

A morphological study of *Acanthocephaloides propinquus* (Acanthocephala, Arhythmacanthidae) parasitising gobiid fishes (Teleostei, Gobiidae) in the northwestern Black Sea

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Abstract

Morphological data for *Acanthocephaloides propinquus* (Arhythmacanthidae) from gobiid fishes from the northwestern Black Sea are presented. Individuals from the Black Sea differ from the descriptions based on Mediterranean specimens in having 4–5 proboscis hooks per row in the former and 5–6 in the latter. The size of the cuticular spines is rejected as a diagnostic character for *A. propinquus* because their length varies in a wide range (3.0–7.5 μm). The diagnostic characters for identifying *A. propinquus* include the presence of small cuticular spines, the testes located in the central part of the body and an acanthor having a single hooklet lacking a root.

Key words

Acanthocephaloides propinquus, acanthocephalans, morphology, gobiid fish, Black Sea

Introduction

Acanthocephaloides propinquus (Dujardin, 1845) is a widespread parasite in the northwestern part of the Black Sea (NWBS) recorded from syngnathid, atherinid, labrid, gobiid, pleuronectid and other fishes (Chernyshenko 1947, 1955, 1960a, b, 1962a, b, 1964, 1966; Butskaya 1952; Chernyshenko and Svetsitskaya 1967, 1970; Naidenova 1974; Parukhin *et al.* 1983; Florescu and Ieniştea 1984; Machkevskiy *et al.* 1990; Kvach 2001, 2002a–c). My previous studies (Kvach 2002b, c) have shown that the acanthocephalans of this species from the Black Sea exhibit some morphological differences from the descriptions based on Mediterranean specimens. The aim of the present work is to analyse some morphological diagnostic characters of *A. propinquus* on the basis of samples from gobiid fishes (Gobiidae) from the northwestern Black Sea.

Materials and methods

Seventy-seven specimens of acanthocephalans (31 males and 46 females) from gobies were studied. These were parasites from the round goby *Neogobius melanostomus* (Pallas) (18

specimens from 12 fishes), ratan goby *N. ratan ratan* (Nordmann) (2 specimens from 1 fish), syrman goby *N. syrman* (Nordmann) (5 specimens from 3 fishes), monkey goby *N. fluviatilis fluviatilis* (Pallas) (1 specimen) and grass goby *Zosterisessor ophiocephalus* (Pallas) (51 specimens from 20 fishes). Fishes were collected from the Gulf of Odessa, estuaries (Tyligul and Hryhorivskiy) and lagoons (Budaki, Burnas and Alibey). The worms were isolated from the intestine, washed in 0.8% saline and fixed in 70% ethanol. They were studied in temporary glycerol mounts. The eggs were stained with haematoxylin and mounted in Berlese's medium to study the acanthor armature. Voucher specimens were deposited in the Helminthological Collection of the I.I. Schmalhausen Institute of Zoology, Kiev, Ukraine (glycerol-gelatine mounts Nos 1-1, 1-2, 1-3, 4-1).

The observations were carried out using PZO (Warsaw) and Lumam I-3 (St. Petersburg) light microscopes. Illustrations were prepared by drawing tube RA-7U 4.2 (Lomo, St. Petersburg). The length and width of the body (Ls, mm; Ws, mm), neck (Ln, mm; Wn, mm), proboscis (Lp, mm; Wp, mm), anterior (At) and posterior (Pt) testes (L, mm; W, mm) and the length of cuticular spines (Cs, μm) were measured. The number of the proboscis hook rows (Hr) was counted. Hooks were counted in six visible rows and the length and width of the

blades of the apical, middle and basal hook (Lb, μm ; Wb, μm) and their roots (Lr, μm ; Wr, μm) were measured. Statistical analyses were performed using Statistica for Windows 5.0, 1995. Values for the mean (M) and standard deviation (SD) were calculated for all parameters. The SD was given only in cases when the number of measurements or counts was >10 .

Results

Body 2.00–7.13 long and 0.30–1.25 mm wide (Table I, Fig. 1). Body surface covered with small cuticular spines 3.0–7.5 μm long (Table I); size of spines not correlating with their location on body. Proboscis cylindrical, armed with 12 rows of hooks; 4–5 hooks per row (Table II, Fig. 1). Specimens with 5 hooks per row comprised 6.8% of the worms examined. No specimen had 6 hooks per row. Longest hooks located in middle part of proboscis; smallest hooks basal (Table II, Fig. 1). Males with testes located in central part of body and 6 pyri-

form posttesticular cement glands. Acanthor (inside egg) with one hooklet lacking root (Fig. 1).

Significant differences were found between male and female specimens from the grass goby relative to the length of the body ($t = 2.80$, $p = 0.007$) and the length of the proboscis ($t = 2.25$, $p = 0.028$) (Table I). A significant correlation was found between the length and the width of the body ($r = 0.90$, $p < 0.05$), which was more pronounced in females ($r = 0.91$) than in males ($r = 0.83$).

Discussion

Meyer (1932) erected the genus *Acanthocephaloides* for three species: *A. propinquus* (type species), *A. incrassatus* (Molin, 1858) and *A. kostylewi* Meyer, 1932; originally, the genus was placed in the family Echinorhynchidae. Golvan (1960, 1969) found cuticular spines on the surface of the body of *A. propinquus* and placed the genus into the family Arhythmacanthidae.

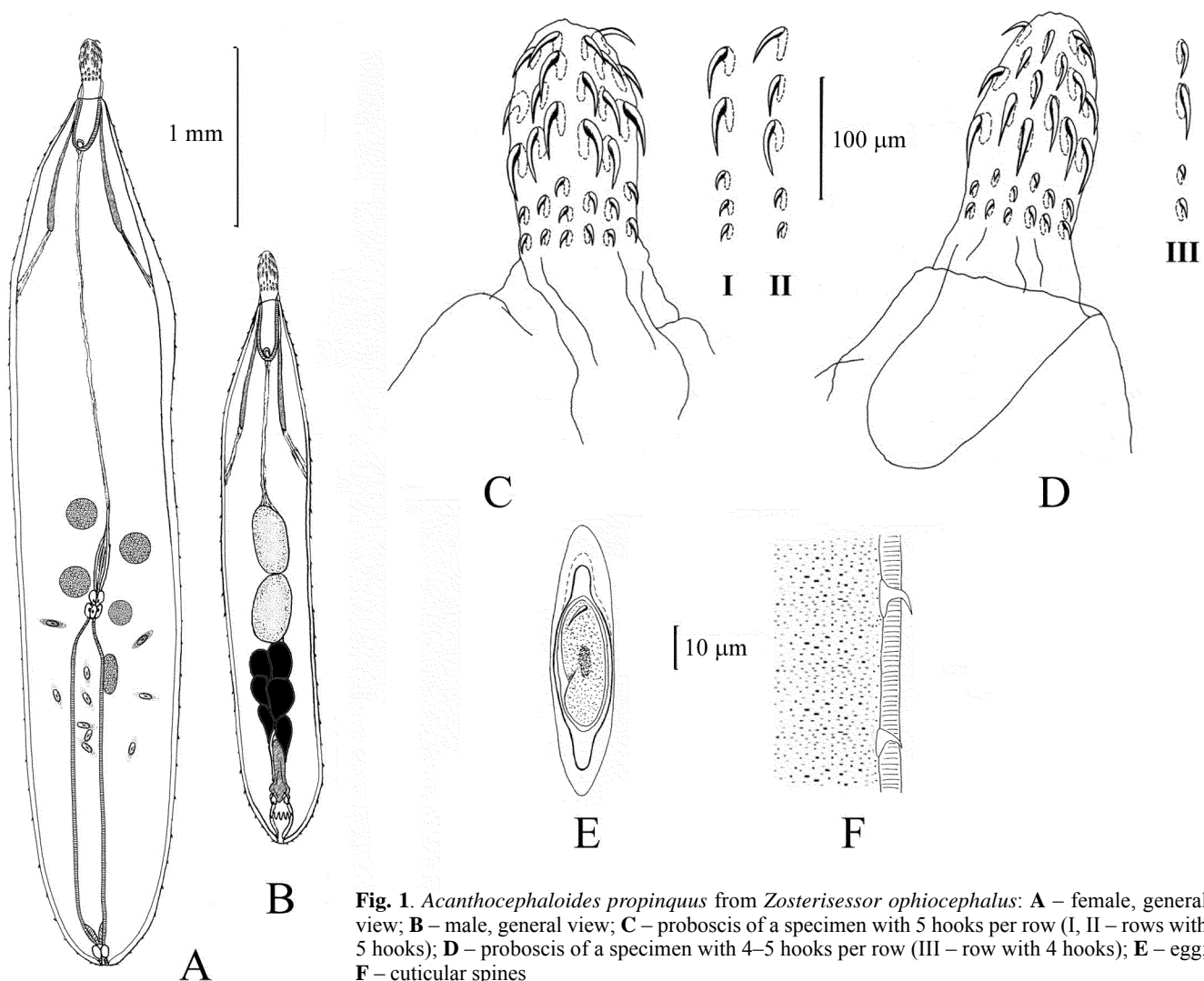


Fig. 1. *Acanthocephaloides propinquus* from *Zosterisessor ophiocephalus*: **A** – female, general view; **B** – male, general view; **C** – proboscis of a specimen with 5 hooks per row (I, II – rows with 5 hooks); **D** – proboscis of a specimen with 4–5 hooks per row (III – row with 4 hooks); **E** – egg; **F** – cuticular spines

Table I. Morphological data for the body of *Acanthocephaloides propinquus* from the northwestern Black Sea; M±SD (min–max)

Index	<i>Z. ophiocephalus</i>		<i>N. melanostomus</i>		<i>N. ratan ratan</i>		<i>N. syrman</i>		<i>N. fluviatilis fluviatilis</i>	
	♂ (n = 21)	♀ (n = 30)	♂ (n = 7)	♀ (n = 11)	♂ (n = 1)	♀ (n = 1)	♂ (n = 1)	♀ (n = 4)	♂ (n = 1)	
Ls, mm	*2.80±0.76 (2.00–4.65)	*3.67±1.28 (2.00–7.13)	2.71 (2.18–3.00)	3.11±0.36 (2.50–3.50)	2.50	2.78	3.13	3.32 (2.95–3.68)	2.38	
Ws, mm	0.49±0.13 (0.30–0.85)	0.60±0.24 (0.33–1.25)	0.44 (0.33–0.58)	0.52±0.09 (0.40–0.73)	0.40	0.38	0.63	0.49 (0.43–0.58)	0.40	
Lp, mm	*0.18±0.04 (0.13–0.30)	*0.21±0.05 (0.14–0.40)	0.19 (0.19–0.20)	0.20±0.03 (0.13–0.23)	0.12	0.22	0.21	0.21 (0.19–0.24)	0.16	
Wp, mm	0.11±0.01 (0.09–0.13)	0.12±0.02 (0.06–0.20)	0.12 (0.10–0.15)	0.11±0.02 (0.08–0.13)	0.11	0.14	0.11	0.125 (0.11–0.13)	0.12	
Ln, mm	0.07±0.01 (0.05–0.10)	0.08±0.02 (0.01–0.12)	0.07 (0.06–0.07)	0.08±0.02 (0.05–0.11)	0.06	0.10	0.08	0.09 (0.08–0.10)	0.08	
Wn, mm	0.14±0.05 (0.10–0.30)	0.16±0.05 (0.01–0.22)	0.14 (0.13–0.19)	0.15±0.03 (0.10–0.19)	0.12	0.19	0.16	0.16 (0.13–0.19)	0.14	
Hr	12	12	12	12	12	12	12	12	12	
Nh	4–5	4–5	4–5	4–5	4–5	4–5	4–5	4–5	4–5	
At	L, mm	0.40±0.20 (0.10–0.80)	–	0.32 (0.23–0.36)	–	0.30	–	0.43	–	0.23
	W, mm	0.24±0.10 (0.10–0.52)	–	0.22 (0.14–0.28)	–	0.17	–	0.31	–	0.21
Pt	L, mm	0.33±0.21 (0.10–0.80)	–	0.29 (0.22–0.35)	–	0.19	–	0.43	–	0.24
	W, mm	0.21±0.09 (0.10–0.46)	–	0.22 (0.15–0.28)	–	0.13	–	0.35	–	0.13
Cs	Lb, µm	4.74±1.46 (3.00–7.50)	4.87±1.47 (3.00–7.50)	4.40 (3.00–7.00)	4.72±0.97 (3.00–7.50)	3.00–4.00	4.00–7.00	4.20–7.00	4.63±1.51 (3.00–7.00)	4.20–5.00

See “Materials and methods” for abbreviations, *significant differences between sexes, n – number of studied specimens.

Table II. Morphological data for the proboscis hooks of *Acanthocephaloides propinquus* from the northwestern Black Sea; M±SD (min–max)

Index	<i>Z. ophiocephalus</i>		<i>N. melanostomus</i>		<i>N. ratan ratan</i>		<i>N. syrman</i>		<i>N. fluviatilis fluviatilis</i> ♂ (n = 1)	
	♂ (n = 21)	♀ (n = 30)	♂ (n = 7)	♀ (n = 11)	♂ (n = 1)	♀ (n = 1)	♂ (n = 1)	♀ (n = 4)		
Apical hooks	Lb, μm	22.44±4.81 (18.00–35.80)	22.51±5.35 (17.05–36.00)	21.82 (18.00–28.10)	21.23±4.78 (18.00–34.90)	21.44	18.90	18.20	24.80 (22.60–29.40)	19.20
	Wb, μm	5.08±0.36 (4.50–5.80)	5.09±0.50 (4.50–6.00)	5.16 (4.00–5.80)	5.02±0.43 (4.60–6.00)	6.00	5.00	4.50	4.73 (4.60–5.00)	5.20
	Lr, μm	18.26±1.80 (16.40–21.40)	18.56±1.28 (16.90–21.00)	18.01 (16.10–20.00)	18.18±1.33 (17.00–21.00)	18.00	21.00	17.20	18.88 (18.20–19.60)	16.50
	Wr, μm	4.98±0.47 (4.50–6.20)	5.20±0.57 (4.50–6.40)	5.41 (4.50–6.20)	5.46±0.59 (4.70–6.40)	6.00	4.70	5.00	5.43 (4.90–5.80)	5.50
Middle hooks	Lb, μm	42.59±6.55 (30.00–55.80)	43.40±8.80 (25.00–64.00)	39.86 (34.10–46.50)	47.04±5.08 (34.10–52.70)	34.10	34.10	40.30	44.95 (37.20–49.60)	55.80
	Wb, μm	6.62±1.27 (4.70–9.30)	6.74±1.66 (3.80–12.40)	7.10 (6.20–9.30)	7.00±1.17 (6.20–9.00)	6.20	4.70	7.80	6.60 (6.20–7.80)	9.30
	Lr, μm	21.52±3.63 (15.00–25.00)	23.71±4.64 (10.00–32.00)	23.03 (18.60–34.10)	26.39±3.52 (21.70–32.00)	21.70	21.70	21.70	24.80 (21.70–27.90)	24.80
	Wr, μm	7.15±1.52 (3.80–9.30)	6.98±1.77 (3.80–10.85)	8.42 (4.70–12.40)	8.07±1.30 (6.20–9.30)	4.70	6.20	6.20	7.38 (6.20–9.30)	7.80
Basal hooks	Lb, μm	14.73±2.32 (10.85–19.00)	15.03±3.13 (10.00–25.00)	15.94 (12.40–18.60)	18.09±3.10 (12.40–25.00)	12.40	15.50	15.50	17.83 (15.50–18.60)	15.50
	Wb, μm	3.84±0.94 (2.50–6.20)	3.82±1.16 (2.50–6.20)	4.88 (3.10–6.20)	4.77±1.27 (3.10–6.40)	3.10	3.10	4.70	4.68 (3.10–6.20)	6.20
	Lr, μm	12.77±3.61 (3.80–18.60)	12.56±3.58 (5.00–18.60)	13.51 (7.80–18.60)	15.87±0.93 (15.50–18.60)	9.30	12.40	12.40	14.73 (9.30–21.70)	15.50
	Wr, μm	3.75±1.29 (1.50–6.20)	4.07±1.32 (2.50–6.40)	5.10 (3.10–6.20)	5.27±1.07 (3.10–6.40)	3.10	3.10	4.70	4.30 (3.10–4.70)	4.70

See “Materials and methods” for abbreviations, n – number of studied specimens.

According to the descriptions by Meyer (1932) and Golvan (1960, 1969), the proboscis of *A. propinquus* has 12 rows each consisting of 6–7 hooks. However, their illustrations show 5–6 hooks in each row, which makes difficult distinguishing *A. propinquus* from *A. incrassatus* on the basis of the number of proboscis hooks per row only. Later, de Buron *et al.* (1986) noted that *A. incrassatus* has a smooth cuticle. This and the location of the male reproductive system in the posterior part of the body differentiate this species from *A. propinquus*. Bray *et al.* (1988) placed *A. incrassatus* in the genus *Paracanthocephaloides* due to the lack of cuticular spines. The most recent morphological study of *A. propinquus* mentioned 12 rows of hooks each containing 5–6 hooks (Dezfuli *et al.* 1992).

Currently, the genus *Acanthocephaloides* includes 9 species (Pichelin and Cribb 1999). Three of them, *A. propinquus*, *A. geneticus* de Buron, Renaud et Euzet, 1985 and *A. cyrusi* Bray, Spencer Jones et Lewis, 1988, have a proboscis with 5–6 hooks per longitudinal row (de Buron *et al.* 1986, Bray *et al.* 1988). *A. cyrusi* is characterized by a proboscis with longer hooks situated apically, which distinguishes it from the specimens of *Acanthocephaloides* found in the Black Sea. *A. propinquus* and *A. geneticus* were differentiated from one another genetically and morphologically. According to de Buron *et al.* (1986), *A. propinquus* had cuticular spines 4 µm long and its acanthor had one hooklet without a root; in contrast, *A. geneticus* had cuticular spines 8 µm long and its acanthor was provided with a rooted hooklet. Furthermore, *A. propinquus* reaches a body length up to 6.23 mm (Dezfuli *et al.* 1992) whereas that of *A. geneticus* reaches 10.7 mm (de Buron *et al.* 1986).

Kostylew (1926a, b) reported the first records of *E. propinquus* and *E. incrassatus* from the Black Sea. Meyer (1932) believed that the material from *Pegusa lascaris* (Risso) described by Kostylew (1926b) as *E. propinquus* was a distinct species and proposed the name *Acanthocephaloides kostylewi* for it. The number of the proboscis hooks and the position of the testes of the specimens described as *E. incrassatus* by Kostylew (1926b) indicate that they belong to *A. propinquus*. Chernyshenko (1947, 1955) described *E. propinquus* from *P. lascaris* from the Gulf of Odessa as armed with 16 rows of hooks (Chernyshenko 1947); therefore, this material corresponds to *Paracanthocephaloides kostylewi*. The confusion arose because Chernyshenko (1947) used Kostylew's (1926b) work for identification and by this reason *A. propinquus* was erroneously identified as *A. incrassatus* (Chernyshenko 1960a, b, 1962a, b, 1964, 1966; Chernyshenko and Svetsitskaya 1967, 1970).

The specimens of *A. propinquus* from the Black Sea have size of the cuticular spines of the body varying from 3.0 up to 7.5 µm (Table I); these are larger than those reported by de Buron *et al.* (1986), i.e. 4 µm. In addition, the neck length is smaller than that described by Dezfuli *et al.* (1992), 0.14 mm. The dimensions of the body cuticular spines of the Black Sea specimens of *A. propinquus* are similar to those of *A. geneticus*. However, the two species are clearly distinguishing by

the lack of a root of the acanthor hooklet in *A. propinquus* and its presence in *A. geneticus*. The significant differences found here between male and female body lengths agree with the data of Sasal *et al.* (2001) based on specimens from the Mediterranean Sea.

In conclusion, *A. propinquus* is characterized by a proboscis armed with 12 hook rows, with 4–6 hooks per row. Specimens from the Mediterranean Sea are characterized by 5–6 hooks per row (Dezfuli *et al.* 1992, de Buron *et al.* 1986) whereas those from the northwestern Black Sea have 4–5 hooks per row. The size of the cuticular spines cannot be used for distinguishing *A. propinquus* from the similar *A. geneticus* because their length varies from 3.0 up to 7.5 µm. Diagnostic characters for *A. propinquus* include relatively small cuticular spines, location of the testes in the central part of the body and an acanthor with a single hooklet lacking a root.

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