OBSERVATIONS ON TWO RHABDOCHONA SPECIES (NEMATODA: RHABDOCHONIDAE) FROM FRESHWATER FISHES IN IRAQ, INCLUDING DESCRIPTION OF R. SIMILIS SP. N.

F. MORAVEC¹, N. M. ALI² and E. S. ABUL-EIS³

¹Institute of Parasitology, Czechoslovak Academy of Sciences, Branišovská 31, 370 05 České Budějovice, Czechoslovakia and ²Department of Hydrobiology, Biological Research Centre, Scientific Research Council, Baghdad, Iraq

Abstract. Two species of the nematode genus Rhabdochaon, R. similis sp. n. and R. denudata denudata (Dujardin, 1845), are reported for the first time from freshwater fishes from Iraq. The new species R. similis sp. n. (type host Glyptothorax sp.) is characterized largely by the presence of a markedly large prostom armed with 14 anterior teeth and without basal teeth, small spicule without a usual dorsal barb, and filamented eggs. Findings of R. denudata denudata in Barbus luteus and Cyprinodon macrostomum represent new host records. Rhabdochaona mesopotamica Rahemo et Kasim, 1979 is considered a junior synonym of R. denudata (Dujardin, 1845).

The helminth fauna of Iraqi freshwater fishes is still little known. The first report on this subject was published only by Herzog (1969) and only a few papers dealing with these parasites appeared since. Of them, only the papers by Rahemo (1978), Rahemo and Kasim (1979) and Ali et al. (1987) reported the presence of Rhabdochaona species in Iraq. A total of four species were recorded by them in this region, but the species identification of some of them does not seem to be reliable and, consequently, a revision of these materials is highly desirable.

In 1989, we examined Rhabdochaona samples from three species of fish hosts collected in the surroundings of Baghdad (unfortunately the localities are unknown), representing one new, hitherto undescribed species and another one which has not so far been reported from this geographical region. This paper gives an account of these findings.

MATERIALS AND METHODS

The nematodes collected from infected fishes were fixed and stored in 70 % ethanol. For examination they were cleared with glycerine. En face views were prepared according to Anderson's (1958) method. All drawings were made with the aid of a Zeiss microscope drawing attachment. The specimens (including types) have been deposited in the helminthological collections of the Institute of Parasitology, Czechoslovak Academy of Sciences, České Budějovice, in Czechoslovakia. All measurements are given in millimetres.

RESULTS

Rhabdochaona similis sp. n.  Figs. 1, 2

Description: Rather long, slender nematodes with almost smooth cuticle. Rudimentary pseudolabilia appearing in lateral view as apical protuberances on anterior extremity in female and indistinct in male. Mouth roughly hexagonal. Two fairly
Fig. 1. *Rhabdochona similis* sp. n. A, B — head end of female, dorsal and lateral views; C, D — head end of male, lateral and dorsal views; E — head end of female, apical view; F — posterior end of male; G — female tail; H — distal tip of larger (left) spicule; I — smaller (right) spicule; J, K — tip of male tail; L, M — tip of female tail.
lare lateral amphids and four small, submedian cephalic papillae present. Prostom large, thick-walled, funnel-shaped, without basal teeth; internally prostom lined with longitudinal ribs forming near anterior margin of prostom 14 small forwardly directed teeth. 3 dorsal, 3 ventral and 4 lateral (arranged in two pairs) on either side. Vestibule relatively short, straight. Deirids small, simple, situated near mid-length of vestibule. Tail of both sexes conical, with bluntly rounded tip bearing a minute knob-like cuticular process in female. Females markedly larger than males.

**Fig. 2. Rhabdochona similis** sp. n. — mature eggs.

**Male** (7 specimens; measurements of holotype in parentheses): Length of body 9.82—12.81 (12.62), maximum width 0.068—0.095 (0.082). Prostom 0.033—0.045 (0.045) long and 0.018—0.021 (0.021) wide in lateral view. Length of vestibule including prostom 0.117—0.135 (0.123), length ratio of prostom and whole vestibule being 1 : 2.7—3.5 (1 : 3.3). Length of muscular oesophagus 0.465—0.621 (0.516), that of glandular oesophagus 2.19—3.17 (2.60). Nerve ring encircling muscular oesophagus 0.195—0.243 (0.225) from anterior end of body, distance of excretory pore 0.255—0.327 (0.327), of deirids 0.066—0.075 (0.075). Subventral preanal papillae occurred in following combinations: 6 + 7, 7 + 7, and 7 + 8 (6 + 7). Additional lateral pair of preanal papillae present approximately at level of third subventral pair (counted from cloacal opening). Of 6 postanal pairs of papillae, second pair situated more laterally, remaining pairs subventral; sometimes lateral pair shifted more ventrally, being then practically indistinguishable from remaining pairs of postanal papillae. Cuticle of ventral surface of body in region of preanal papillae with numerous fine undulating longitudinal wrinkles. Larger (left) spicule well sclerotized, 0.450—0.522 (0.522) long; length of its shaft 0.195—0.258 (0.258), representing 43—49 (49) % of whole spicule length; distal tip moderately widened, lanceolate. Smaller (right) spicule 0.099—0.117 (0.108) long, without dorsal barb at distal tip. Length ratio of spicules 1 : 4.2—5.0 (1 : 4.8). Tail conical, 0.270—0.360 (0.360) long, with obtuse tip.
Female (5 specimens; measurements of allotype in parentheses): Length of body of gravid females with mature eggs 38.99—40.68 (40.68), maximum width 0.231 to 0.258 (0.258). Prostom 0.069—0.078 (0.069) long and 0.033—0.045 (0.033) wide in lateral view. Length of vestibule including prostom 0.165—0.180 (0.171), length ratio of prostom and whole vestibule being 1 : 2.3—2.5 (1 : 2.5). Length of muscular oesophagus 0.720—0.891 (0.891), that of glandular oesophagus 5.50—5.75 (5.75). Distance of nerve ring 0.303—0.306 (0.306), of excretory pore 0.423—0.495 (0.423), of deirids 0.090—0.111 (0.111). Tail conical, conspicuously slender, 0.561—0.573 (0.561) long, with rounded tip bearing a minute terminal cuticular knob-like process. Vulva post-equatorial, 16.95—17.14 (16.95) from posterior end of body. Muscular vagina directed posteriorly. Eggs oval, size 0.030—0.036 × 0.021—0.027 (0.030 to 0.033 × 0.021—0.024); each pole of mature (larvated) egg provided with a rather thick, long filament; length of filaments some 0.150—0.200 (—).

Hosts: Glyptothorax sp. (type host) (Sisoridae, Siluriformes) and Barbus luteus (Heckel) (Cyprinidae, Cypriniformes); only one male was found in the latter host species.

Localization: intestine.

Locality: surroundings of Baghdad, Iraq.

Deposition of types: Institute of Parasitology, Czechoslovak Academy of Sciences, České Budějovice (holotype, allotype, paratypes: N = 564).

Etymology: The specific name "similis" (= similar) relates to the fact that this species is similar to the closely related species R. glyptothoracis Karve et Naik, 1951.

Comments: — The genus Rhabdochona Railliet, 1910 comprises many species that are intestinal parasites of freshwater fishes. Its representatives are distributed over all continents with the exception of the Australian zoogeographical region.

A list of members of this genus given by Moravec (1975) included 45 species considered as valid. However, numerous additional new species have been described since, mainly from Asia. At present this genus comprises a total of 87 nominal species (see Moravec and Coy Otero 1987, Moravec and Huffman 1988, Mashego 1990, Moravec and Scholz 1991), but the validity of some of them is questionable. One of these species, R. mesopotamica Rahemo et Kasim, 1979, has been synonymized with R. denudata (Dujardin, 1845) in this paper (see p. 239).

Of all Rhabdochona species, R. similis sp. n. is the most similar to R. glyptothoracis Karve et Naik, 1951, a species described from Glyptothorax lonah from western India (Poona) (Karve and Naik 1951). Both these parasites exhibit a number of common morphological and biometrical features (e.g., presence of a markedly large prostom without basal teeth, simple deirids, small spicule without a dorsal barb, similar lengths of spicules, females much larger than males) and also their hosts are closely related, belonging to the same genus. However, both the species differ distinctly in the number and character of egg filaments (a single, fairly thick filament on each egg pole in R. similis sp. n. compared to a bunch of fine long polar filaments in R. glyptothoracis) and the shape of the female tail tip (provided with a knob-like cuticular process in R. similis compared to the bluntly rounded, slightly swollen tip separated from the preceding portion by a slight constriction in R. glyptothoracis); moreover, there are also differences in the numbers and arrangement of male caudal papillae and in the egg size; the vagina of R. glyptothoracis is directed anteriorly, while that of R. similis sp. n. is directed posteriorly; geographical distribution of these two parasites should also be taken into account.

The shape of the tail and some other morphological features of R. similis sp. n. (as also of R. glyptothoracis) show affinities of this species with some Rhabdochona members parasitizing catfishes (Siluriformes) in Asia, Africa and North America. Of the species with filamented eggs, simple deirids are known only for the North
American species *R. longleyi* Moravec et Huffman, 1988, a parasite recently described from blind catfishes (Ictaluridae) from the subterranean waters in Texas; but this species markedly differs from both *R. similis* and *R. glyptothoracis* in possessing only 6 anterior teeth in the prostom and in the presence of the dorsal barb on the small spicule.

*R. similis* sp. n. somewhat resembles also the palaeartic species *R. ergensi* Moravec, 1968, a parasite of fishes of the genus *Noemacheilus* (Cobitidae) in Europe and Central Asia; however, in contrast to the first species (and also *R. glyptothoracis*), *R. ergensi* is characterized by bifurcate deirids, presence of the barbed small spicule, and numerous egg filaments; differences exist also in the length of the prostom in relation to the whole vestibule length.

Until now, several *Rhabdochona* species have been reported from catfishes of the family Sisoridae. In addition to the above mentioned *R. glyptothoracis* Karve et Naik, 1951, these are: *R. longicauda* Dzhaliilov, 1964 from *Glyptosternum reticulatum* in Soviet Central Asia (Tajikistan) and Afghanistan, *R. mazeedi* Prasad et Sahay, 1965 from *Bagarius yarrellii* in India, *R. bagarii* Gupta et Srivastava, 1982 from *Bagarius bagarius* from India and *R. wangi* Moravec et Scholz, 1991 from *Bagarius bagarius* from China. All these species differ considerably in their morphology from *R. similis* sp. n., namely in the absence of polar filaments on eggs (*R. mazeedi, R. bagarii, R. wangi*) and bifurcate deirids and a conspicuously longer (exceeding 1 mm) left spicule (*R. longicauda*).

*Barbus luteus* is probably only an accidental host for *R. similis* sp. n.

**Rhabdochona denudata** (Dujardin, 1845)

Syn.: *Dispharagus denudatus* Dujardin, 1845; *Cucullanus pachystomus* Linstow 1873; *Dispharagus filiformis* Zschokke, 1884; *Rhabdochona brevispicula* Akhmerov, 1905; *R. crassa* Finogenova, 1967; *R. mesopotamica* Rahemo et Kasim, 1979.

Following description based on specimens from *Barbus luteus*, measurements of those from *Cyprinon macrostomum* given in parentheses.

**Description:** Small nematodes with smooth cuticle. Mouth roughly hexagonal. Two lateral amphids and four small submedian cephalic papillae present. Prostom funnel-shaped, relatively wide, basal teeth mostly absent or, more rarely, slightly outlined; anterior teeth 14 in number, lateral teeth arranged in pairs. Vestibule relatively long, straight in younger specimens and usually S-shaped in older ones. Deirids small, bifurcate, approximately in mid-length of vestibule. Tail of both sexes with sharp terminal cuticular spike.

**Male** (7 specimens from *B. luteus* and 4 from *C. macrostomum*): Length of body 3.85—5.88 (3.79—4.52), maximum width 0.068—0.082 (0.068—0.082). Prostom 0.015—0.018 (0.015—0.018) long and 0.009—0.012 (0.012) wide. Length of vestibule including prostom 0.081—0.105 (0.063—0.093), of muscular oesophagus 0.180—0.195 (0.144—0.195), of glandular oesophagus 0.94—2.23 (1.09—1.54). Nerve ring encircling muscular oesophagus 0.123—0.171 (0.144—0.201) from anterior end of body, distance of excretory pore 0.186—0.231 (0.195—0.219), of deirids 0.048—0.066 (0.048—0.054). Subventral preanal papillae occurred in following combinations: 8 + 9, 9 + 9, and 9 + 10 (8 + 8, 9 + 9, and 10 + 10). Additional pair of lateral preanal papillae present approximately at level of third subventral pair (counted from cloacal opening). Postanal papillae: 6 pairs present, five pairs subventral and one pair lateral, being located approximately at level of first subventrals or slightly below them. Area rugosa absent. Larger (left) spicule 0.321—0.363 (0.330—0.333) long, length of its shaft 239
Fig. 3. *Rhabdocoela denuudata* (Dujardin, 1845) from *Barbus luteus*. A—C — head end of female, lateral dorsal and apical views; D, E — smaller (right) spicule; F, G — distal tip of larger (left) spicule; H, I — mature egg; J — tip of female tail; K — tip of male tail; L — female tail; M — male tail.
0.183—0.210 (0.180—0.195), representing 57—60 % (55—59 %) of whole spicule length; distal tip of this spicule provided with ventral tooth-like process formed by spicular cover. Smaller (right) spicule 0.078—0.099 (0.078—0.090), with distinct dorsal barb at its distal end. Length ratio of spicules 1 : 3.7—4.3 (1 : 3.7—4.2). Tail conical, 0.180—0.255 (0.186—0.210) long, with sharp cuticular spike at tip.

Female (6 specimens from B. luteus and 5 from C. macrostomum): Length of body of gravid females with mature eggs 8.83—12.99 (6.35—6.90), width 0.122—0.177 (0.109—0.136). Prostom 0.018—0.021 (0.018—0.021) long and 0.015—0.018 (0.012—0.015) wide. Length of vestibule including prostom 0.081—0.105 (0.006—0.099), of muscular oesophagus 0.195—0.303 (0.120—0.186), of glandular oesophagus 1.54—2.90 (1.76—1.81). Distance of nerve ring 0.114—0.192 (0.105 to 0.150), of excretory pore 0.216—0.321 (0.168—0.186), of deirids 0.048—0.075 (0.042—0.075). Tail conical, 0.180—0.216 (0.135—0.192) long, with sharp terminal cuticular spike. Vulva postequatorial, 3.35—5.30 (2.58—3.06) from posterior end of body. Muscular vagina directed posteriorly. Eggs oval, size 0.038—0.042 × 0.018 to 0.021 (0.039—0.042 × 0.018—0.021); surface of mature (larvated) eggs provided with fine, irregular, almost transparent flock-like coating.

Hosts: Barbus luteus (Heckel) and Cyprinion macrostomum (Heckel) (both fam. Cyprinidae).

Locality: Surrounded of Baghdad, Iraq.

Comments: — Despite the fact that gravid females of the present material originating from C. macrostomum are distinctly smaller than those from B. luteus, both these forms are entirely identical in other features and, accordingly, it is necessary to consider them conspecific. The general morphology and measurements of these specimens correspond to the species Rhabdochona denudata (Dujardin, 1845), as it has been redescribed by Moravec (1975) on the basis of European materials from Lucioperca cephalus.

In addition to the nominate subspecies R. denudata denudata (Dujardin, 1845), Moravec and Amin (1978) established a separate subspecies R. denudata zhaitiliori parasitizing cyprinids of the subfamily Schizothoracinae in Afghanistan and Soviet Central Asia (Tajikistan) and recently Moravec and Nagasawa (1989) erected another one, R. denudata honshuensis, based on specimens from the cyprinid Zacco platypus in Japan; both the last named subspecies differ from the nominate subspecies mainly in the shape and structure of the distal tip of the larger spicule. On comparing the Iraqi specimens with the above mentioned subspecies, it is apparent that they may be assigned to Rhabdochona denudata denudata.

In 1979, Rahemo and Kasim described two new Rhabdochona species, R. mesopotamica and R. grandipapillata, from Cyprinion macrostomum of the River Tigris in Iraq. Comparison of the original description of R. mesopotamica with R. denudata of the present material originating from the same fish host species and the same region indicates that both these species can be considered identical. The main difference between R. denudata and R. mesopotamica should be the presence of 20 anterior teeth (instead of 14 in R. denudata) in the prostom and the absence of deirids in the latter species. However, some features of R. mesopotamica reported in the original description are evidently erroneous (e.g., absence of deirids, presence of caudal alae in male, number of preanal papillae) and, therefore, it is highly probable that also the number of anterior teeth, which is rather difficult to study, has not been established correctly. Deirids of R. denudata are small, often difficult to observe upon lateral view, and apparently that is why they were not located in R. mesopotamica. In our opinion, the name Rhabdochona mesopotamica Rahemo et Kasim, 1979 should be
considered a junior synonym of *R. denudata* (Dujardin, 1845). Consequently, also the subgenus *Rhabdochonoides* Rahemo et Kasim, 1979 (type species *R. mesopotamica*) becomes a synonym of the nominate subgenus *Rhabdochona* Railliet, 1916.

According to Moravec (1975), *Rhabdochona denudata* is a widespread palaeartic species distributed over nearly all Europe, Trans-Caucasia and western Siberia, occurring also in Central Asia and down south reaching Israel; it has been reported as well from the Soviet Far East and recently Moravec and Nagasawa (1989) recorded it even from Japan. It has not so far been recorded from Iraq and the present finding represents the first record of this parasite in the basin of the Rivers Euphrates and Tigris.

It has been mentioned by Mayr (1963) that the most different allopatric populations of the animal species are found near the border of its distribution, this being manifested in parasites by the change of their preferred hosts. These changes have a genetic basis and, as it is apparent from some observations on fish nematodes, they may be manifested not only by a mere shift from one host to another, but also by change of the degree of host specificity.

Such an example may be the border populations of *Rhabdochona denudata*: while in almost whole area of its distribution this palaeartic species parasitizes fishes of the subfamily Leuciscinae, in the R. Jordan basin in Israel it occurs as well in members of *Varicorhinus* (Barbinae) and *Noemacheilus* (Cobitidae) and in Central Asia in *Schizothoracichthys* and *Schizothorax* (Schizothoracinae) (Moravec 1975, Moravec and Amin 1978); the present finding of this parasite in *Barbus luteus* (Barbinae) in Iraq is another confirmation of this phenomenon. In other regions the above mentioned groups of host fishes are parasitized by their specific *Rhabdochona* species (see Moravec 1984).

REFERENCES


**MORAVEC F. 1984:** Obecné nepelyt biomonie parazitických hlistic (Nematoda) sladkovodních ryb. Studie ČSAV No. 4. Academia, Prague, 114 pp.


**MORAVEC F., COY OTERO A. 1987:** *Rhabdochona cubensis* sp. n. (Nematoda: Rhabdochonaidae) from the freshwater fish *Gambusia pectorata* from Cuba. Helminthologia 24: 103—110.

**MORAVEC F., HUFFMAN D. G. 1988:** *Rhabdochona longleyi* sp. n. (Nematoda: Rhabdocoainae) from blind catfishes, *Trogloplanis patersoni* and *Satam euryctomus* (Ictaluridae) from the subtropical waters of Texas. Folia Parasitol. 35: 235—243.


Received 27 August 1990
Accepted 21 September 1990


The book, written by a prominent Polish specialist in medical and veterinary entomology, is intended, in the author’s own words, for teachers and students in university biological departments and medical and veterinary schools. Compared with other textbooks, its concept is new. The reader is supposed to have a knowledge of general entomology and arthropod taxonomy and attention is focused on specific parasitological problems, particularly, as stated in the Introduction, on questions which are treated marginally or addressed differently in other specialities. The layout of the book conforms to this pattern. Each chapter begins with an introduction elucidating the subject and preparing the reader for the problems dealt with in detail. The chapters end with a summary and list of relevant literature. The choice of topics is very interesting and includes not only problems important for medical practice, but also those giving a new perspective for research in medical entomology. Thus there is an abundance of material to stimulate the reader.

The introductory chapter is entitled “Parasitism as an interspecific relationship”. First, there is a survey of various views concerning this relationship. There are the definitions based on the interrelations between two organisms of different species analyzed by the author from the viewpoint of the criteria of harm or advantage, of metabolic dependence, and of the ecological approach to interspecific relations. The interspecific relations are further dealt with at the populational level. The remaining part of this chapter includes definitions of parasitoids and predators, as well as parasitism and parasite.

The second chapter concerns host-finding by parasitic arthropods. The main factors influencing the insect’s long-range and short-range search for a host are dealt with separately. The third chapter is devoted to feeding methods in haematophagous arthropods.

The author differentiates two groups of haematophages, solenophages and telmophages, according to their mode of feeding. The fourth chapter is devoted to biological rhythms in parasitic arthropods especially to dependence of the biological rhythm on seasonal climatic conditions and circadian rhythms.

The fifth chapter is very comprehensive. It covers 36 pages and deals with the man’s impact on the fauna and evolution of parasitic arthropods. The problems of housing, utilization of new areas, breeding of domestic mammals, and entomoparasitological effects of rapid transcontinental travel are discussed in individual paragraphs.

The next chapter, “Regularities in the phylogenesis of parasitic arthropods”, concerns theoretical questions of the parasite-host evolutionary relationship. Particularly the rules of phylogenetic parallelism and coevolution (Kellogg-Fahrenholz’s, Sziadat’s, Eichler’s, Zlotorzycka’s, Janicki’s, and Harrison’s rules and briefly also many other rules) are critically discussed. The seventh chapter entitled “Immunobiology of infestation” is divided into the following paragraphs: skin reactions in the host, humoral and cellular defense against ectoparasites, inducing resistance. The role of arthropods as vectors of pathogens is briefly discussed in the eighth chapter. Attention is given to the function of arthropods as both vectors and reservoirs, as well as to the fundamentals of the theory of natural fecality of infections.

The ninth chapter contains information about the problems of the parasite control. Its first part is devoted to the questions of chemical control and its negative side effects (resistance of the parasites, pollution of the environment etc.). The following part deals with the bases of the biological control either direct with one species against another or by disturbance of reproduction.

The tenth chapter which is distinctly nontraditional, concerns the importance of entomolo-