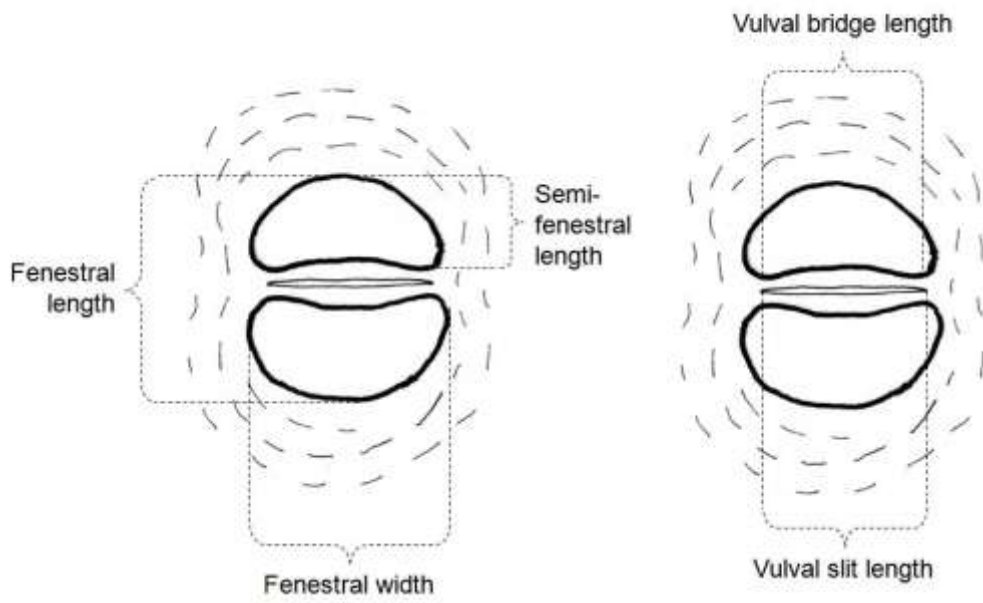


Fig. 16: Measurements of vulval fenestra

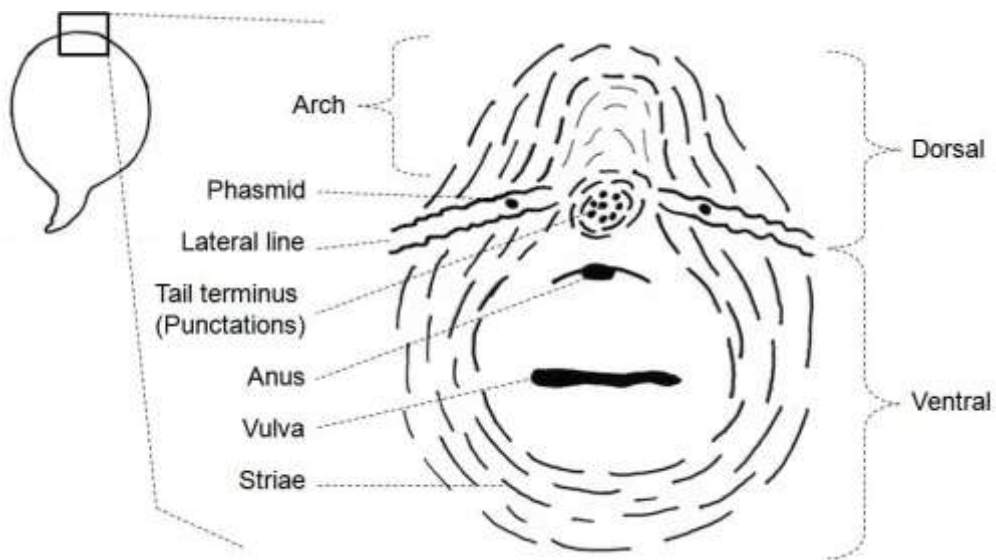


Fig. 17: Perineum of *Meloidogyne*

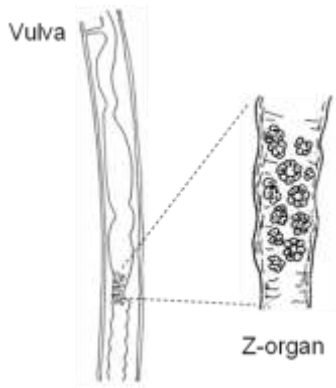


Fig. 18: Z-organ in the uterus of some species of *Xiphinema* except *X. americanum* sensu lato