Acanthocephaloides irregularis *n. sp.* *(Acanthocephala: Arhythmacanthidae)* *from marine fishes off the Ukrainian Black Sea coast*

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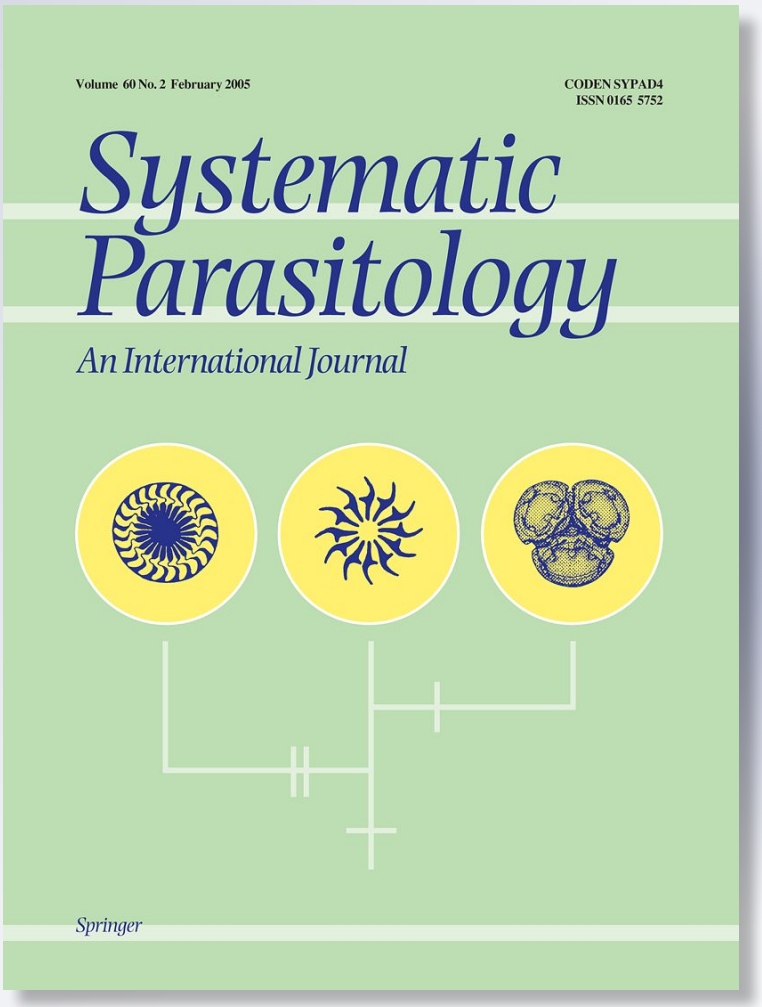

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Acanthocephaloides irregularis n. sp. (Acanthocephala: Arhythmacanthidae) from marine fishes off the Ukrainian Black Sea coast

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Abstract *Acanthocephaloides irregularis* n. sp. (Arhythmacanthidae) is described from four species of marine fishes in the Gulf of Odessa and Sukhyi Lyman, Ukrainan Black Sea waters, making it the tenth species of the genus. The hosts are the combtooth blenny *Parablennius zvonimiri* (Kolombatovic) (Blenniidae), the mushroom goby *Ponticola eurycephalus* (Kessler) (Gobiidae), the tubenose goby *Proterorhinus marmoratus* (Pallas) (Gobiidae) and the black-striped pipefish *Syngnathus abaster* Risso (Syngnathidae). The new species is most similar to its closest relative, *Acanthocephaloides propinquus* (Dujardin, 1845), in proboscis shape and armature (12 longitudinal rows of 5 hooks) and the shape of the trunk, reproductive system and lemnisci, but differs in having randomly distributed trunk spines. These trunk spines are organised in circular rings of individual spines separated by aspinose zones. The new species is also unique in having an anterior trunk collar, a very large triangular cephalic ganglion, nucleated pouches at the posterior end of the proboscis receptacle, and hooks and spines with roots bearing anterior manubria. Valid and invalid species of *Acanthocephaloides* Meyer, 1932 are listed and a key to all ten species is included.

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Introduction

Marine fishes from the Gulf of Odessa and Sukhyi Lyman in the Black Sea, off the coast of the Ukraine, have not been examined in detail for parasites. A new species of *Acanthocephaloides* Meyer, 1932 was collected from four species of marine fishes. This new species closely resembles *A. propinquus* (Dujardin, 1845) Meyer, 1933, which has been collected elsewhere in the Black Sea (Kvach, 2006) and neighbouring waters (Oğuz & Kvach, 2006), and was initially confused with it. The description of the new species and a clarification

of its relationships with valid species of the genus are presented herein.

Materials and methods

Collections were made during July, 2005 from Odessa Bay (between 46°28′N, 31°45 E and 46°26′N, 31°46′E) and from Sukhyi Lyman (46°19′N, 31°40′E) off the Ukrainian coast. Fish were caught by depth net (100 × 50 cm; mesh 5 mm), taken to the Odessa Branch of the Institute of Biology of the Southern Seas, NAS, Ukraine, and then examined. A total of 185 acanthocephalans from fishes in Odessa Bay and 324 from those in Sukyi Lyman were collected (Table 1). Upon the dissection of the fish hosts, acanthocephalans were placed in saline solution, cooled until the probosces were extruded, then fixed in 70% ethanol, 5% formalin or AFA, stained in Mayer's carmine or azocarmine, dehydrated in an ethanol series, cleared in xylene and mounted in Canada balsam.

These parasites were measured at the Biology Laboratory, Faculty of Science, Ataturk University, Erzurum, Turkey. Definitive identifications were made by one of us (OMA) at the Institute of Parasitic Diseases Inc. (PCI), Scottsdale, Arizona, USA, and the scanning electron microscope (SEM) studies were undertaken by RAH and Dr Atif Naggar at Brigham Young University, Provo, Utah, USA.

For SEM, a few specimens of the new species previously fixed in 70% ethanol were placed in CPD baskets and dehydrated in 95% and 100% ethanol for at least 10 min. per soak followed by critical point drying (Lee, 1992). Samples were then mounted on SEM sample mounts, gold coated and observed with an FEI XL30 ESEM FEG. Digital images of the structures were obtained using digital imaging software attached to a computer.

Measurements are in micrometres, unless otherwise stated. Range values are followed by the mean in parentheses. Length measurements are given before the width, and the latter refers to the maximum width. Trunk length does not include the neck, proboscis, or bursa. Eggs refer only to fully developed eggs usually removed from the body cavity. Type specimens were deposited at the Harold W. Manter Laboratory (HWML) collection, at the University of Lincoln, Nebraska.

Results

A new species of *Acanthocephaloides* was recovered from four species of marine fishes in the Gulf of Odessa and Sukhyi Lyman off the Ukrainian Black Sea coast. The hosts are the combtooth blenny *Parablennius zvonimiri* (Kolombatovic) (Blenniidae), the mushroom goby *Ponticola eurycephalus* (Kessler) (Gobiidae), the tubenose goby *Proterorhinus marmoratus* (Pallas)

Table 1 Collections of *Acanthocephaloides irregularis* n. sp. from four fish species in the Gulf of Odessa and Sukhyi Lyman during July, 2005

Fishes examined*	Gulf of Odessa							Sukhyi Lyman						
	Fish			Acanthocephalans				Fish			Acanthocephalans			
	No. exam.	No. infect.	%	No. of parasites		Total parasites	Mean	No. exam.	No. infect.	%	No. of parasites		Total parasites	Mean
				M	F						M	F		
Proterorhinus marmoratus	32	21	65.6	87	95	182	8.6	32	26	81.3	106	164	270	10.4
Syngnathus abaster	11	1	9.1	1	1	2	2.0	4	2	50	3	5	8	4
Parablennius zvonimiri	7	1	14.3	1	–	1	1.0	–	–	–	–	–	–	–
Ponticola eurycephalus	–	–	–	–	–	–	–	15	10	66.7	23	23	46	4.6
Total	54	23	42.6	89	96	185	8.0	52	38	73.1	132	192	324	8.5

* Four *Parablennius tentacularis* (Blennidae) examined from Odessa Bay were not infected

M, male; F, female

(Gobiidae), and the black-striped pipefish *Syngnathus abaster* Risso (Syngnathidae).

A total of 185 and 324 worms were recovered from three host species from each of the Gulf of Odessa and Sukhyi Lyman, respectively. The prevalence of infection was higher in fish from the Sukhyi Lyman site (73.1%) than from the Gulf of Odessa (42.6%), but the intensity of infection was comparable, being 8.5 and 8.0, respectively. The tubenose goby was the most frequently and heavily infected fish in both locations (Table 1).

The combtooth blenny and the black striped pipefish inhabit relatively shallow waters around seaweed and seagrass, as well as brackish waters in the Black and Mediterranean Seas (Perlmutter, 1961). The mushroom goby and the tubenose goby inhabit inshore habitats, brackish lagoons and estuaries in the Azov Sea and the northern Black Sea between Bulgaria and eastern Crimea (Miller, 1986; Reshetnikov et al., 1997).

Unidentified crustaceans appear to constitute a major part of the diet of all four fish in addition to algae, polychaetes and insects (Perlmutter, 1961; Miller, 1986). In addition, the black-striped pipefish also feeds on newborn fish, such as guppies, and brine shrimp (Dawson, 1986). The distribution of the new acanthocephalan species would presumably correspond with that of the host species indicated above, with the assumption that the crustacean intermediate host(s) are also present within the same geographical range. However, this does not appear to be the case for gobies introduced to localities away from their native habitats. Tubenose gobies and round gobies *Negobius melanostomus* (Pallas) had none of their Black Sea goby-specific metazoan parasites in their new locations in the North American Great Lakes (Muzzall et al., 1995; Pronin et al., 1997). No overall increase in acquired native American parasites was observed in the invasive gobies during the decade following their establishment in the Great Lakes. The parasite load appeared quite low compared with that in their native habitats (Kvach & Stepien, 2008).

Acanthocephaloides irregularis n. sp.

Type-host: *Proterorhinus marmoratus* (Pallas) (Gobiidae).

Other hosts: *Parablennius zvonimiri* (Kolombatovic) (Blenniidae), *Ponticola eurycephalus* (Kessler, 1874) (Gobiidae), *Syngnathus abaster* Risso (Syngnathidae).

Type-locality: Odessa Bay (46°28′N, 31°45 E to 46°26′N, 31°46′E), Black Sea.

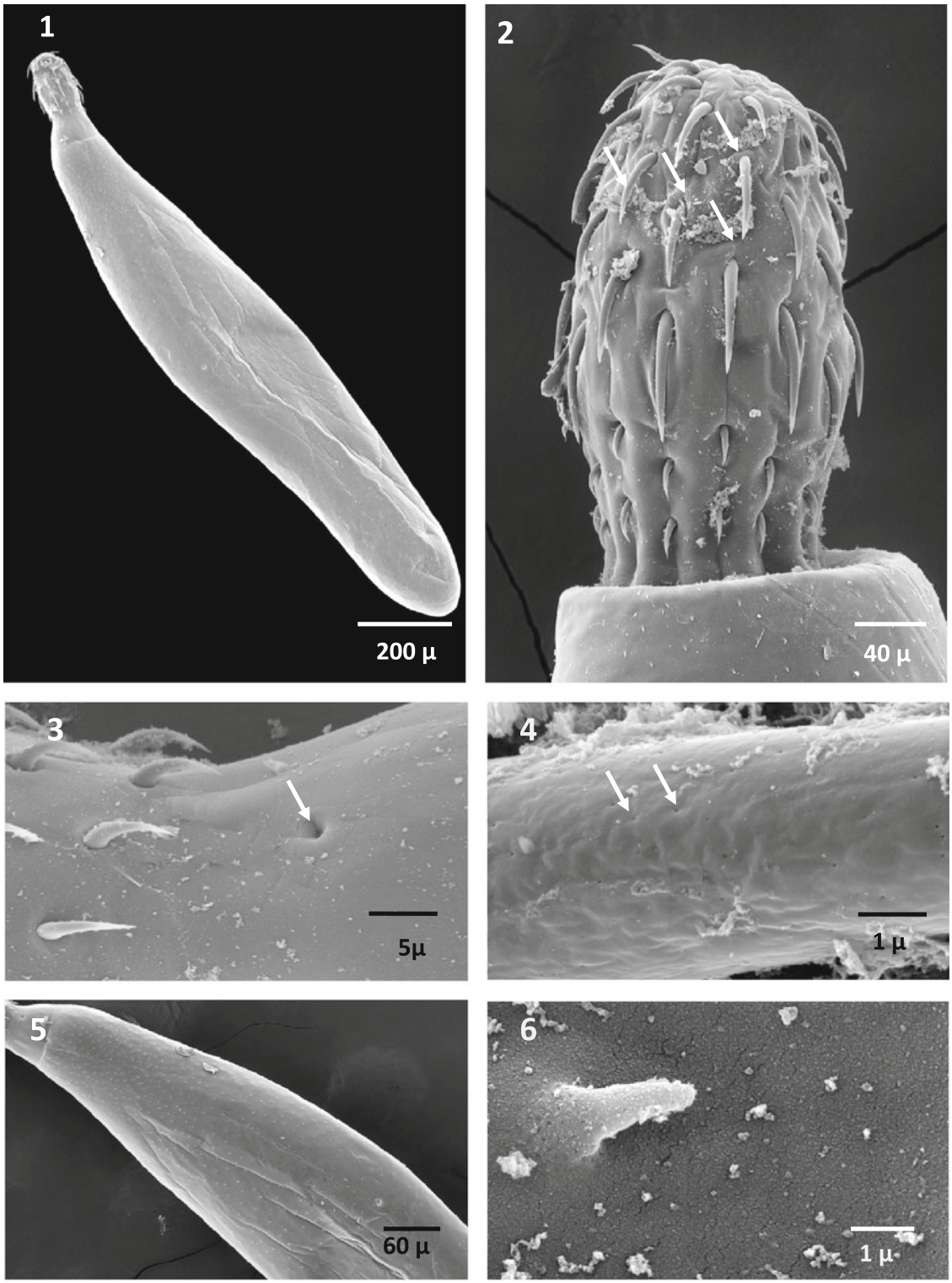
Other locality: Sukhyi Lyman (46°19′N, 31°40′E), Black Sea.

Type-specimens: HWML Coll. No. 49700 (holotype male), No. 49701 (allotype female) and No. 49702 (2 slides).

Etymology: The new species is named for its irregular distribution of trunk spines.

Description (Figs. 1–21; Table 2)

General. With characters of *Acanthocephaloides* (Arhythmacanthidae). Worms small, elongate fusiform, especially anteriorly (Figs. 1, 15, 21). Trunk and shared structures relatively larger in females than in males. Trunk with unspined anterior collar (Figs. 1, 5, 15, 16, 21) and many small (2–3 long), randomly distributed, blunt-ended, translucent spines (Figs. 5–10, 12); posterior trunk spines directed anteriorly, slightly longer than anterior spines (Figs. 8, 12). No epidermal micropores in neck or proboscis, scarce in trunk, most evident near spines, especially near posterior spines (Figs. 6, 8). Proboscis cylindrical with median swelling (Figs. 2, 15, 16, 21). Proboscis hooks in 12 longitudinal rows of 5 rooted hooks: apical, subapical and median hooks (at proboscis swelling) increase in size progressively posteriorly, followed by 2 (rarely 1 or 3) small, almost equally long, spiniform hooks (spines) (Fig. 18). Each of apical, subapical and median hook circles alternate in position and size: anterior hooks in each circle smaller than posterior hooks of same circle. Posterior spines also alternate in position (Fig. 2). Hook surface corrugated, with small micropore-like pits (Fig. 4). Roots of all hooks and spines, prominent, simple, posteriorly directed, with anterior manubrium (Fig. 18). Neck with single pair of sensory pits (Fig. 3). Proboscis receptacle thin-walled, 2–3 times as long as proboscis, with very large (about half its own length), triangular cephalic ganglion of at its posterior end; nucleated pouches present adjacent to posterior tip of receptacle (Fig. 16, arrowed). Lemnisci digitiform, longer than receptacle. Gonopore terminal in both sexes (Figs. 15, 16, 21).



◀ **Figs. 1–6** SEM micrographs of *Acanthocephaloides irregularis* n. sp. from *Proterorhinus marmoratus* collected in Odessa Bay. 1. Allotype female, showing the elongate, fusiform trunk and anterior collar. 2. The proboscis of a female, showing its cylindrical form with a median swelling; note the alternating position of the hooks and spines in each circle and the larger posterior hooks compared to the anterior hooks in each circle. 3. One of two sensory pits on the neck of a male specimen. 4. A high magnification of a hook, showing its corrugated surface and the small micropore-like pits (arrows). 5. The anterior end of a male, showing the randomly distributed trunk spines and anterior collar (far left) characteristic of this species. 6. Enlarged view of an anterior trunk spine; note its blunt end

Male. [Based on adults: 65 from *Proterorhinus marmoratus* in the Gulf of Odessa; 34 from *P. marmoratus* and 22 from *Ponticola eurycephalus* in Sukhyi Lyman.] Measurements given in Table 2. Testes usually equatorial, about equal in size. Cement glands 6, clavate, in 3 pairs; 3 on each side open into single cement duct; both cement ducts unite to form common cement duct shortly before opening into common sperm duct at posterior end of Saefftigen's pouch (Fig. 15). Bursa terminal but opens ventrolaterally; trunk spines (Fig. 12) and single circle of prominent, saucer-like sensory structures with central dome (Figs. 12–15, 17) present on bursa.

Female. [Based on adult females with ovarian balls and ripe or unripe eggs, or with ovarian balls only: 65 from *Proterorhinus marmoratus* in the Gulf of Odessa, and 62 from *P. marmoratus* and 12 from *Ponticola eurycephalus* in Sukhyi Lyman.] Measurements given in Table 2. Reproductive system about half as long as trunk (Fig. 21). Gonopore terminal, with prominent, lateral, slit-like lips. Vagina complex. Uterus long; uterine bell with prominent nucleated cells (Fig. 20). Eggs fusiform, with slightly corrugated surface and polar prolongation of fertilisation membrane (Figs. 11, 19).

Remarks

The new species of *Acanthocephaloides* was recovered from four species of marine fishes in the Gulf of Odessa and Sukhyi Lyman off the Ukrainian in Black Sea coast. Due to the superficial similarity between the new species and *A. propinquus* (Dujardin, 1845), and the recent reporting by Oğuz & Kvach (2006) of *A. propinquus* in other fish species from the Gulf of Odessa and from the nearby Sea of Marmara, which is connected to the Black Sea via the Bosphorus, *A. irregularis* n. sp. was initially confused with the latter species until examined by one of us (OMA). While the above authors (Oğuz & Kvach, 2006) did not specify the arrangement of trunk spines in their specimens, raising the possibility that their specimens may have actually belonged to *A. irregularis*, they made no reference to other differentiating structures, such as the nucleated pouches at the posterior end of the proboscis receptacle. Despite the similarities in the proboscis armature, their illustrations suggest that their specimens may in fact have been *A. propinquus*: the proboscis hook and spine roots do not appear to have anterior manubria, the cephalic ganglion appears to be very small and rounded, nucleated pouches at the posterior end of the receptacle appear to be absent, and there is no collar on the anterior trunk. Furthermore, Kvach's (2006) illustrations suggest that trunk spines are in transverse rows and not randomly distributed. The above comparisons summarise the major differences between the new species and *A. propinquus,* its closest relative. Furthermore, the new species has a ring of prominent sensory discs on the bursa. No sensory structures have been reported in any other species of *Acanthocephaloides*. These characteristics, and others, are used in the following key to distinguish between the new species and the nine other valid species of the genus.

Specimens of *A. irregularis* collected from *Proterorhinus marmoratus* in Sukhyi Lyman were somewhat larger than those from the same host species collected from the Gulf of Odessa. Size differences of the trunk, proboscis, proboscis receptacle, lemnisci and testes were particularly noticeable (Table 2). These differences can be attributed to the effect of factors in the different geographical locations on parasite growth and development. Similar observations have been noted in other acanthocephalans reported from widely separated geographical areas, e.g. *Mediorhynchus papillosus* Van Cleave, 1916 reported across North America, Eurasia and Taiwan (Amin & Dailey, 1998).

The taxonomy of *Acanthocephaloides*

The previously accepted division of Arhythmacanthidae Yamaguti, 1935 into three subfamilies was primarily based on the presence, distribution or

Table 2 Metrical (in micrometres) and meristic data for *Acanthocephaloides irregularis* n. sp. from different species of marine fishes* collected during July, 2005 in the Gulf of Odessa and Sukhyi Lyman

	Proterorhinus marmoratus		*Ponticola eurycephalus*		*Proterorhinus marmoratus*	
	Gulf of odessa		Sukhyi Lyman		Sukhyi Lyman	
	Males (N = 65)	Females (N = 65)	Males (N = 22)	Females (N = 12)	Males (N = 34)	Females (N = 62)
TL	2,334 ± 401 (1,304–4,059)	2,666 ± 420 (1,501–4,256)	2,745 ± 200 (2,091–3,085)	2,870 ± 360 (2,287–3,593)	2,750 ± 610 (1,746–4,723)	3,160 ± 720 (1,254–5,658)
TW	472 ± 125 (200–1082)	455 ± 89 (225–713)	560 ± 100 (345–730)	500 ± 120 (369–861)	530 ± 130 (365–984)	560 ± 170 (319–1,402)
PL	250 ± 46 (125–393)	297 ± 31 (218–364)	250 ± 39 (161–323)	280 ± 70 (196–467)	260 ± 40 (123–323)	280 ± 40 (129–371)
PW	115 ± 14 (88–177)	127 ± 14 (89–178)	126 ± 10 (113–145)	140 ± 20 (113–153)	120 ± 8 (96–129)	130 ± 20 (72–153)
PHR	12	12	12	12	12	12
H/R	5	5	5	5	5	5
PRL	371 ± 100 (101–731)	388 ± 83 (148–591)	380 ± 128 (145–738)	380 ± 140 (121–516)	390 ± 110 (177–836)	452 ± 90 (246–615)
PRW	118 ± 20 (80–175)	142 ± 26 (63–187)	113 ± 14 (88–137)	110 ± 20 (98–123)	120 ± 30 (88–172)	131 ± 40 (73–196)
LL	491 ± 63 (395–586)	508 ± 119 (275–706)	480 ± 70 (404–565)	530 ± 163 (363–687)	420 ± 200 (319–750)	560 ± 100 (369–861)
H1	30 ± 4 (24–39)	32 ± 4 (26–39)	31 ± 4 (24–37)	32 ± 3 (28–37)	32 ± 3 (26–37)	31 ± 5 (22–39)
H2	40 ± 6 (32–55)	42 ± 2 (39–47)	39 ± 4 (32–47)	41 ± 4 (37–47)	40 ± 6 (30–49)	39 ± 4 (32–45)
H3	52 ± 4 (45–59)	56 ± 4 (49–63)	55 ± 3 (51–59)	54 ± 3 (49–59)	52 ± 5 (41–61)	54 ± 4 (47–59)
H4	19 ± 2 (16–22)	22 ± 2 (16–24)	20 ± 2 (18–22)	20 ± 2 (16–22)	20 ± 2 (18–22)	20 ± 2 (18–24)
H5	18 ± 2 (14–22)	20 ± 2 (18–24)	20 ± 2 (16–22)	19 ± 2 (16–20)	20 ± 1 (18–22)	21 ± 2 (18–24)
ATL	250 ± 47 (83–375)		300 ± 50 (196–395)		340 ± 110 (99–687)	
ATW	191 ± 43 (66–284)		230 ± 27 (161–250)		250 ± 80 (58–442)	
PTL	248 ± 63 (91–541)		314 ± 59 (172–404)		310 ± 90 (107–565)	
PTW	184 ± 37 (58–263)		230 ± 33 (172–295)		220 ± 80 (58–516)	
BL	187 ± 76 (40–345)		230 ± 69 (129–323)		260 ± 90 (121–492)	
BW	205 ± 39 (129–284)		210 ± 41 (145–266)		250 ± 60 (175–344)	
EL		54 ± 5 (48–60)		37 ± 2 (34–40)		35 ± 3 (30–40)
EW		13 ± 1 (12–14)		10 (10)		9 ± 1 (8–10)

* Measurements of one specimen from *Parablennius zvonimiri* and two specimens from *Syngnathus abaster* in Odessa Bay were not included

** All measurements are in μm

ATL, anterior testes length; ATW, anterior testes width; BL, bursa length; BW, bursa width; EL, egg length; EW, egg width; H/R, number of proboscis hooks per row; H1, H2, H3, H4, H5, hook length from anterior to posterior; LL, lemniscus length; PHR, number of proboscis hook rows; PL, proboscis length; PRL, proboscis receptacle length; PRW, proboscis receptacle width; PTL, posterior testis length; PTW, posterior testis width; PW, proboscis width; TL, trunk length; TW, trunk width

absence of trunk spines (Golvan, 1969). These subfamilies are: (1) the Arhythmacanthinae Yamaguti, 1935 (including *Heterosentis* Van Cleave, 1931 and *Hypoechinorhynchus* Yamaguti, 1930), with anterior trunk spines and a globular proboscis; (2) the Neoacanthocephaloidinae Golvan, 1960 (including *Acanthocephaloides* Meyer, 1932 and *Neoacanthocephaloides* Cable & Quick, 1954), with anterior and genital spines and a short, cylindrical proboscis with two types of hooks; and (3) the Paracanthocephaloidinae Golvan, 1969 (including *Breizacanthus* Golvan, 1969, *Euzetacanthus* Golvan & Houin, 1964 and *Paracanthocephaloides* Golvan, 1969), with no trunk spines but with a short, cylindrical proboscis bearing two types of hooks.

Exceptions, synonymies and reassignments

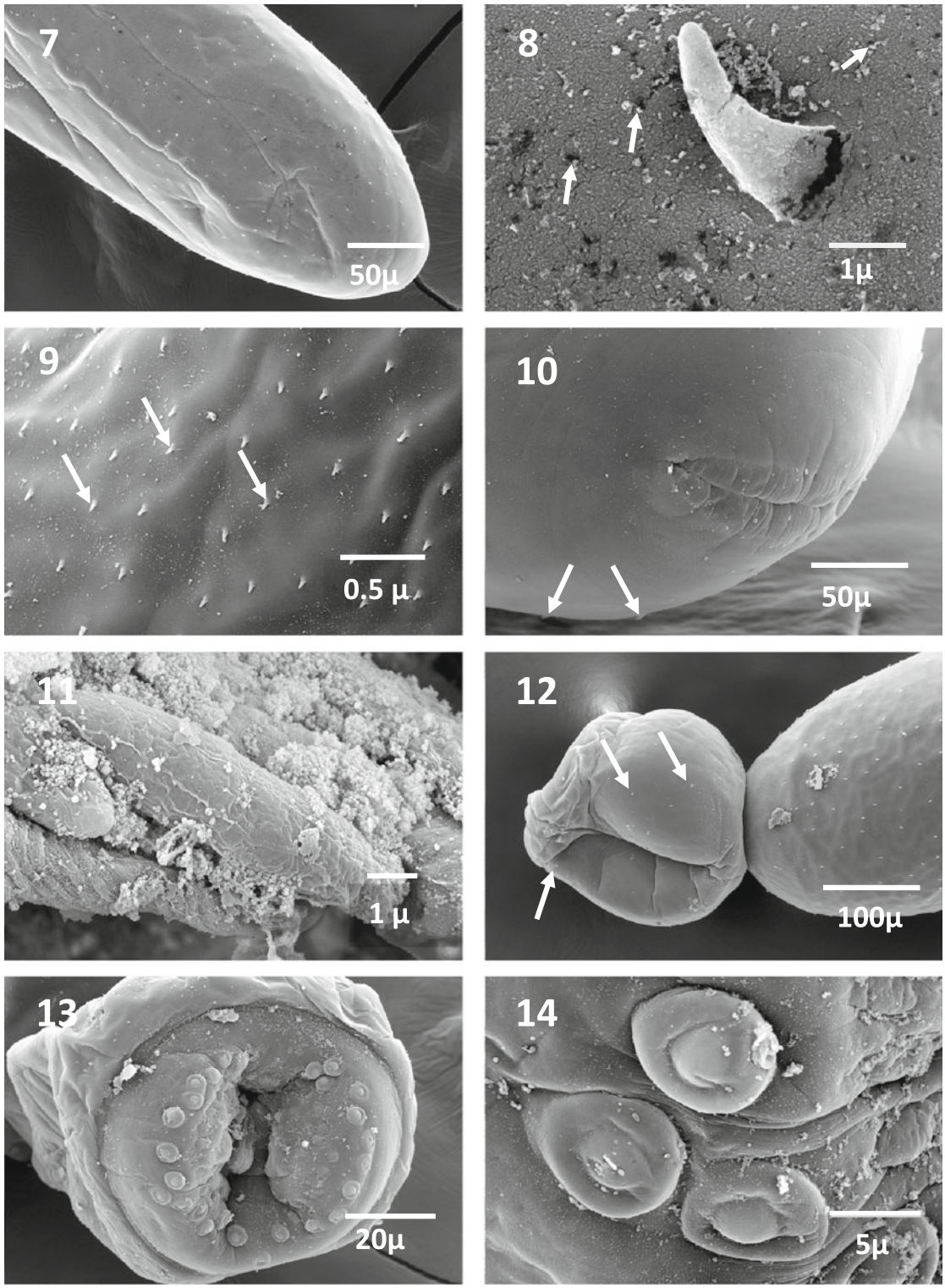
Many exceptions, especially those relating to trunk spine patterns, were noted by Araki & Machida (1987), Pichelin & Cribb (1999) and Amin et al. (2011). Amin et al. (2011) indicated the "irrelevance of trunk spines in the distinction of the Golvan's (1969) subfamily system" which they "proposed to delete all together". Trunk spines, however, remain an important taxonomic character at the generic level. These considerations have become instrumental in the realignment of generic assignments within the family Arhythmacanthidae as follows:

1. *Heterosentis* was revised, a new species from Vietnam described and a key to its 15 recognised species provided by Amin et al. (2011).
2. *Neoacanthocephaloides spinicaudatus* Cable & Quick, 1954 is reassigned to *Acanthocephaloides* in agreement with Pichelin & Cribb (1999), who proposed that *Neoacanthocephaloides* is a junior synonym of *Acanthocephaloides*.
3. *Acanthocephaloides incrassatus* (Molin, 1858) Meyer, 1932 and *A. kostylewi* Meyer, 1932, with no trunk spines, are reassigned to *Paracanthocephaloides* in agreement with Bray et al. (1988). The reassignment of *P. kostylewi* to *Solearhynchus* de Buron & Maillard, 1985, as proposed by Kvach & Oğuz (2010), is not accepted, as the proboscis has more than one type of hooks.
4. *Acanthocephaloides neobythitis* Yamaguti, 1939 and *A. rhinoplagusiae* Yamaguti, 1935 are returned to *Acanthocephaloides* after having been reassigned to *Yamagutisentis* Golvan, 1969 by Golvan (1969), in agreement with Araki & Machida (1987), who raised legitimate questions about trunk spine patterns.
5. *Acanthocephaloides soleae* (Porta, 1905) [syn. *Echinorhynchus soleae* Porta, 1905] is reassigned to *Solearhynchus,* in agreement with Golvan (1994), as the proboscis hooks gradually decrease in size posteriorly.
6. *Acanthocephaloides chabanaudi* Dollfus, 1951 is reassigned to *Paracanthocephaloides* in agreement with Golvan (1969), as its trunk is unarmed.
7. *Acanthocephaloides japonicus* (Fukui & Morisita, 1936) is a synonym of *Acanthocephalus japonicus* (Fukui & Morisita, 1936) Petrochenko, 1956.
8. Specimens misidentified as *Acanthocephaloides propinquus* by Golvan (1956) are correctly identified as *A. distinctus* Golvan, 1969.

Valid species

With the above consideration in mind, 10 species remain in *Acanthocephaloides* which are here considered valid. These are:

1. *A. claviformis* Araki & Machida, 1987 off Japan.
2. *A. cyrusi* Bray, Spencer Jones & Lewis, 1988 in Lake St. Lucia, Natal, South Africa.
3. *A. distinctus* Golvan, 1969 off Senegal.
4. *A. geneticus* de Buron, Renaud & Euzet, 1986 off the Mediterranean coast of France.
5. *A. ichiharai* Araki & Machida, 1987 off Japan.
6. *A. neobythitis* Yamaguti, 1939 [syns *Neoacanthocephaloides neobythitis* (Yamaguti, 1939); *Pseudorhadinorhynchus neobythitis* (Yamaguti, 1939); *Yamagutisentis neobythitis* (Yamaguti, 1939)] off Japan.
7. *A. propinquus* (Dujardin, 1845) Meyer, 1933 [syns *Echinorhynchus propinquus* Dujardin, 1845; *E. fabri* (Rudolphi, 1819); *E. kostylevi* (Meyer, 1932), *E. pumilio* (Rudolphi, 1819)] in the Atlantic Ocean, Mediterranean Sea and Black.Sea.
8. *A. irregularis* n. sp. in the Black Sea.
9. *A. rhinoplagusiae* Yamaguti, 1935 off Japan.
10. *A. spinicaudatus* (Cable & Quick, 1954) Pichelin & Cribb, 1999 off Puerto Rico.



◀**Figs. 7–14** SEM micrographs of *Acanthocephaloides irregularis* n. sp. from *Proterorhinus marmoratus* collected in Odessa Bay. 7. The posterior region of a female, showing the random distribution of trunk spines extending to the posterior extremity of the body. 8. A spine from the posterior trunk; there are more micropores around the posterior trunk spines (arrows) than around anterior trunk spines. 9. The mid-section of a worm, showing the posteriorly directed, randomly distributed trunk spines. 10. The terminal gonopore of a female specimen, showing its lateral orientation; note the anteriorly directed trunk spines (arrows). 11. An egg *in situ*; note its fusiform shape and corrugated surface. 12. The posterior end of a male, showing the terminal bursa opening ventrally; note the presence of trunk spines reaching to the posterior extremity as well as on the bursa (arrows). 13. An *en face* view of a bursa showing its thick, muscular lining and single ring of sensory discs. 14. A close-up of some bursal sensory discs; note their raised profile and central dome

Key to the species of *Acanthocephaloides*

1. Proboscis hook rows with 3 spines and 3 hooks that increase in size anteriorly. Apical hook reaches 83–101 or 118–137 μm in length and has root with large, oblique, anterior manubrium.. Posterior spines rootless. Whole trunk with regular transverse rows of uniform, acuminate, 13–22 μm long spines……*A. cyrusi*

– Proboscis hook rows variable, with 5–6 or 6–13 hooks and spines. Apical hook smallest; posterior hook largest, reaching up to 74 μm. Hook and spine roots (when present) invariably simple, posteriorly directed, without manubria. Trunk spines markedly smaller, with variable distribution……2

2. Proboscis with 12 rows of 5–6 hooks and spines; all spines well rooted. Trunk totally covered with spines……...……3

– Proboscis with 10 or 13–18 rows of 6–13 hooks and spines; spines with or without roots. Trunk with only anterior or anterior and posterior spines…….....6

3. Trunk spines randomly distributed. Anterior trunk with collar. Proboscis hook and spine roots with small, anterior manubrium. Receptacle with nuclear pouches posteriorly. Cephalic ganglion about half as long as receptacle. Bursa with ring of prominent sensory discs…… ……*A. irregularis* n. sp.

– Trunk spines in transverse rows. Anterior trunk without collar. Proboscis hooks and spine roots without manubria. Receptacle without pouches. Cepahlic ganglion much smaller than above. No sensory structures on bursa reported……...……4

4. Trunk spines more closely packed anteriorly and posteriorly, much more widely spaced and scarce in middle. Proboscis hook rows with 3–4 hooks and 1–2 spines…….……..*A. geneticus*

– Trunk spines in regularly spaced rows in middle, without gap. Proboscis hook rows with 3–4 hooks and 2–3 spines……..……5

5. Males and females 2 and 7 mm long, respectively. Testes short distance from receptacle. Usually 2 spines of *c*.17 μm long in each proboscis hook row. Apical, subapical and posterior hooks 32, 37 and 47 μm long, respectively ..……..*A. propinquus*

– Males and females 8 and 12 mm long, respectively. Testes post-equatorial, widely separated from receptacle. Usually 3 spines in each proboscis hook row, 25, 20 and 20 μm long, from anterior. Hooks larger, 32, 50 and 65 μm from anterior…….……..*A. distinctus*

6. Proboscis with 10 slightly diagonal rows of 9 hooks and 4 spines. Trunk spines in 13 diagonal rows anteriorly (stouter ventrally) and 9 rows posteriorly…..……...*A. spinicaudatus*

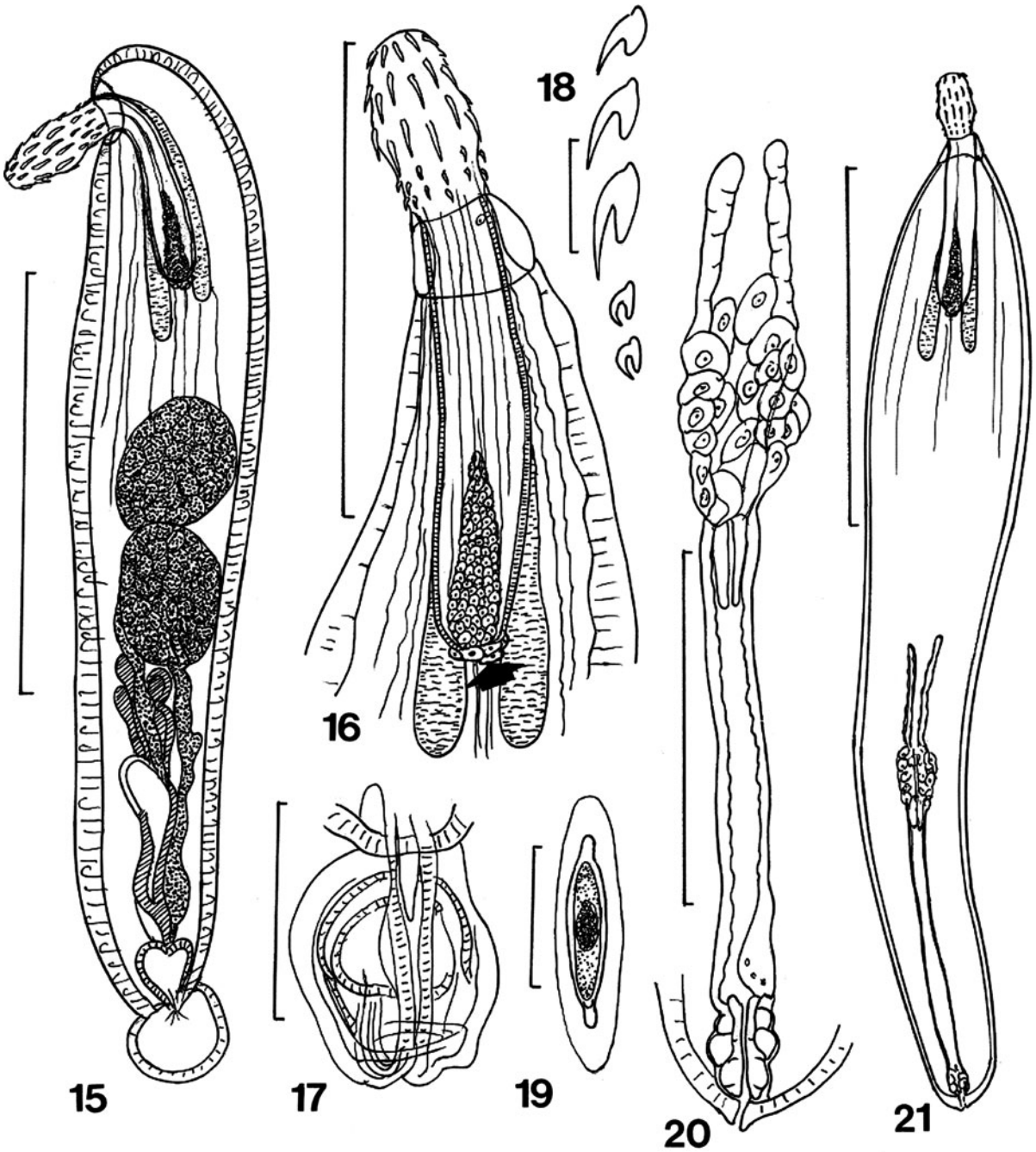
– Proboscis with 14–18 rows of 6–9 hooks and 2–4 spines. Trunk spines only anterior……...……7

7. Proboscis hook rows with 2 or 4 well-rooted spines……...8

– Proboscis hook rows with 2 or 3 rootless spines.. ……..9

8. Proboscis with 14 rows of 6 hooks and 4 spines which decrease in length posteriorly. Four large, nucleated muscle cells present posterior to proboscis receptacle……..…….*A. rhinoplagusiae*

– Proboscis with 17–18 rows of 10–14 hooks/spines (9 hooks and 2 spines in 1 specimen). No muscle cells present..……..…..*A. neobythitis*



9. Proboscis with 14 rows each of 6 hooks and 2 spines. Trunk with anterior swelling .....*A. claviformis*

– Proboscis with 13–14 (rarely 12 or 16) rows of 10–12 hooks/spines (9 hooks and 3 spines in 1 specimen). Trunk cylindrical.....*A. ichiharai*

◀ **Figs. 15–21** Type-material of *Acanthocephaloides irregularis* n. sp. from *Proterorhinus marmoratus* collected in Odessa Bay. 15. A lateral view of a paratype male showing equatorial testes and long triangular cephalic ganglion. Note double and common cement ducts (striped) and sperm ducts (dotted) joining at posterior end of Saefftigen's pouch (not shaded). 16. Anterior end of a paratype male showing anterior trunk collar, large triangular cephalic ganglion, nucleated pouches at the posterior end of the proboscis receptacle (arrowed), and lemnisci longer than the receptacle. 17. A lateral view of the bursa of a paratype male showing bursal rays. Sensory discs on the inside rim were not possible to show. 18. One row of proboscis hooks and hook roots with anterior manubria from a male specimen. 19. A fusiform egg showing polar prolongation of fertilisation membrane. Corrugated egg surface is indicated. 20. A female reproductive system. Note the terminal gonopore, long uterus, and prominent uterine bell cells. 21. A paratype female showing the anterior fusiform trunk shape and the proportional size of the reproductive system compared to trunk size. *Scale-bars*: 15,21, 1 mm; 16,20, 500 μm; 17, 200 μm; 18, 50 μm; 19, 25 μm

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