FOLIA PARASITOLOGICA 39: 235–247, 1992.

Acanthocephalans from some aquatic birds from the Bulgarian Black Sea coast

Z. DIMITROVA and T. GENOV

Department of Zoology, Higher Institute of Zootechnics and Veterinary Medicine, 62 D, Blagoev Street, 6000 Stara Zagora, Bulgaria;
Institute of Parasitology, Bulgarian Academy of Sciences, Akad. G. Bonchev Street, Bl. 25, 1113 Sofia, Bulgaria

Key words: Acanthocephala, aquatic birds, Bulgaria, morphology

Abstract. A total of 371 birds from 53 species of the orders Podicipediformes, Ciconiiformes, Anseriformes, Gruiformes, Charadriiformes and Coraciiformes from the Bulgarian Black Sea coast were studied for helminth parasites. Acanthocephalans were found in 9 species: *Mediorhynchus papillosus* and *Prosthorhynchus genitopapillatus* in *Tringa erythropus* (new host records), *Acanthocephalus lucii* in *Alcedo atthis* (accidentally), *Sphaerirostris* sp. in *Charadrius dubius, Filicollis anatis* in *Anas clypeata, A. querquedula, Fulica atra, Gallinula chloropus* and *Calidris ferruginea,* and *Polymorphus magnus* in *Anas platyrhynchos* and *A. clypeata.* The species are described and figured.

Previous faunistic investigations recorded the following acanthocephalans from aquatic birds in Bulgaria: *Polymorphus magnus* Skrjabin, 1913 (Vasilev and Georgiev 1956, Georgiev and Denev 1959, Vasilev 1961, 1962, 1963, 1973, Kamburov and Vasilev 1972, Petrova 1984), *Polymorphus diploinflatus* Lundström, 1942 (Tsacheva 1967), *Filicollis anatis* (Schrank, 1788) (Kamburov and Vasilev 1972, Vasilev 1973, Petrova 1984), *Ahythmorhynchus invaginabilis* (Linstow, 1902), *Plagiorhynchus spiralis* (Rudolphi, 1809), *Sphaerirostris lancea* (Westrumb, 1821) and *S. pinguis* (Van Cleave, 1918) (Petrova 1984).

The aim of the present study is to extend the previous investigations by an examination of the new host groups and to add new information on the morphological peculiarities of the species found.

MATERIALS AND METHODS

The investigation was based on the study of the acanthocephalans collected from 371 birds from 53 species belonging to the orders Podicipediformes, Ciconiiformes, Anseriformes, Gruiformes, Charadriiformes and Coraciiformes during the period 1983–1987. The material was collected from the Bulgarian Black Sea coast (the villages of Krapec and Durankulak at the lake of Durankulak, North-Eastern Bulgaria, and the lake Vaya at Bourgas) by expeditions from the Institute of Parasitology, Bulgarian Academy of Sciences. The specimens were fixed and preserved in 70 % ethanol and studied in temporary mounts in glycerol (25–100 %) or lactic acid (30 %).

The measurements are presented in millimetres. The localization is in the small intestines except where otherwise stated. The prevalence is given as a ratio: number of infected birds / number of examined birds.

The specimens are deposited in the Collection of the Institute of Parasitology, Sofia, under the numbers included in the text.

The species are arranged according to Amin (1985).

RESULTS AND DISCUSSION

Acanthocephalans were found in birds belonging to 9 species: *Anas platyrhynchos, A. querquedula, A. clypeata* (Anseriformes), *Gallinula chloropus, Fulica atra* (Gruiformes), *Charadrius dubius, Tringa erythropus, Calidris ferruginea* (Charadriiformes) and *Alcedo atthis* (Coraciiformes). A review of the recorded acanthocephalan species follows:

Family Gigantorhynchidae Hamann, 1892

Mediorhynchus papillosus Van Cleave, 1916 Fig. 1A, B

Specimen studied: 1 female (No. 8646-3) from *Tringa erythropus,* Dolno Ezerovo (near Bourgas), April 1984; prevalence: 1/5.

Description: Total length 11.89. Trunk elongated, almost cylindrical, 11.10 long and 1.17 wide. Lacunar system composed of transverse canals under trunk surface (creating impression of internal segmentation). Proboscis frustum shaped, 0.586 long, consisting of two parts: protoboscis (0.378 long); and teloboscis (0.208 long). Proboscis 0.220 wide at its apex, 0.321 at conjunction between protoboscis and teloboscis, and 0.378 at base (Fig. 1A). Protoboscis armed with 10 spiral rows of 9 hooks in each row. Maximum length of hook blades 0.0252–0.0275, that of roots 0.0325–0.0375 (with widened bases). Teloboscis armed with 10 (11?) irregular spiral rows of 7–8 spines in each row. Neck conic, 0.208 long and 0.214 wide. Proboscis receptacle sac-like, consisting of two parts: single-walled sac attached at proboscis apex (0.98 long); and double-walled sac attached at posterior part of protoboscis (1.20 long). Brain ganglion 0.599 from anterior proboscis end. Lemnisci band-like, and slightly unequal, 3.45–3.60 long, their maximum width 0.21 (Fig. 1B). Eggs not observed. Genital pore terminal.

Comments: – This species was originally described on the basis of specimens from *Myochanes virens* (Passeriformes) and *Porzana carolina* (Gruiformes) from North America. There are several descriptions demonstrating its variability (Petrochenko 1958, Khokhlova 1966, Schmidt and Kuntz 1977, Peresadko 1980). Our specimen is morphologically most similar to the description by Peresadko (1980), who recorded the species in charadriiform hosts in Western Siberia, but the roots of the hooks and the proboscis receptacle of our specimen are larger than those of the Siberian acanthocephalans of the same species.

M. papillosus has been recorded in Bulgaria from various passeriform birds in North-Eastern Bulgaria, Thrace and Western Stara Planina (Stoimenov 1962, 1963, Tsacheva 1967, Tsacheva-Petrova 1971).

The finding of the *M. papillosus* in the *T. erythropus* is a new host record.

Family Echinorhynchidae Cobbold, 1876

Acanthocephalus lucii (Müller, 1776) Fig. 1 C–E

Specimen studied: 1 female (No. 10117) from the stomach of the *Alcedo atthis*, Krapec, April 1985; prevalence: 1/1.

Description: Total length 6.87. Trunk 6.24 long and 0.94 wide, almost cylindrical and slightly sigmoid with the anterior part wider than posterior part (Fig. 1C). Proboscis 0.504 long and 0.391 wide, almost cylindrical, situated perpendicularly to trunk axis; anterior part invaginated (one or two hooks of each row on the invaginated part). Hooks in 13 longitudinal rows with 5–6 hooks in each row (Fig. 1D). First hooks with blade 0.0925–0.105 long and 0.0225 thick; following (II, III and IV) hooks with blade 0.1175–0.1225 long and 0.0275 thick; posterior (V and VI) hooks 0.040–0.0875 long and 0.010–0.0125 thick. Anterior four hooks with well-developed roots, 0.0567–0.0630 long; posterior two hooks with underdeveloped roots (roots wider in anterior parts). Neck short, with length 0.126 and with 0.410. Proboscis receptacle double-walled, attached at proboscis base; 1.07 long and 0.378 wide. Lemnisci 0.90 long and 0.20 wide, slightly shorter than proboscis receptacle, with widened posterior end. Genital system 1.7 long, occupying last fourth of metasome (Fig. 1E). Genital pore subterminal. Developed eggs not observed, but egg balls with diameter of about 0.125.

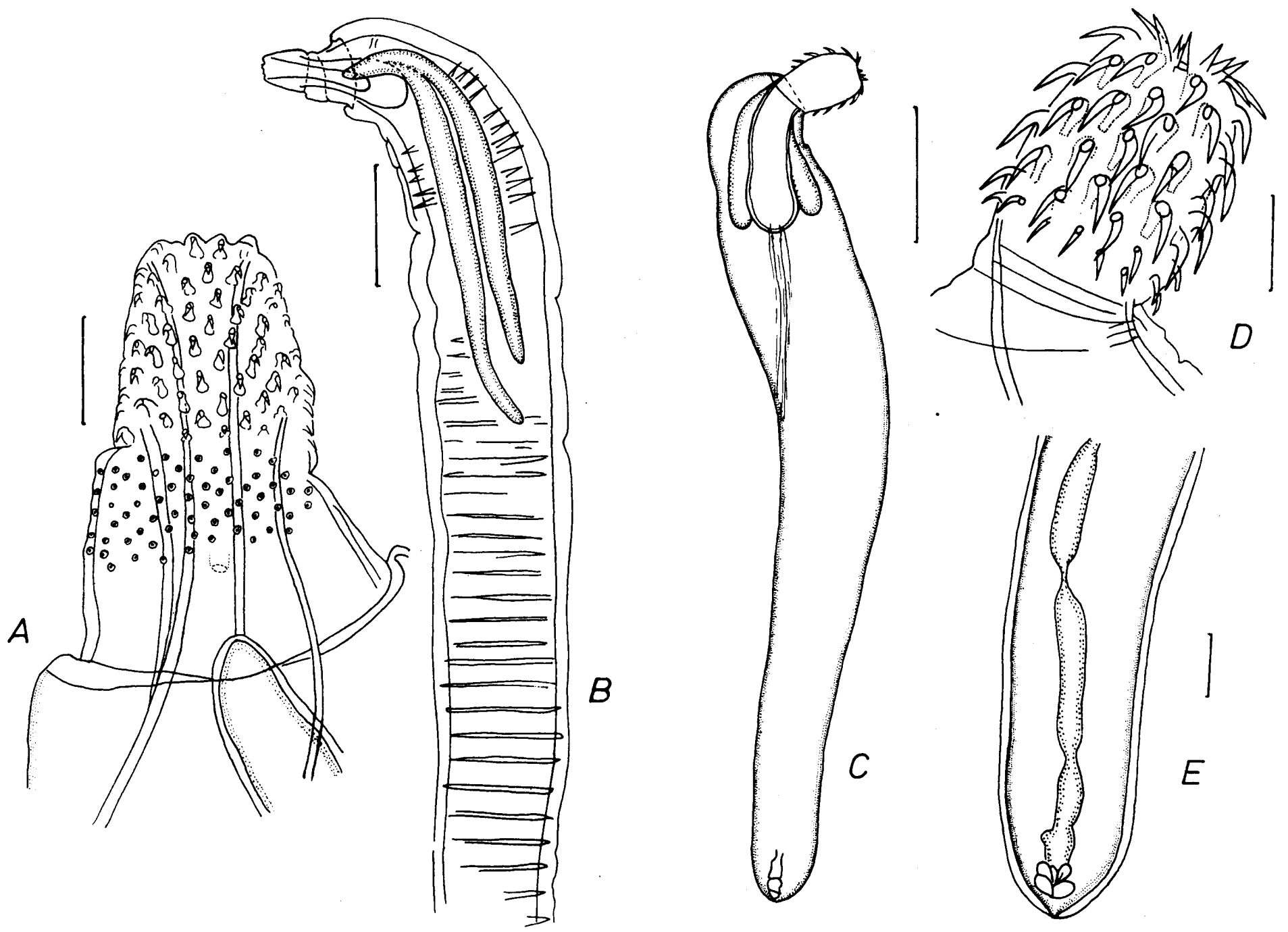

Fig. 1. A, B: *Mediorhynchus papillosus*, female. A – proboscis; B – anterior end; C–E: *Acanthocephalus lucii*, female. C – general view; D – proboscis; E – posterior end. Scale-bars: A, D, E 0.2 mm; B, C 1 mm.

Comments: – The specimen studied differs from the descriptions of Lühe (1941, cited after Kurashvili 1967) and Petrochenko (1956) in the smaller dimensions of the trunk and the proboscis, and the slightly larger blades of the hooks. It is closer to the specimens from fresh-water fish studied by Andruyk (1981) and from the *Anas querquedula* described by Czaplinski (1962). In comparison with the latter description, there are insignificant differences in the measurements of the hooks, the proboscis and the proboscis receptacle.

This species is widespread in Bulgaria in different species of fresh-water fish (for survey see Kakacheva-Avramova 1983). Except for fresh-water fish, it has also been recorded as an accidental parasite of amphibians (Ryzhikov et al. 1980), and birds, i.e. the *Delichon urbica* (Petrochenko 1958) and *Anas querquedula* (Czaplinski 1962). The present record in the stomach of the *Alcedo atthis* might be considered as accidental and probably as a result of feeding on infected fish.

Family Centrorhynchidae Van Cleave, 1916

Sphaerirostris sp. Fig. 2A, B

Specimen studied: 1 female (No. 11198) from *Charadrius dubius,* Krapec, April 1986; prevalence: 1/7.

Description: Total length 8.82. Trunk fusiform, divided by constriction into two parts: anterior part widened (4.20 long and 1.47 wide) and posterior part cylindrical (3.57 long and 0.72 wide) terminating in papilla-like constriction (Fig. 2 A). Proboscis in two parts separated from one another by constriction with anterior part partially invaginated. Total proboscis length 0.75 (0.48 evaginated part and 0.27 invaginated part). Maximum width of anterior part 0.33, width at constriction 0.25 and width as base 0.36. Armature consists of 34 (or 36?) longitudinal rows of at least 10 hooks in each row: hooks I–V on anterior part; hooks VI and VII at point of constriction; and hooks VIII–X on posterior part. Length of hook blades: I = 0.0275; II = 0.0350; III = 0.0350; IV = 0.0350; V = 0.0425; VI = 0.0400; VII = 0.0375; VIII = 0.0375; IX = 0.0325 and X = 0.0350. Length of hooks I–V with roots 0.040–0.075 long; roots of last 3–4 hooks in each row transformed into spines. Neck short, cylindrical, 0.284 long and 0.334 wide. Proboscis receptacle double-walled, attached slightly anteriorly to proboscis constriction and 0.95 long and 0.30 wide. Lemnisci longer than proboscis receptacle, with digitiform posterior ends measuring 1.68 long and with maximum width 0.34. Uterus long, tubular. Vagina surrounded by glandular cells (Fig. 2B). Genital pore subterminal. Trunk full of elongated oval egg-balls, 0.233–0.284 long and 0.090–0.158 wide.

Comments: – Our specimen is similar to the description of *S. lanceoides* (Petrochenko, 1949) by Khokhlova (1971) but differs from it by the smaller dimensions of the blades of the hooks (0.043–0.049 in *S. lanceoides*). It is also similar by the length of the blades to *S. lancea* (Westrumb, 1821) (0.043 according to Be-

lopolskaya 1983). The latter species has 30 (Petrochenko 1958) or 32 (Belopolskaya 1983) longitudinal rows of hooks. Due to the presence of characteristics from both *S. lancea* and *S. lanceoides*, the present specimen is described as *Sphaerirostris* sp.

Family Plagiorhynchidae Golvan, 1960

Prosthorhynchus genitopapillatus Lundström, 1942 Fig. 2C, D

Specimens studied: 2 males (Nos. 8646-1, 2) from *Tringa erythropus,* Dolno Ezerovo (Bourgas District), April 1984; prevalence: 1/5.

Description: Total length 9.18–9.27. Trunk elongate-elliptical, narrowed posteriorly to proboscis and with rounded posterior extremity; 7.74–8.28 long and 1.62 wide (Fig. 2C). Proboscis cylindrical, situated at angle to trunk axis, 0.90–1.29 long (anterior part of one of the proboscises invaginated) and 0.25–0.27 wide at base. Armature consists of 16–18 longitudinal rows of hooks with 16 hooks in each row (Fig. 2D). Hooks with similar shape and size; hooks I–XV with blades 0.065–0.075 long and 0.014–0.020 thick with roots 0.065–0.075 long and 0.0150–0.0175 thick;

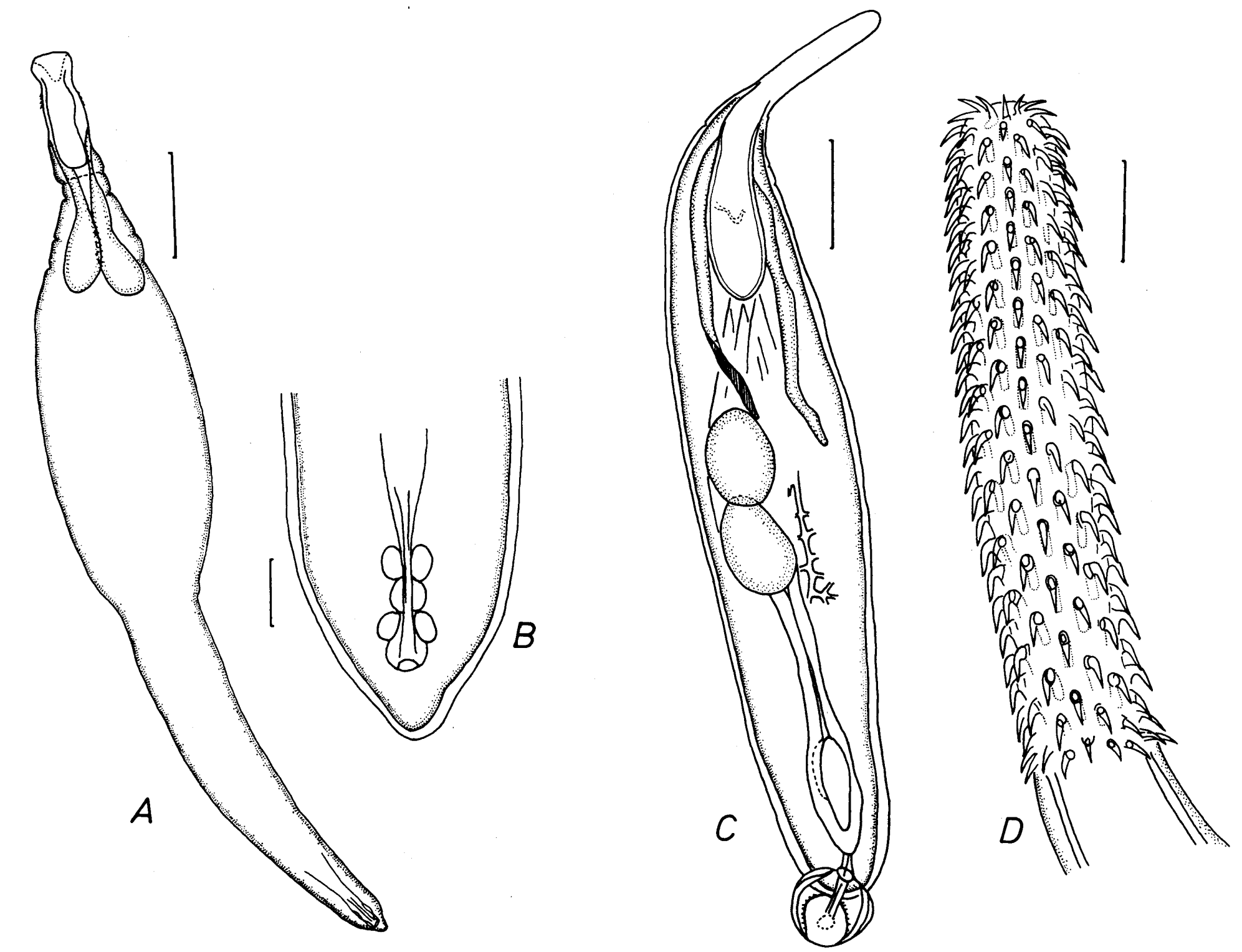

Fig. 2. A, B: *Sphaerirostris* sp., female. A – general view; B – posterior end; C, D: *Prosthorhynchus genitopapillatus*, male. C – general view; D – proboscis. Scale-bars: A, C 1 mm; B 0.1 mm; D 0.2 mm.

hook XVI transformed into spine and without root. Neck short, with shape of frustum, 0.213 long and 0.350 wide. Proboscis receptacle double-walled, with cylindrical anterior part and rounded posterior part, attached at proboscis base, and measuring 1.83–2.16 × 0.48–0.51. Lemnisci elongated, band-like, with tapering posterior extremities, reaching to anterior testis (2.01–3.20 long, 0.15–0.21 wide). Testes situated along trunk axis, slightly overlapping one another; occupying median, widest part of trunk; oval, 0.90–1.05 long and 0.69–0.75 wide. Cement glands tubular, 3.00–4.22 long. Ducts of cement glands 0.60 long. Genital bursa everted, almost spherical and measuring 0.60–0.90 × 0.72–0.75. Genital pore terminal.

Comments: – This species was described on the basis of specimens from different passeriform and piciform birds, and also from *Haematopus ostralegus* (Charadriiformes) in Sweden (Lundström 1942, cited after Petrochenko 1958). The specimens studied differ from the original description by the smaller hooks (0.075 and 0.04–0.09, respectively). In comparison with the description of Tsacheva (1965) based on specimens from *Sturnus vulgaris*, the present material differs by the number of the hooks in each row, the dimensions of the proboscis and the lemnisci.

Golvan (1956) and Schmidt (1981) consider *P. genitopapillatus* as a synonym of *P. cylindraceus* (Schrank, 1788) but Amin (1985) and Khokhlova (1986) recognize it as valid.

This species was recorded in Bulgaria from various passeriform birds in the Strandzha Mts., in the vicinity of Sofia, in Thrace, and in Western Stara Planina (Zhelyazkova-Paspaleva 1962, Tsacheva 1965, 1967, Tsacheva-Petrova 1971).

The finding of *P. genitopapillatus* in *T. erythropus* is a new host record.

Family Polymorphidae Meyer, 1931

Filicollis anatis (Schrank, 1788) Fig. 3A–D

Specimens studied: *Anas querquedula* (prevalence: 3/10) – No. 10103 (1 female), Durankulak, April 1985; No. 12653 (5 males and 7 females). No. 12669 (1 female), Krapec, April 1987; *Anas clypeata* (prevalence: 1/1) – No. 10678-4 (1 female), Krapec, April 1987; *Fulica atra* (prevalence: 7/40) – No. 9643 (2 males and 6 females), No. 9788 (2 females), Krapec, October 1984; No. 10066 (1 male and 1 female), Krapec, June 1985; No. 11154 (2 males and 3 females). No. 11158 (2 males and 1 female), Durankulak, March 1986; No. 11409 (2 females), Krapec, October 1986; No. 12637 (3 males and 3 females), Krapec, April 1987; *Gallinula chloropus* (prevalence: 4/23) – No. 8767 (1 male); No. 8795 (1 male), Krapec, April 1984; No. 11413 (1 male and 1 female), Krapec, October 1986; No. 12657 (1 male), Krapec, April 1987; *Calidris ferruginea* (prevalence: 1/18) – No. 11207 (1 female), Durankulak, April 1986.

Description (based only on mature specimens from *F. atra*; for measurements see Tables 1, 2):

Male (3 specimens): Trunk fusiform with spinose anterior part (Fig. 3A). Proboscis almost spherical (Fig. 3B). Anterior hooks 7–8 with similar size and shape of blade; hooks III–V largest (Table 2). Neck conical. Proboscis receptacle double-walled, attached proboscis base. Lemnisci band-like, reaching to testes. Testes situated

along trunk axis and slightly overlapping one another and at widest part of trunk, elliptical. Cement glands 6 in number situated in pairs or in compact group towards posterior end of trunk. Genital pore terminal.

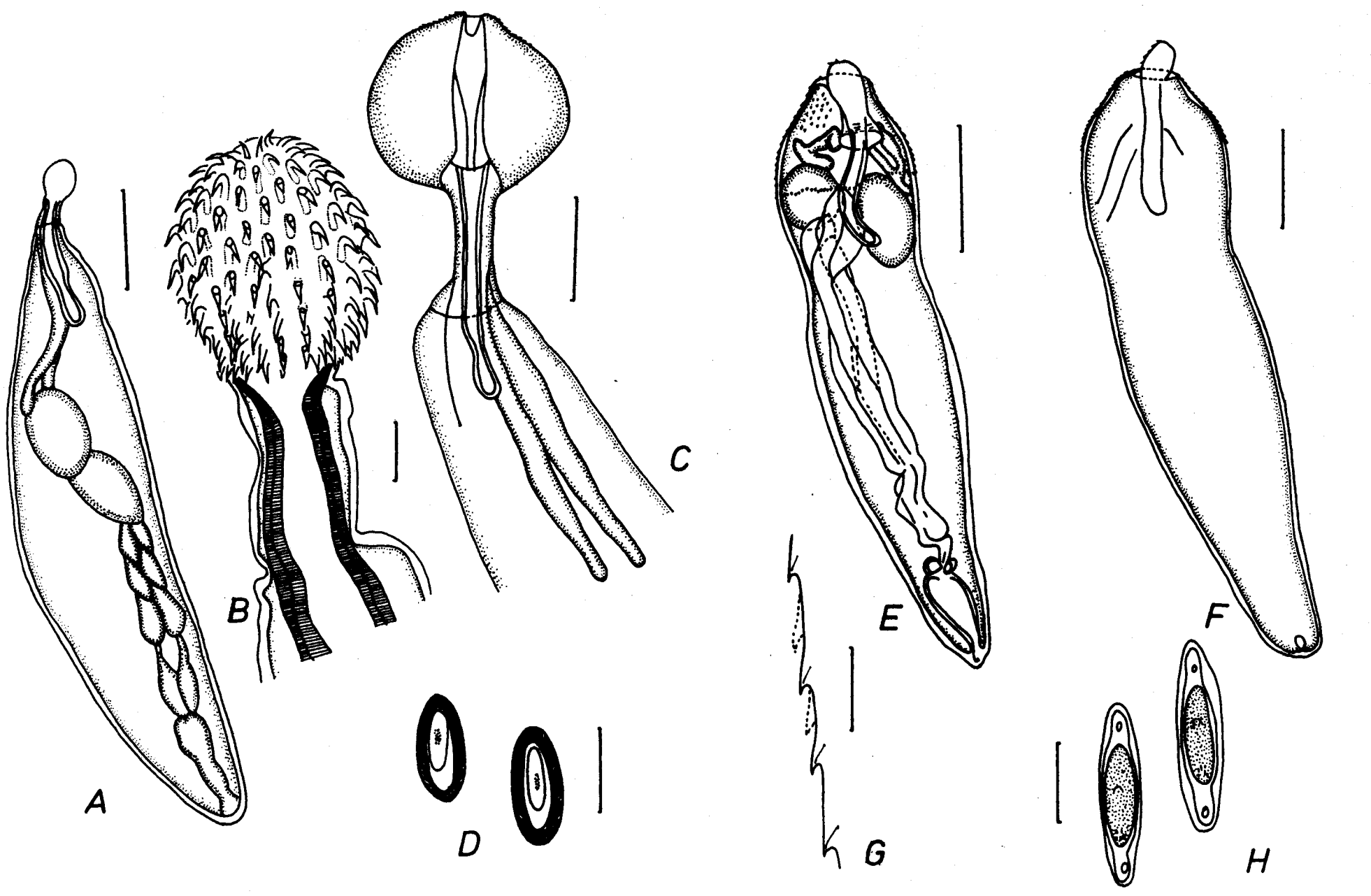

Fig. 3. A–D: *Filicollis anatis*. A – male, general view, scale-bar 1 mm; B – male, proboscis; C – female, anterior end; D – eggs. E – H: *Polymorphus magnus*. E – male, general view; F – female, general view; G – female, longitudinal row of spines on anterior part of trunk; H – eggs. Scale-bars: A, C 1 mm; B 0.1 mm; G, H 0.05 mm.

Female (10 specimens): Trunk oval to band-like in shape. Proboscis transformed into bulbus (Fig. 3C). Hooks situated on apical part of bulbus in rosette-like group. Neck long and cylindrical. Proboscis receptacle long, cylindrical and reaching up to posterior end of neck or extending into anterior part of metasome. Lemnisci long and band-like. Egg balls oval. Ripe eggs (observed only in two specimens with length of metasome being 11.4 and 13.2) eliptical, without polar prolongations on middle shell (Fig. 3D). Genital pore terminal.

Comments: – This species is presented in the material studied mainly by immature specimens. The metric data for mature specimens from different hosts studied are given in Tables 1 and 2. Our specimens have larger dimensions of the blades of the hooks (up to 0.0441) than the published descriptions of the species (according to Lühe 1911, cited after Petrochenko 1958 – 0.031; according to Atrashkevich 1982 – 0.041). They are similar in this character to the *F. trofimenkoi* Atrashkevich, 1982 from anseriform birds in Chukotka (with hooks up to 0.048). All the other characteristics (the shape and the size of the trunk, proboscis receptacle, lemnisci and eggs) correspond to *F. anatis*.

Table 1. Metric and meristic data for mature specimens of *Filicollis anatis* from different hosts

Host	*Fulica atra*						*Gallinula chloropus*			*Anas clypeata*	
Sex	male			female			male			female	
	n	Range	Mean	n	Range	Mean	n	Range	Mean	n	Range
Total length:	3	6.98–7.04	6.98	10	8.46–22.50	13.61	2	6.08–6.52	6.30	1	22.65
Trunk:	3	5.58–6.28	6.10	10	6.21–18.00	10.26	2	5.01–6.00	5.01	1	18.00
length	3	5.58–6.28	6.10	10	6.21–18.00	10.26	2	5.01–6.00	5.01	1	18.00
max. width	3	1.32–1.59	1.47	9	1.40–4.65	2.51	2	1.29–1.47	1.38	1	4.50
Proboscis:											
length	3	0.347–0.410	0.384	10	1.35–2.85	2.15	2	0.347–0.416	0.382	1	1.86
width:											
ant. part	3	0.076–0.133	0.088	–	–	–	2	0.158–0.158	0.158	–	–
maximal	3	0.296–0.320	0.305	10	1.50–3.30	2.26	2	0.328–0.353	0.340	1	2.25
at base	3	0.170–0.233	0.197	–	–	–	2	0.258–0.309	0.284	–	–
Hooks:											
Longitudinal rows (number)	3	20, 18, 19	–	–	–	–	2	18,18	–	–	–
Hooks in one row	3	10, 10, 10	–	–	–	–	2	10–11, 8–9	–	–	–
Neck:											
length	2	0.480–0.630	0.555	10	0.75–1.65	1.20	1	0.567	–	1	2.40
width	2	0.347–0.441	0.394	10	0.27–0.57	0.37	2	0.441–0.567	0.504	1	0.30
Proboscis receptacle:											
length	3	1.40–1.52	1.45	8	1.5–2.49	1.90	2	1.29–1.50	1.395	1	3.16
width	3	0.150–0.192	0.177	6	0.09–0.16	0.135	2	0.27–0.35	0.310	1	0.10
Lemnisci:											
length	3	1.65–0.16	1.72	10	2.4–4.95	3.49	2	1.95–2.25	2.10	1	6.60
width	3	0.15–0.16	0.153	8	0.09–0.48	0.23	2	0.15–0.18	0.165	1	0.72

Table 1 – continued

Host	*Fulica atra*						*Gallinula chloropus*			*Anas clypeata*	
Sex	male			female			male			female	
	n	Range	Mean	n	Range	Mean	n	Range	Mean	n	Range
Spinose part of trunk:											
length	3	0.420–0.567	0.505	–	–	–	–	–	–	–	–
Spines:											
length	3	0.013–0.017	0.017	–	–	–	2	0.018–0.023	0.020	–	–
number rows	–	–	–	–	–	–	1	48	–	–	–
number of spines in row	2	7, 9	–	–	–	–	1	8	–	–	–
Testes:											
length	3	0.88–1.11	–	–	–	–	1	0.90	–	–	–
width	3	0.51–0.66	–	–	–	–	1	0.66–0.72	–	–	–
Cement glands:											
total length	3	0.66–1.11	0.91	–	–	–	2	0.70–0.75	0.73	–	–
ducts (length)	3	0.504–0.880	0.691	–	–	–	2	0.60–0.66	0.63	–	–
Genital bursa:											
length	3	0.630–0.840	0.757	–	–	–	1	0.80	–	–	–
Female genital system:											
total length	–	–	–	3	1.26–1.80	1.48	–	–	–	–	–
Eggs:											
length	–	–	–	4	0.057–0.070	0.065	–	–	–	2	0.050–0.069
width	–	–	–	4	0.020–0.038	0.028	–	–	–	–	–

Table 2. Metric data for hooks of males of *Filicollis anatis* from *Fulica atra* and *Gallinula chloropus* (in µm)

Host		*Fulica atra*			*Gallinula chloropus*		
		n	Range	Mean	n	Range	Mean
I blade	length	4	35.0–37.5	36.0	4	35.0–41.0	37.2
	thickness	4	7.5–8.8	8.2	4	7.5–10.0	8.8
root	length	2	25.0–31.5	28.3	–	–	–
	thickness	–	–	–	–	–	–
II blade	length	5	37.5–41.3	39.5	3	35.0–44.1	38.9
	thickness	5	10.0–11.2	10.2	3	10.0–12.5	10.8
root	length	3	32.5–37.8	34.5	–	–	–
	thickness	2	7.5–10.0	8.8	–	–	–
III blade	length	6	40.0–42.5	41.9	3	42.5–44.1	43.6
	thickness	6	12.5–13.8	12.9	3	12.5	12.5
root	length	5	37.5–44.1	40.4	–	–	–
	thnickness	3	7.5–10.0	8.3	–	–	–
IV blade	length	5	42.5	42.5	4	42.5–44.1	43.6
	thickness	5	12.5–15.0	14.0	4	12.5–15.0	13.8
root	length	4	40.0–44.1	41.7	–	–	–
	thickness	3	7.5–10.0	8.3	–	–	–
V blade	length	4	42.5	42.5	4	37.5–43.8	40.7
	thickness	4	12.5	12.5	4	12.5–15.0	13.8
root	length	5	37.5–44.1	40.8	–	–	–
	thickness	3	7.5–10.0	8.3	–	–	–
VI blade	length	6	37.5–40.0	39.6	4	37.5–43.8	40.3
	thickness	6	10.0–11.3	10.2	4	10.0–12.5	11.0
root	length	2	30.0–40.0	35.0	–	–	–
	thickness	1	10.0	–	–	–	–
VII blade	length	5	35.0–37.5	37.0	4	28.4–40.0	35.0
	thickness	5	7.5–10.0	9.0	4	7.5–11.3	9.1
root	length	1	27.5	–	–	–	–
	thickness	–	–	–	–	–	–
VIII blade	length	6	32.5–37.5	34.6	3	28.4–37.5	33.6
	thickness	6	7.5–10.0	9.2	3	7.5–10.0	8.8
root	length	–	–	–	–	–	–
	thickness	–	–	–	–	–	–
IX blade	length	5	27.5–32.5	30.5	2	32.5–35.0	–
	thickness	5	7.5–10.0	8.5	2	7.5–10.0	–
root	length	–	–	–	–	–	–
	thickness	–	–	–	–	–	–

Table 2 – continued

Host		*Fulica atra*			*Gallinula chloropus*		
		n	Range	Mean	n	Range	Mean
X blade	length	6	25.0–32.5	29.2	2	32.5	–
	thickness	4	7.5	7.5	2	7.5	–
root	length	–	–	–	–	–	–
	thickness	–	–	–	–	–	–
XI blade	length	–	–	–	1	22.5	–
	thickness	–	–	–	1	7.5	–
root	length	–	–	–	–	–	–
	thickness	–	–	–	–	–	–

Previously, it was recorded in Bulgaria in the *Anas platyrhynchos, A. platyrhynchos* f. *domestica* and *Gallinula chloropus* in North-Eastern Bulgaria and Sofia district (Kamburov and Vasilev 1972, Vasilev 1973, Petrova 1984).

Polymorphus (*Polymorphus*) *magnus* Skrjabin, 1913 Fig. 3E–H

Specimens studied: *Anas clypeata* (prevalence 1/1) – No. 10678-1–3 (1 male and 2 females), Krapec, April 1987; *Anas platyrhynchos* (prevalence: 1/8) – No. 10749 (1 female), caeca, Vaya lake, February 1986.

Description (based on specimens from *A. clypeata*):

Male (1 specimen): Total length 5.24. Trunk fusiform with constriction after anterior widened part; 4.80 long and 1.11 wide. Anterior part of body spinose, 0.95 long (partially invaginated), with 40 longitudinal rows of at least 13–15 spines (0.0175–0.0225 long) in each row. Proboscis oval, partially invaginated (Fig. 3E), and measuring 0.435 long and 0.221 wide. Proboscis armed with 14 longitudinal rows of 8 hooks in each row. Hooks with following lengths: I to IV 0.0575–0.0625; V 0.0475–0.0525; VI 0.0500–0.0525; VII 0.0475–0.0500; and VIII 0.0425. Neck invaginated in metasome. Proboscis receptacle double-walled, attached at proboscis base, and 0.851 long and 0.17 wide. Lemnisci highly folded. Testes oval, situated in anterior third of trunk, slightly oblique, with measurements 0.520–0.720 × 0.420–0.440. Cement glands 4 in number, situated in two pairs posteriorly to testes; one pair longer than another (2.25 and 2.07). Ducts of cement glands 2 in number, 0.60–0.62 long. Genital bursa bell-like and 0.95 long.

Female (1 whole specimen and 1 metasome): Total length 6.47. Trunk 5.7–6.0 long and 1.38–1.41 wide; its shape and armament as in male (Fig. 3F, G). Length of spinose zone 1.0–1.5 with 50–52 longitudinal rows of 22–26 spines (0.0075–0.0250 long) in each row. Proboscis oval, 0.473 long and 0.265 wide. Proboscis with 14 longitudinal rows of 8–9 hooks in each row. Anterior four hooks of each row larger

than the others, with well-developed roots. Length of hooks as follows: I to IV 0.0567–0.063 (root 0.0567–0.065); V 0.0567–0.063; VI and VII 0.0504; and VIII and IX 0.0441. Neck invaginated. Proboscis receptacle cylindrical, double-walled, 1.26 long and attached to proboscis base. Numerous elliptical eggs, their middle shell with polar prolongations (Fig. 3H). Eggs measuring 0.0945–0.125 × 0.025–0.0275.

Comments: – The specimens studied differ from the descriptions of Skrjabin (1913, cited after Petrochenko 1958) and Petrochenko (1958) by the smaller dimensions of the trunk, testes and cement glands, and the smaller number of the longitudinal hook rows. They are closer to the description by Khokhlova (1966) based on specimens from *Melanitta nigra.*

This species was previously recorded in Bulgaria as a widespread parasite of anseriform and galliform hosts in different regions of the country (Vasilev and Georgiev 1956, Georgiev and Denev 1959, Vasilev 1961, 1962, 1963, 1973, Kamburov and Vasilev 1972, Petrova 1984).

Acknowledgements. We are grateful to Drs. V. Y. Biserkov, N. H. Chipev, A. K. Kostadinova and B. B. Georgiev for their participation in the field work and to Dr. S. R. Stoitsova for the critical review of the English text.

REFERENCES

AMIN O. M. 1985: Classification. In: D. Crompton & B. Nickol (Eds.), Biology of Acanthocephala. Cambridge University Press, Cambridge, pp. 27–72.

ANDRYUK L. V. 1981: Structure of the acanthocephalans *Acanthocephalus lucii* (Müller) Lühe. Izv. Timiryaz. Selskokhoz. Akad. 3: 146–151 (In Russian.)

ATRASHKEVICH G. I. 1982: *Filicollis trophimenkoi* sp. n. (Acanthocephala, Polymorphidae) from Anatinae from North-Western Chukotka. Parazitologiya 16: 102–106. (In Russian.)

BELOPOLSKAYA M. M. 1983: Acanthocephalans from charadriiform birds in the European part of USSR. Vestn. Leningr. Gosud. Univ. Biol. 3: 17–25. (In Russian.)

CZAPLINSKI B. 1962: Nematodes and acanthocephalans of domestic and wild Anseriformes in Poland. II Nematoda (excl. *Amidostomum*) and Acanthocephala. Acta Parasitol. Pol. 10: 277–319.

GEORGIEV B., DENEV Yo. 1959: Helminths of birds in the Tarnovo region. Izv. Nauchnoizsled. Vet. Bakter. Parasitol. Epizootol. Inst. 1: 157–160. (In Bulgarian.)

GOLVAN Y. J. 1956: Acanthocephales d'oiseaux. Troisième note. Revision des espèces européennes de la sous-famille des Plagiorhynchinae A. Meyer, 1931 (Polymorphidae). Ann. Parasitol. Hum. Comp. 31: 350–384.

KAKACHEVA-AVRAMOVA D. 1983: Helminths of Fresh-Water Fishes in Bulgaria. Publ. House of the Bulgarian Academy of Sciences, Sofia, 261 pp. (In Bulgarian.)

KAMBUROV P., VASILEV I. 1972: Helminth fauna of waterfowl in Bulgaria. Izv. Tsentr. Khelmintol. Lab. 15: 109–133. (In Bulgarian.)

KHOKHLOVA I. G. 1966: On the fauna and morphology of avian acanthocephalans from the lower Enisey and Norilsk Lakes. Trudy GELAN 17: 260–276. (In Russian.)

KHOKHLOVA I. G. 1971: Acanthocephalans from birds in Yakutian SSR. Trudy GELAN 22: 215–223. (In Russian.)

KHOKHLOVA I. G. 1986: Acanthocephalans of Terrestrial Vertebrates in the Fauna of USSR. Nauka, Moscow, 276 pp. (In Russian.)

KURASHVILI B. E. 1967: Acanthocephalans of Animals in Georgia. Mecniereba, Tbilisi, 96 pp. (In Russian.)

PERESADKO L. V. 1980: New nematodes and acanthocephalans from the charadriiform birds in Western Siberia. In: Systematics and ecology of animals, Publ. House Nauka, Novosibirsk, pp. 10–23. (In Russian.)

PETROCHENKO V. I. 1956: Acanthocephalans of Domestic and Wild Animals. Vol. 1. Publ. House of Academy of Sciences of USSR, Moscow, 436 pp. (In Russian.)

PETROCHENKO V. I. 1958: Acanthocephalans of Domestic and Wild Animals. Vol. 2. Publ. House of Academy of Sciences of USSR, Moscow, 456 pp. (In Russian.)

PETROVA K. 1984: On the acanthocephalans from wild birds in Bulgaria. In: Fauna, Taxonomy and Ecology of Helminths on Birds. Publ. House of the Bulgarian Academy of Sciences, Sofia, pp. 185–187. (In Bulgarian.)

RYZHIKOV K. M., SHARPILO V. P., SHEVCHENKO N. N. 1980: Helminths of the Amphibian Fauna of USSR. Publ. House Nauka, Moscow, 280 pp. (In Russian.)

SCHMIDT G. D. 1981: *Plagiorhynchus formosus* Van Cleave, 1918, a synonym of *Plagiorhynchus cylindraceus* (Goeze, 1782) Schmidt and Kuntz, 1966. J. Parasitol. 67: 597–598.

SCHMIDT G. D., KUNTZ R. E. 1977: Revision of *Mediorhynchus* Van Cleave, 1916 (Acanthocephala) with a key to species. J. Parasitol. 63: 500–507.

STOIMENOV K. 1962: Contribution to the knowledge of the helminths of *Coloeus monedula* L. in North-Eastern Bulgaria. Izv.-Tsentr. Khelmintol. Lab. 7: 169–173. (In Bulgarian.)

STOIMENOV K. 1963: Contribution to the knowledge of the helminths of *Corvus corone cornix* L. in North-Eastern Bulgaria. Izv. Tsentr. Khelmintol. Lab. 8: 175–180 (In Bulgarian.)

TSACHEVA K. 1965: Nematoda and Acanthocephala in *Sturnus vulgaris* L. in the vicinities of Sofia. Izv. Zool. Inst. Muz. 18: 185–187. (In Bulgarian.)

TSACHEVA K. 1967: Contribution to the knowledge of helminth fauna of wild birds in Thrace, Acanthocephala. Izv. Zool. Inst. Muz. 23: 175–181. (In Bulgarian.)

TSACHEVA-PETROVA K. 1971: Contribution to the knowledge of the helminth fauna of wild birds in Western Stara Planina (Nematoda – Acanthocephala). Izv. Zool. Inst. Muz. 33: 185–194. (In Bulgarian.)

VASILEV I. 1961: Turkey – a host of *Polymorphus magnus* Skrjabin, 1913. Izv. Tsentr. Khelmintol. Lab. 6: 45–46. (In Bulgarian.)

VASILEV I. 1962: Helminth fauna of the domestic goose (*Anser anser* dom.) in Bulgaria. Izv. Tsentr. Khelmintol. Lab. 7: 11–17. (In Bulgarian.)

VASILEV I. 1963: Contribution to the knowledge of the helminth fauna of *Gallus gallus* dom. in Bulgaria. Izv. Tsentr. Khelmintol. Lab. 8: 15–19. (In Bulgarian.)

VASILEV I. 1973: Contribution to the knowledge of the helminth fauna of the domestic ducks in Bulgaria II. Izv. Tsentr. Khelmintol. Lab. 16: 13–23. (In Bulgarian.)

VASILEV I., GEORGIEV B. 1956: Case of polymorphosis and streptocarosis of ducks in Bulgaria. Izv. Inst. Eksper. Veter. Med. 5: 175–182. (In Bulgarian.)

ZHELYAZKOVA-PASPALEVA A. 1962: Contribution to the knowledge of the helminth fauna of wild birds in Strandzha region. Izv. Tsentr. Khelmintol. Lab. 7: 137–152. (In Bulgarian.)

Received 27 August 1991 Accepted 6 December 1991

FOLIA PARASITOLOGICA 39: 247–248, 1992.

SPREADING OF THE NEMATODE *ANGUILLICOLA CRASSUS* (DRACUNCULOIDEA) AMONG EEL POPULATIONS IN EUROPE

Anguillicola crassus Kuwahara, Niimi et Itagaki, 1974, a pathogenic swimbladder parasite of eels, was originally known only from East-Asian countries (Japan, China), parasitizing there the Japanese eel, *Anguilla japonica* Temminck et Schlegel, and the introduced European eel, *A. anguilla* (L.) (Kuwahara, Niimi, Itagaki 1974: Jpn. J. Parasitol. 23: 275–279; Hirose,