REDESCRIPTION OF THE NEMATODE
PHILOMETRA OBTURANS
(PRENNANT, 1886) WITH A KEY TO THE PHILOMETRID
NEMATODES PARASITIC IN EUROPEAN
FRESHWATER FISHES

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Abstract. A redescription of the nematode Ph. obturans (Prenant, 1886), based on specimens from pike (Esox lucius L.) from the R. Elbe basin in Czechoslovakia, is presented. In addition to gravid, subgravid and mature females from the blood system also the male and mature female, found for the first time in the host’s eye, are described. The paper is supplemented by a key for the identification of the philometrid nematodes parasitizing freshwater fishes of Europe.

The nematode Philometra obturans (Prenant, 1886) is a specific parasite of pike (Esox lucius L.) whose large-sized gravid females occur in the gill arteries and the aorta of the fish. In spite of the high pathogenic effects on the host (obstruction in blood circulation, embolism, perforation of gill arteries, feeding on blood, etc.) and a wide distribution of this nematode in waters of Europe and Asia, the morphology of Ph. obturans is still little known. It is due mainly to the unusual location in the host’s body that these nematodes are found accidentally during current dissections of the fish, and then mainly their fragments only. Although there have been several reports on this parasite of pike from the U.S.S.R. from Karelia (Gorbunova 1936, Shulman et al. 1959), the Ukraine (Shumilo 1953, Paliy 1958, Shumilo and Kulakovskaya 1963), Russia (Izyumova 1960), Kazakhstan (Kolesnikova 1960) and Siberia (Titova 1965, Roytman and Naumova 1967, Kashkovsky et al. 1974), and also from Hungary and Czechoslovakia (Molnár 1970, Moravec 1971, Ergens et al. 1975), all these literary data are limited essentially to the records of Ph. obturans from the various bodies of water.

Until recently, the only existing description of this species was practically the original description of the gravid female given by Prenant (1886); his description of Filaria obturans was based on specimens obtained from pike bought at the market in Nancy (France). Later his data including drawings were taken over into several monographs (Linstow 1909, Skryabin 1923, Bykhovskaya-Pavlovskaya et al. 1962). However, since the description by Prenant was incomplete and inaccurate and related to the gravid female only, it does not answer the purpose of present taxonomy. The male and mature and subgravid females of Ph. obturans were unknown.

During a study on the fish parasites of the Mácha Lake system (R. Elbe basin), North Bohemia, carried out in 1975 and 1976, materials of the nematode Ph. obturans were obtained for a more complete description of this species. However, since this paper was submitted for publication, another recent publication concerning Ph. ob-
Philometra obturans (Prenant, 1886)

Gravid female (10 specimens) (Fig. 1): — Body of living female brown in colour, cylindrical, tapering slightly to both ends; anterior end narrower than posterior one; both ends of body rounded. Cuticle thick, with slight longitudinal striations. Length of body 90—170 (average 144) mm, maximum width 0.558—0.775 mm. Oral opening spherical, very small. Minute mouth papillae arranged in two circles; papillae of outer circle forming two dorsolateral and two ventrolateral pairs; inner circle

Fig. 1 Philometra obturans (Prenant, 1886) — gravid female. A, B — head end (lateral and apical views); C — anterior part of body (lateral view); D — posterior part of body (lateral view); E — dorsolateral projections on posterior end of body (dorsal view); F, G — posterior end of body (dorsal and lateral views).
consisting of four simple, hardly visible papillae located dorsolaterally and ventrolaterally. Distinct lateral amphids present. Overall oesophagus measuring 1.43 to 3.19 mm; ratio of length of oesophagus to length of body 1:46—82. Oesophagus narrow, only slightly inflated at anterior end. Dorsal oesophageal gland prominent, extending anteriorly along oesophagus up to nerve ring level; anterior part of oesophagus throughout muscular. Oesophageal gland provided with giant cell nucleus located in about its mid-length. Distance of nerve ring from anterior extremity 0.204 — 0.258 mm, excretory pore not located. Intestine dark in colour, straight, displaced laterally; its posterior end atrophied, forming ligament attached ventrally to body wall (at distance of 0.68 mm from posterior extremity). Posterior end of body rounded, bearing two small dorsolateral papilla-like projections; sometimes one projection conspicuously larger than other or both these being indistinct. Vagina and vulva absent. Ovaries situated near anterior and posterior ends of body. Uterus opposed, occupying almost whole internal space of body, filled with first-stage larvae; anteriorly it reaches to short distance below nerve ring, posteriorly almost to posterior extremity. Depending on length of nematode body uterus contains 40,000 to 100,000 larvae. Length of larvae 0.504—0.576 mm, maximum width 0.018—0.021 mm.

Subgravid female (10 specimens) (Fig. 2): — Body whitish, in more advanced females brown in colour; length of body 25—115 mm, maximum width 0.245—0.571 mm. Overall length of oesophagus 1.22—2.04 mm, nerve ring 0.204—0.245 mm from anterior extremity. Excretory pore just below nerve ring level. Anus atrophied.

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**Fig. 2. Philometra obturans** (Prenant, 1886) — subgravid female. A, B — posterior end of a specimen with doubled dorsolateral projections (dorsal and lateral views); C, D — posterior end of body of specimen 52 mm long (dorsal and lateral views); E — posterior extremity of specimen 52 mm long (dorsal view).
Vulva and vagina not located. Uterus containing spherical, uncleaved eggs 0.015 to 0.027 mm in diameter or embryo at different developmental stages (diameter of round morula 0.030—0.045 mm, size of oval embryo 0.054—0.060 × 0.030—0.036 mm). Posterior end of body rounded, in younger females somewhat narrowed, provided with two subventral papilla-like projections. Size and shape of these projections considerably variable, these being markedly large and sometimes doubled in smallest specimens (body length 25—52 mm) (Figs. 2 A, B), while in more advanced nematodes they resemble those of gravid females.

**Mature female** from gill artery (1 specimen) (Fig. 3): — Body whitish, 11.60 mm long, maximum width 0.122 mm; anterior end wider than posterior one. Oesophagus narrow, slightly inflated at anterior end, its overall length being 2.448 mm. Giant nucleus of oesophageal gland 1.564 mm, nerve ring 0.141 mm, and excretory pore 0.165 mm from anterior extremity. Intestine narrow, straight, its posterior end atrophied. Vulva present, situated 3.75 mm from posterior extremity. Uterus well developed, not containing eggs so far. Posterior end of body rounded, without distinct lateral projections.

**Mature female** from vitreous body of eye (1 specimen) (Figs. 4 E—H): — Body thread-like, whitish, with rounded ends; cuticle smooth. Length of body 3.77 mm, maximum width 0.027 mm. Head end bearing two circles of mouth papillae, their exact number not established. Muscular oesophagus slightly inflated at anterior end, posterior part of oesophagus overlapped by dorsal oesophageal gland provided with giant nucleus;

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**Fig. 3. Philometra obturans** (Prenant, 1886) — mature female from gill artery. A — anterior part of body; B — posterior end of body (lateral view); C — posterior extremity.
oesophageal gland reaching anteriorly to short distance below nerve ring. Overall length of oesophagus 0.693 mm, length of oesophageal gland 0.540 mm; width of anterior muscular part of oesophagus 0.006 mm, of oesophageal gland 0.018 mm; giant oesophageal nucleus 0.450 mm from anterior extremity. Nerve ring encircling muscular oesophagus 0.117 mm from anterior end of body, distance of excretory pore 0.138 mm. Oesophagus opening into intestine through valves. Intestine narrow, straight, its posterior part indistinct. Vulva (1.24 mm from posterior extremity) short, anteriorly running vagina and developing tubular uterus present. Posterior end of body rounded, with subterminal outlets of phasmids. Anus indistinct.

**Male** (1 specimen) (Figs. 4 A—D): — Body thread-like, whitish, with smooth cuticle; its length 3.56 mm, maximum width 0.024 mm. Head end rounded. Minute subterminal mouth papillae present, their number, however, not established. Oesophagus

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**Fig. 4. Philometra obturans** (Prenant, 1886). A—D — male (A — anterior part of body, B — head end, C, D — posterior end of body, ventral and lateral views); E—H — mature female from vitreous body of eye (E — vulva region, F — anterior end of body, G — anterior part of body, H — posterior end of body, lateral view).
cylindrical, muscular, with anterior end bulbously inflated; posterior part of oesophagus overlapped by well developed dorsal oesophageal gland filling up almost entire width of body; giant nucleus of oesophageal gland present. Overall length of oesophagus 0.588 mm, of oesophageal gland 0.450 mm; width of anterior muscular part of oesophagus 0.006 mm, in region of its bulbous extension at anterior end 0.012 mm. Nerve ring 0.126 mm, excretory pore 0.141 mm from anterior extremity. Posterior end of body lobed; at level of cloaca transverse mound present containing inconspicuous caudal papillae. Caudal papillae: one ventrolateral pair and two adanal (lateral and dorsolateral) pairs present. Outlets of phasmids located subterminally on posterior, narrowed end of body. Spicules fairly wide (up to 0.006 mm), with proximal ends only slightly sclerotized. Length of right spicule 0.063 mm, of left spicule 0.051 mm; length ratio of spicules 1 : 1.19. Gubernaculum narrow, 0.045 mm long, with distinct reflected dorsal barb on distal tip. Ratio of length of gubernaculum to length of larger spicule 1 : 1.4, length ratio of gubernaculum and smaller spicule 1 : 1.04. Spicules and gubernaculum orange in colour. Length of tail 0.012 mm.

Host: northern pike, Esox lucius L. (length of body 21—53 cm). Location: gravid and subgravid females in gill arteries and aorta, more advanced mature females in gill arteries, young mature females and males in vitreous body of eye. Locality: Břehyně Brook in section between Mácha Lake and fishpond Břehyně near Doksy, North Bohemia, Czechoslovakia (the Elbe River drainage system). Incidence: in 34 out of 145 (23.5 %) E. lucius examined from this locality; intensity of infection: 1—4 nematodes per fish. Deposition of specimens: Institute of Parasitology, Czechoslovak Academy of Sciences, Prague.

DISCUSSION

Even though the morphology of gravid females of Philometra obturans corresponds on the whole to the description given by Prenant (1886), several important features were overlooked or interpreted erroneously by the latter author. According to Prenant (1886) the gravid female possesses the vulva and vagina located near the anterior end of the uterus; his drawing suggests, however, that the anterior ovarian loop was considered to be the vulva. It is evident from the present material that the vulva and vagina are present in young mature females only (approximately at the boundary of the second and third thirds of the body length), whereas in gravid females these organs are atrophied like in other members of the genus. Prenant (1886) had not mentioned the presence of two dorsolateral papilla-like projections on the posterior extremity of the gravid female which were observed in this species for the first time by Moravec (1971); the projections are usually well developed in gravid females, being indistinct only exceptionally. Although Prenant (1886) had not found any mouth papillae, in our specimens these were always present and their arrangement was typical of the genus Philometra (see Rasheed 1963).

The body size of the gravid female of Ph. obturans is considerably variable. In the present material the body length of gravid females ranged from 90 to 170 mm, while the largest subgravid females measured up to 115 mm in length. Prenant (1886) reported the length of gravid females to be 150—200 mm; Izyumova (1960) and Titova (1965) found a single gravid female 120 and 182 mm long, respectively. According to Ollenschläger (1975) the length of Ph. obturans females is 200—250 μm (probably an error for 200—250 mm); it is not clear, however, from his work whether these data are original or have been taken erroneously from the literature. The size
of the nematode body is associated with the number of larvae in the uterus; while in the female 90 mm long approximately 40,000 larvae were found, the uterus of the female with the body length of 170 mm contained some 100,000 larvae.

In the measurements of the spicules and gubernaculum of the male, *Ph. obturans* is closest to the North American species *Philometra cylindracea* (Ward et Magath, 1916) (Ashmead and Crites 1975, Molnár and Fernando 1975) parasitic in *Perea flavescens* and to the Eurasian species *Philometroides sanguinea* (Rudolphi, 1819) (Molnár 1967) from *Carassius* spp.; in contrast to *Ph. obturans* the spicules of the two species are almost equal and of a somewhat different structure and both these species differ from *Ph. obturans* in many other significant features (ornamentation of the cuticle of gravid females, length of their oesophagus, location in the host, etc.). Male’s caudal papillae are usually indistinct in the philometrid nematodes and have hitherto been described only exceptionally, preventing thus comparison of this sign in *Ph. obturans* and other congeners. In my opinion, at present this feature is not a suitable taxonomical criterion, because it is rather difficult to establish the exact number and arrangement of the caudal papillae in the philometrid nematodes.

Members of this difficult group of nematodes are, in addition to their morphological structures, characterized as well by their location in the host, particularly that of the gravid females. In the majority of species the females occur in the abdominal cavity, subcutaneous tissues or in the fins of the fish. Out of the numerous species of philometrid nematodes *Ph. obturans* is the only known member parasitic in the host’s blood system.

In 1928, Walton described from the abdominal cavity of *Esox lucius* from the U.S.A. young females of the genus *Philometra*) which he named *Ph. translucida*. According to Bauer and Gussev (1969) this species may be conspecific with *Ph. obturans*. Although the gravid and subgravid females of *Ph. obturans* occur almost exclusively in the blood system, Paliy (1958) found in the Ukraine two young females of this parasite in the abdominal cavity of pike; this would agree with the opinion of Bauer and Gussev (1969). On the other hand, according to the original description, *Ph. translucida* possesses only four distinct mouth papillae, whereas in *Ph. obturans* there are eight minute papillae of the outer circle and four papillae in the inner circle. The definitive solution of this problem will only be possible when additional specimens of *Ph. translucida* are available to study.

In comparison with females, the males of *Philometra* and related genera are noted for the very small size of the body and they have usually different location in the host; therefore, the males can be found only during a very careful examination of the host’s organs (most often the swim-bladder) using the dissecting microscope; during routine dissections of the fish the males are found only occasionally and, so far, these have not been described in most species of philometrid nematodes. *Ph. obturans* is practically the last European freshwater member of this nematode group in which the males have not been known at all and the morphology of females has been recognized only insufficiently. The present material made it possible to work out a key for the identification of the philometrid nematodes parasitizing the freshwater fishes of Europe. The key enables the specific identification on the basis of the nematode morphology only, provided that the features of both sexes are used in combination; otherwise, for a reliable determination, it is necessary to consider also the type of host and location in it. Since some genera of the family Philometridae based on the female morphology only (males are indistinguishable) are not generally

*) Rasheed (1963) listed this species within the genus *Thwaitia* Rasheed, 1963 which is considered by the present author (Moravec 1971) a synonym of the genus *Philometra* Costa, 1845.
recognized, the key is not limited to the genus *Philometra* but includes as well the species of *Philometroides*. Due to insufficiency of data, the key omits the species *Philometra acipenseris* (del Lupo, 1898) described from *Acipenser sturio* (locality?).

**KEY TO THE PHILOMETRID NEMATODES OF THE EUROPEAN FRESHWATER FISHES**

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1. Cuticle of gravid female densely covered with bosses
   - Cuticle of gravid female smooth, without bosses

2. Body length of gravid female 40—50 mm; gravid females located in fins (mainly in caudal fin). Parasite in cyprinid fishes of the genus *Carassius*
   - Body length of gravid female 100—160 mm; gravid females located in skin under scales. Parasite in *Cypinus carpio*

3. Length of gravid female 30—42 mm; its posterior end provided with two large, conspicuous cone-shaped lateral projections; gravid females located in subcutaneous tissues of head. Parasite in cyprinid fishes of the genera *Alburnus*, *Abramis*, *Blicca*, *Scardinius*, *Aspius*.
   - Length of gravid female at least 60 mm; its posterior end rounded, with two small lateral papilla-like projections; gravid females located in abdominal cavity or blood system

4. Living gravid female brown in colour, length of body 90—200 mm, located in blood system (gill arteries, aorta, heart) of *Esox lucius*.
   - Living gravid female red or white in colour, length of body 60—120 mm, located in abdominal cavity of cyprinids

5. Length of gravid female 60 mm. Parasite in *Aspius*.
   - Length of gravid female 70—120 mm. Parasite in *Gobio*, *Phoxinus* and *Leuciscus*.

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1. Length ratio of gubernaculum and larger spicule 1 : 2.2—5.3. Males located on swim-bladder and in abdominal cavity
   - Length ratio of gubernaculum and larger spicule 1 : 1.3—1.7. Males located on swim-bladder, in abdominal cavity or in eye

2. Length of spicules 0.127—0.177 and 0.120—0.164 mm, length of gubernaculum 0.051 to 0.069 mm; length ratio of gubernaculum and larger spicule 1: 2.15—3.24

3. Spicules equal (0.190—0.230 mm long), length of gubernaculum 0.051 to 0.062 mm; length ratio of gubernaculum and spicules 1: 3.7
   - Spicules unequal (0.204—0.357 and 0.180—0.222 mm long), their length ratio being 1: 1.18 to 1.60; length of gubernaculum 0.053—0.078 mm; length ratio of gubernaculum and larger spicule 1: 3.63—5.30

4. Spicules distinctly differ in structure and lengths; length of spicules 0.063 and 0.051 mm, length of gubernaculum 0.045 mm. Males located in vitreous body of eye
   - Spicules of the same structure, almost equal in length. Males located on swim-bladder and in abdominal cavity

5. Spicules shorter than 0.6 mm (0.045—0.053 and 0.054—0.057 mm), slender; length of gubernaculum 0.041 mm
   - Spicules longer than 0.6 mm; their middle part somewhat extended laterally

6. Spicules 0.066—0.084 mm long, length of gubernaculum 0.063 mm; length ratio of gubernaculum and larger spicule 1: 1.33
   - Spicules somewhat longer (0.090—0.108 and 0.082—0.088 mm); length of gubernaculum 0.053—0.066 mm; length ratio of gubernaculum and larger spicule 1: 1.68

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Резюме. Дано переописание беременных самок нематоды Philometra obturans (Prenant, 1886), выделенных из кровеносной системы щуки (Esoc lucius L.) из бассейна р. Лабы в Чехо-словацких. В первый раз описан самец и зрелая самка этого вида, паразитирующего в стекловидном теле глаза щуки. Приведена таблица для определения филометридных нематод, паразитирующих у европейских пресноводных рыб.

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W. Eichler: Parasitologisch-insektizidkundliches Wörterbuch.  
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In the series of dictionaries concerning biological disciplines another one has been published, this time devoted to parasitology and science of insecticides, an unusual combination at first sight, but quite justified in its essence. The author is the well known specialist Prof. Dr. W. Eichler of the Humboldt University in Berlin, who, together with five associates (M. Ya. Ass, H. Beitz, V. Bozděch, J. Jíra, K. Odening) took up the task of compiling a survey of most important terms used in the above mentioned disciplines and of presenting their English and Russian equivalents and brief definition or explanation. Very useful for the user is also the introductory short chapter devoted to orthography in parasitology and science of insecticides, which may serve as a source of valuable information to authors of different works. 

The focus of the book, however, is the lexicographical section proper (pp. 21–418) listing a total of 5 886 terms, given mostly in German, English and Russian. Only where an equivalent in relevant language is lacking, its meaning, but not the translation itself, is stated in brackets or not at all. The vocabulary entries primarily comprise the most important professional terms used in relevant scientific fields, the German and Latin names of selected taxa, names of diseases, chemical compounds and preparations. At the end of the volume there is a list of references, a list of English and Russian terms and a list of Latin names of animals and plants.

Prof. Eichler succeeded in choosing the most important terms of mentioned disciplines used in the German language. Due to the extensive text it was necessary to choose very brief definitions and explanations and omit any etymological references. The statement of some obsolete, but still current names of taxa in professional literature, together with their correct equivalents, may be considered right. Very suitable is also the explanation of many abbreviations. It stands to reason that opinions on the expediency of all terms entered in the dictionary may differ, if we consider their large number. Some of them could be obviously omitted, e.g. Atomophobie, Blattflöhe, particularly when they are not German (blue tick, depluming louse), and others, on the contrary, should be added, e.g. Dermacentor pictus, Liquide de Swan, especially so if we take into consideration that some other vocabulary entries are listed twice (Fauresche Lösung, Liquide de Faure). Likewise excessive appear to be the terms Pfiemenschwanz, Pfiemenschwänze, Pfiemenschwanzartige. The vocabulary entry 708 is incomplete. Some definitions are not precise. Acarinium and aphanipterum indicate a group of mites or fleas not only in a nest, but also on the body of a certain host individual, not a host species. Diseases with natural foci are not only transmissible ones. Neither the translation of some terms is always adequate. For example “kleschhi” are not only “Zeeken”, but also “Milben”. The correct translation of the term 5 771 is tick-borne encephalitis. *Aedes aegypti*, where the English name “yellow fever mosquito” is lacking, is not a synonym of *Stegomyia fasciata*, but vice versa. These mistakes may be easily corrected in the next edition.

As a whole, the reviewed dictionary is a useful book for all specialists engaged in parasitology and in the field of insecticides, particularly for those who regularly deal with German literature. The indices appended at the end of the publication make it also usable for English and Russian literature. The appearance of this dictionary is a commendable publishing initiative.

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