Zootaxa 3363: 63–64 (2012)
www.mapress.com/zootaxa/

Correspondence

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

What is a nematode?

ALDO ZULLINI
University of Milano-Bicocca, Milano (Italy). E-mail: aldo.zullini@unimib.it

In their classic book "An Introduction to Nematology" Chitwood & Chitwood (1950) wrote (1): "*Having briefly considered the history of general nematology, the question naturally arises,* "What is a nematode?*". In answering this question it is necessary first to designate a nematode as a triploblastic, bilaterally symmetric, unsegmented, non-coelomate animal of the Series Scolecida Huxley, 1865".* Actually, definition of taxa is not an easy task, because monothetic characters are rare, as polythetic traits are more common and evident, albeit of probabilistic value. To highlight this problem, the following paradoxical but empirically correct diagnosis of the taxon Nematoda is given.

Nematodes are animals from 110 µm long to 8.4 m long (2). They are thread-like, pyriform to spherical (3), transparent or not transparent. Also depending on the gut content, cysts and adults may be any colour. They move by sinusoidal motion, by accordion-like movements (contracting and stretching), compass-like, by appendage movements, or they do not move at all. The body is symmetrical or asymmetrical. Structures (following different body features and species) show symmetry based on the number 2 (bilateral), 3, 5, 6, 8, 10, or 12, or display multiradial symmetry (4). Eyes are present or absent. Cuticle is smooth, annulated, lumpy, thorny or scaled; with setae or without setae. Suckers present or absent. The mouth is a thin tube, a wide and large cavity, with teeth or without teeth, with stylet or without stylet; alternatively, the mouth is absent (5). The mouth aperture is surrounded by zero, two, three, four or six lips. Pharynx is long, medium, or short (6); it is simple or complex (7). Intestine contains from less than 20 cells to more than one million cells. Anus is present or absent (8). Tail is very long, short or absent (9); it is thread-like, conical, digitate, hemispherical, straight or bent.

Sexual dimorphism is present or absent. The female genital aperture (transverse, longitudinal, or pore-like) opens anteriorly (10), at mid-body, or posteriorly. Ovaries and uteri may be one, two, or many (11). Uterus smaller than the rest of the body, or larger (12). Reproduction is oviparous or ovoviviparous. Eggs are few or many (13). Nematodes are gonochoristic, hermaphroditic, or intersexual (14). Females reproduce sexually or by parthenogenesis. Parthenogenesis is mitotic or meiotic. Males have one testis or two; they have one, two or zero copulatory spicules (15). Sperms are spherical, ellipsoidal or thread-like; they are introduced into vagina or (traumatically) through the female cuticle (16). Sex determination is genetic or epigenetic. Sex chromosomes are XY-XX or X0-XX. Chromosome number in the two sexes is identical or different (17). Lifespan is short or long (18).

Nematodes can be free-living or parasitic. Parasites are obligate or facultative, external (ectoparasites) or internal (endoparasites). Parasites attack one host or two (19). Nematodes can be found in the sea (at all depths), in fresh water, in the soil, in plants (roots, stems, leaves, flowers, fruits), in vertebrate and invertebrate animals (gut, blood, muscles, eyes, kidney, placenta, etc.). They live on the soil surface or as deep as 1.3 km beneath it (20); they have been found on mountains at 6100 m elevation (21), in hot springs, and have been thawed out alive from Antarctic ice (22) and from the sea-ice surface in the Arctic Ocean (23). Nematodes feed on bacteria, fungi, algae, plants, animals – including other nematodes – (24) or organic detritus; they are omnivorous or monophagous (25). Other nematodes do not ingest food but live in symbiosis with sulphur-oxidizing bacteria (26).

Following the Aristotelian logic, in the present case the term "nematode" is a *definiendum* (= term to be defined). But already Plato understood that the *definiens* (= set of words defining a *definiendum*) poses a lot of problems. Whereas we can define the term "birds" by only one or two characters (by a few words), it is not so for the term "nematodes".

(1) Chitwood, B.G & Chitwood, M.B. (1950) *An introduction to nematology. Anatomy.* Washington, D.C., B.G. Chitwood, VIII + 213 pp.
(2) *Nanomermis tripylae* Andrássy, 1978 and *Placentonema gigantissimum* Gubanov, 1951, respectively.
(3) For example *Ecphyadophora tenuissima* and *Meloidogyne incognita.*
(4) de Coninck L.A.P. (1965) *Traité de Zoologie: anatomie, sistématique, biologie.* 4, Masson, Paris.
(5) e.g., *Astomonema,* Ott, Rieger, Rieger & Enderes, 1982

Accepted by P. Mullin: 21 Jun. 2012; published: 3 Jul. 2012