

## Platyhelminthes of three species of shorebirds (Charadriiformes) in the Slovak Republic

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### Summary

Twelve platyhelminth parasites, digenetic trematodes and cestodes, were recovered from three species of charadriid shorebirds (Charadriiformes) in the Slovak Republic; namely ringed plover – *Charadrius hiaticula* (N=9), little ringed plover – *Charadrius dubius* (N=56) and golden plover – *Pluvialis apricaria* (N=14). New host records were registered for six helminth species: trematodes *Tanaisia fedtschenkoi* and *Echinoparyphium recurvatum* and tape-worms *Aploparaksis pseudofilum* and *Megalacanthus guarti* found in *C. hiaticula* and trematodes *Brachylaima fuscatum* and *Himasthla* sp. from *P. apricaria* and *C. dubius*, respectively. In platyhelminths the new data about morphological variability of insufficiently described cestodes of the genus *Anomotaenia* and trematodes *Brachylaima fuscatum* and *Levinseniella somateriae* have been pointed out.

Key words: Platyhelminths; Charadriiformes; *Charadrius dubius*; *Charadrius hiaticula*; *Pluvialis apricaria*; new host records; Slovak Republic

### Introduction

During the parasitological survey of free living birds of the Slovak Republic the two representatives of the genus *Charadrius* L., 1758, namely ringed plover – *Charadrius hiaticula* (L.) and little ringed plover – *Charadrius dubius* Scop., 1786, as well as the related bird species golden plover – *Pluvialis apricaria* (L.) were investigated. A breeding range of ringed plover extends around much of the Arctic. The little ringed plover nests in Europe from the Mediterranean up to southern Scandinavia and golden plover nests in northern Europe, north-western Siberia and on Iceland (Ferianc, 1977). All bird hosts examined belong to Pan-European endangered species. Partial data on helminths of these birds were previously published by Macko (1965). Most of the recent studies on shorebird parasites

were carried out in North America and Australia (Canaris and Kinsella, 2000, 2001). Galkin (1987), Deblock (1990), Deblock and Canaris (1991), Galaktionov (1991), Bondarenko and Kontrimavichus (1999), Nikolov and Georgiev (2002) and others studied several taxonomically problematic parasite groups from these hosts.

The aim of this paper was to summarise all data available on platyhelminths of three charadriids in the Slovak Republic and to contribute to the so far known data on their morphology.

### Material and Methods

The shorebirds (N=79) were collected from several localities of eastern and south-western parts of the Slovak Republic in the period of 1957 – 1969. A great part of investigated bird hosts (N=38) originated from Senné wetland, which recently was designated as an internationally important, so-called Ramsar locality. Senné fishponds lie on a water bird migration road and represent one of the most important breeding and resting sites of rare, endangered and vulnerable water birds in Slovakia. The other birds were obtained from localities Chmelnica near Prešov, water gate on the Topľa River near Bardejov, Turany above Ondava and Ostrov near Moča. Birds were shot and their internal organs and a body cavity were inspected within 3 hours. As many as 9 specimens of *Charadrius hiaticula*, 56 specimens of *C. dubius* and 14 individuals of *Pluvialis apricaria* were examined. Platyhelminths were fixed in alcohol-formaldehyd-acetic acid, stained in Semichon's and Blazhin's acetic carmine and mounted into Canada balsam. Helminths from ruff – *Philomachus pugnax* (L.) and lapwing – *Vanellus vanellus* (L.) (see Macko, 1959, 1963; Macko and Špakulová, 1995) and type specimens of *Taenia (Anomotaenia) microrhyncha* (Krabbe, 1869) from Zoological Museum in Copenhagen, Denmark were used as a comparative material. Voucher specimens of helmin-

ths under consideration are deposited at the Parasitological Institute of the Slovak Academy of Sciences in Košice. Measurements are in micrometers except where indicated. The width of rostellar hooks was measured as shown on the Figure 20.

## Results

### TREMATODA

Family: Eucotylidae Cohn, 1924

#### 1. *Tanaisia fedtschenkoi* Skrjabin, 1924

Hosts: *Charadrius dubius*; *C. hiaticula* – new host species. Localities: Senné, Bardejov, Chmelnica (eastern Slovakia). Site of infection: kidney.

Prevalence and intensity of infection: *C. dubius* 8.9 % (5/56) and 2 – 11 specimens; *C. hiaticula* 11.1 % (1/9) and 2 specimens.

Remarks: *T. fedtschenkoi* is a widespread trematode parasitic in aquatic birds. Macko (1965) studied this parasite in detail, and pointed out a considerable variability of several taxonomically significant characters; especially those distinguishing *T. fedtschenkoi* from other related taxa. The morphology of specimens from a new host *C. hiaticula* was within a range of the variability previously stated for this taxon.

Family: Brachylaimidae Joyeux et Foley, 1930

#### 2. *Brachylaima fuscatum* (Rudolphi, 1819)

Host: *Pluvialis apricaria* - new host species.

Locality: Senné (eastern Slovakia).

Site of infection: small intestine.

Prevalence and intensity of infection: 7.1 % (1/14) and 6 specimens.

Despite the fact that trematodes were recovered only from one host specimen, they differed from each other significantly particularly in the width of the body, ratio of oral and ventral sucker size, position of ventral sucker, position of uterus between suckers, position of vitellaria, opening of genital organs and other details (Tab.1). Special attention should be paid to the trematode of a size 5.6 x 0.6 mm (Fig. 1; Table 1, specimen No. 1). The oral sucker is bigger than ventral sucker and the distance between centres of the suckers is 1.1 mm, that comprises 19.6 % of the body length (in comparison to another *B. fuscatum* specimens studied, ventral sucker is dislocated most to the anterior part of the body). In the other specimen (Fig. 3), the distance between suckers was 1.4 mm, which represents 25.9 % of body length. Vitellaria extended from anterior margin of ventral sucker, whilst in previous specimen (Fig. 1) 200 – 234 behind ventral sucker.

Specimen No. 2 (Fig. 2; Table 1) had more robust body 4.7 x 0.8 mm in size. Oral sucker smaller than ventral sucker, the distance between centres of suckers 1.1 mm, what represents 24.7 % of the body length. Ventral sucker dislocated more to posterior part of the body and the distance

between ventral sucker and anterior testis was shorter than in other *B. fuscatum* individuals. Vitelline fields of the specimen in Fig. 2 extend from ventral sucker to area 177 – 374 from anterior testis. In another trematode, vitellaria extend to anterior testis area (Fig. 5).

Terminal part of male genitals (Figs. 4, 5) is formed by looped seminal vesicle, turning into unclear thin-walled muscular cirrus-sac, surrounded by prostatic glands. In some specimens, prostatic glands are visible also around seminal vesicle. Cirrus unarmed, more or less cylindrical (Figs. 4, 5) or pyriform (Fig. 3). Uterus ascending to various distance prior to ventral sucker, in one *B. fuscatum* specimen extending up to pharynx (Figs. 1 – 3). Lateral coils of uterus may overlap an internal margin of the intestine. The egg size varies considerably. In specimen No. 6, egg sizes were 26 – 29 x 17 – 20, in specimen No. 5 31 – 34 x 17 – 20.

Remarks: The identification of species of the genus *Brachylaima* Dujardin, 1843 remains problematic as it was shown by revisions of *B. fuscatum* (Rudolphi, 1819) and *B. mesostoma* (Rudolphi, 1803) (Braun, 1901, 1902 ex Skryabin, 1948). As the Rudolphi's type material was in a very poor condition, the revisions of *B. fuscatum* and *B. mesostoma* were made on the basis of morphologically similar specimens later collected from other localities and hosts. The number of individuals studied by Braun was not sufficient and it did not allow determining of variability ranges in *B. fuscatum*, *B. mesostoma* and other species of the genus *Brachylaima* (see e.g. Skryabin, 1948; Freitas *et al.*, 1967). With regards to the present knowledge, a new revision of these species seems to be necessary.

Specimens included into the present study have been identified as *B. fuscatum*, even though they are bigger than those reported by Braun from *Columba palumbus* L. (see Skryabin, 1948; present results – Table 1). Our observations as well as data provided by Rutkowska (1973) and Sitko (2001) demonstrate that the size of these trematodes varies considerably. A location of the uterus seems to be an important discriminative feature. *B. fuscatum* possesses an inter-caecal uterus, in *B. mesostoma* uterine branches overlap intestine and extend up to the lateral body margin (Witenberg ex Skryabin, 1948). This feature, however, is not clearly depicted in *B. mesostoma* figures (cfr. Skryabin, 1948 Fig. 71; Bykhovskaya-Pavlovskaya, 1955 Fig. 14; Bykhovskaya-Pavlovskaya, 1962 Fig. 50; Machalska, 1980 Fig. 1c). If the topography of the uterus and intestine caeca was similar to that shown on above *B. mesostoma* figures, or the same as in our trematodes (sometimes overlapping the intestine), it could be presume that *B. fuscatum* and *B. mesostoma* represent the same species and *B. fuscatum* should be considered just a junior synonym of *B. mesostoma*.

Family: Echinostomatidae Dietz, 1909

#### 3. *Echinoparyphium recurvatum* (Linstow, 1873)

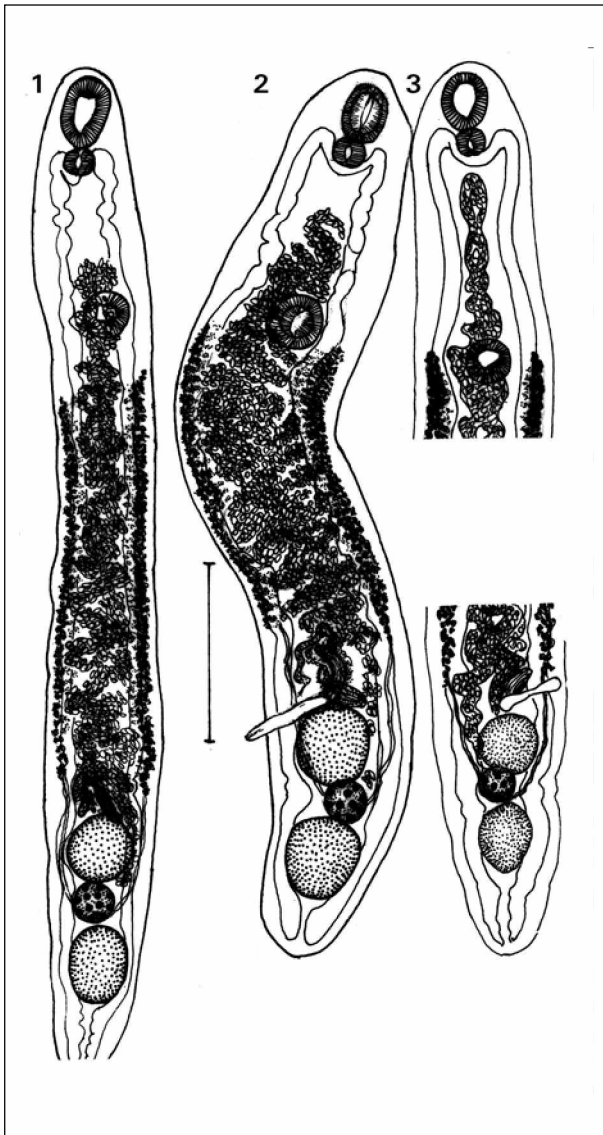
Host: *Charadrius hiaticula* – new host species.

Locality: Turany above Ondava (eastern Slovakia).

Table 1. Measurements of *Brachylaima fuscatum* and *B. mesostoma*

Species	<i>B. fuscatum</i>						<i>B. mesostoma</i>			
	Present data						Braun ex Skryabin (1948)	Sitko (2001)	Witenberg ex Skryabin (1948)	
Specimen No.	1	2	3	4	5	6	Total range			
Figure	1	2 and 4	3	5	5					
Body length (mm)	5.63	4.65	5.46	5.14	5.00	damaged	4.65 – 5.63	5.33	2.1	
Body width	616	817	739	794	849	1037	616 – 1037	1114	600	
Oral sucker	343×249	328×277	312×257	343×282	367×328		312 – 367×249 – 328	280 – 360×280 – 300	408 – 450	
Pharynx	151×168	156×183	140×172	160×179	156×195		140 – 160×168 – 195	150	198 – 258	
Ventral sucker	273×277	312×312	281×277	281×289	335×195	367×367	273 – 367×277 – 367	240	?	
Distance 1* (mm)	1.15	1.16	1.48	1.25	1.22		1.15 – 1.48			
Distance 2** (mm)	1.10	1.15	1.42	1.21	1.20		1.10 – 1.42		0.7	
Anterior testis	359×347	438×429	320×312	405×503	390×343	366×366	320 – 438×312 – 503	400 length	482×458	
Posterior testis	425×324	445×436	378×343	406×394	406×345	378×390	378 – 445×324 – 436	400 length	482×482	
Cirrus – sac		276×62	234×124				276 – 312	220×73	180×70	
Cirrus		507×52 – 45 – 29	335×48 – 48 – 25				335 – 507×48 – 52			
Ovary	210×226	250×257	210×203	296×250	164×230	218×249	164 – 296×203 – 257	200 rounded	462×450	
Eggs	30 – 31	27 – 29×16	27 – 28×17	27 – 29×17 – 19	31 – 34×17 – 20	26 – 29×17 – 20	26 – 31×16 – 20	27×14 – 18	29 – 32×16	32×23

\* Distance 1 – distance between ventral sucker and anterior extremity of the body; \* \* distance 2 – distance between centres of oral and ventral suckers



Figs. 1 – 3. *Brachylaima fuscatum* (Rudolphi, 1819) from *Pluvialis apricaria*. Variability in the body size and topography of internal organs. Scale-bar: 1mm

Site of infection: small intestine.

Prevalence and intensity: 22.2 % (2/9) and 4 and 12 specimens.

Remarks: *E. recurvatum* is relatively widespread in water-birds. Morphology and variability of investigated trematodes corresponded with data recorded in available keys and monographs (Skryabin and Baschkirova, 1956; Yamaguti, 1971; Sitko, 1993).

#### 4. *Himasthla* sp.

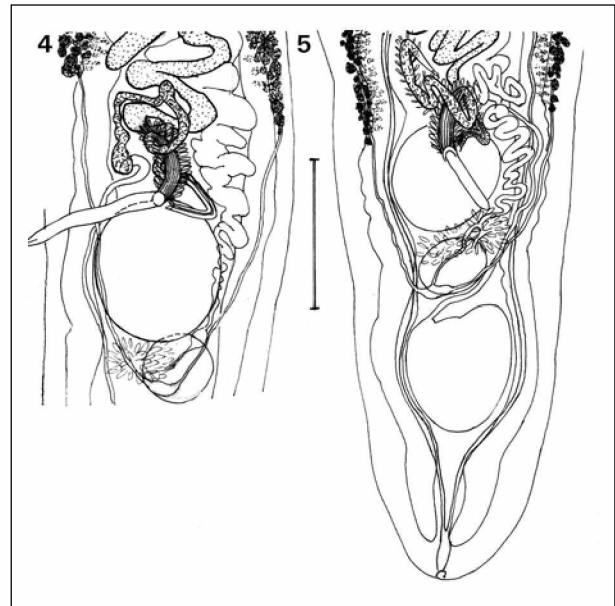
Host: *Charadrius dubius* – new host species.

Locality: Senné (eastern Slovakia).

Site of infection: small intestine.

Prevalence and intensity of infection: 1.8 % (1/56) and fragments of 2 specimens.

Fragments of 2 trematodes 2.3 – 2.4 × 0.3 mm. Anterior



Figs. 4 – 5. *Brachylaima fuscatum* (Rudolphi, 1819) from *Pluvialis apricaria*. 4 – opening of genitalia and position of vitellaria; 5 – the arrangement of the posterior part of the body. Scale-bar: 500 µm

part of the body missing. Body margins fluted, tegument armed with transverse rows of spines. Testes and ovary tandem, situated in posterior part of the body. Ovary rounded, pre-testicular, 245 × 146 and 248 × 106 in size. Vitellaria in lateral fields, in better-preserved specimen extending to testicular region (Fig. 6). Eggs 76 × 55 in size.

Remarks: By morphology and size of organs in fragments, a total length of these trematodes was estimated to approximately 4 mm. Number of spines in head collar and another characters of the anterior part of the fluke fragments was not determined. However, the topography of organs and armament of the tegument tallies with the diagnosis of the genus *Himasthla* Dietz, 1909. The egg size and proportions of fragments refers to smaller form of *H. militaris* (Rudolphi, 1802), described in charadriids from western and southern Europe. Sitko (1993) presents more recent morphological data on *H. militaris*. *C. dubius* is a new host species for trematodes of the genus *Himasthla*.

Family: Microphallidae Travassos, 1920

#### 5. *Levinseniella somateriae* Kulachkova, 1958

Host: *Pluvialis apricaria* – new host species.

Locality: Senné (eastern Slovakia).

Site of infection: small intestine.

Prevalence and intensity of infection: 7.1 % (1/14) and > 100 specimens.

Very small trematode parasites 137 – 203 × 93 – 141. Body mostly triangle-shaped (Figs 7 and 8). Anterior two-thirds of the body gently spined. Oral sucker subterminal, rounded 27 – 34 in diameter. Prepharynx undetectable. Pharynx usually rounded, 12 – 16 in longer diameter. Oesophagus to 40 in length. Intestinal caeca not extending

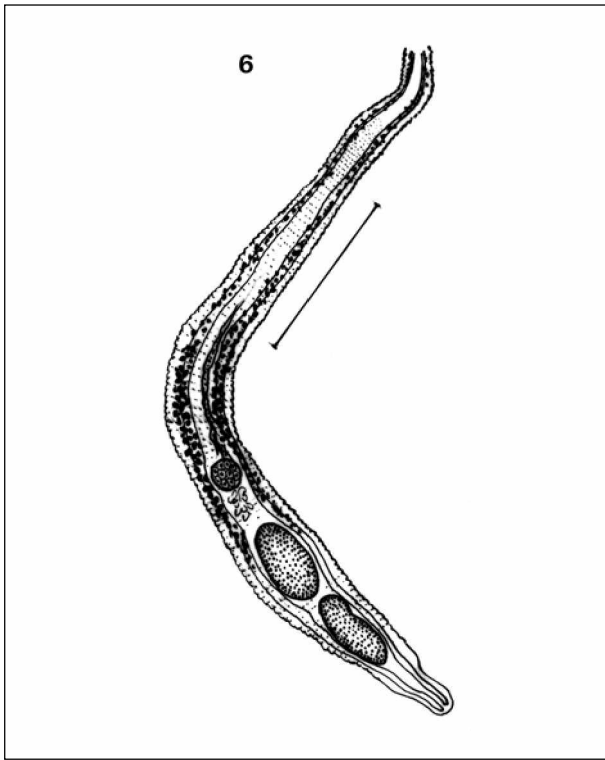
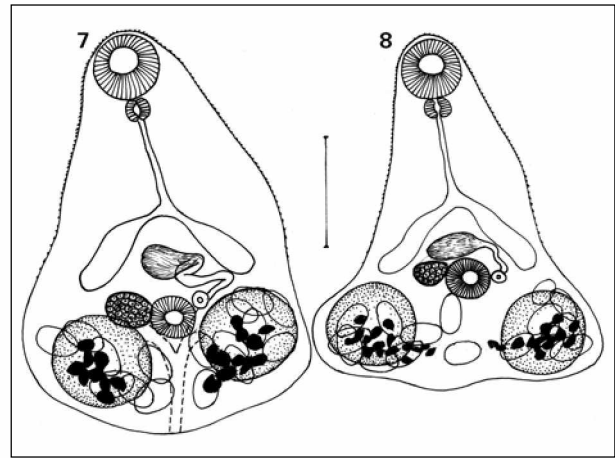


Fig. 6. *Himasthla* sp. from *Charadrius dubius*. The fragment of the premature specimen. Scale-bar: 500  $\mu$ m

posteriorly to testes (Figs. 7 and 8). Ventral sucker rounded 20 – 24 in diameter, situated between testes (Fig. 7), or anterior to them, on the boundary between the second and last third of the body (rarely in the hindbody). The distal margin of ventral sucker situated at 60 – 80 % of the total length of the trematode (measured from the anterior extremity of the body). Genital organs posterior to intestinal branches; their topography and position in relation to the intestine is variable, depending - among others - on the location of ventral sucker and overall shape of the hindbody. Testes mostly rounded, 41 – 58 in diameter, rarely oval 55  $\times$  37; symmetrical, postovarian. Testes with gentle indentations were found in one particular specimen. Seminal vesicle anterior to ventral sucker between caeaca. Genital pore on the left side, lateral to ventral sucker. Ovary oval, or irregularly triangle-shaped, located on the right to the ventral sucker. Vitellaria grouped in two lateral fields in the region of testes; in two specimens the two fields of vitelline follicles unite in hindbody. Eggs less numerous, 20 – 22  $\times$  12 – 14 in size.

Remarks: Microphallids investigated resemble *Levinseniella minuta* Price, 1934, but this species is characterised by complex structure of the genital atrium, likewise *Atriotrema lecitholaterale* Belopolskaja, 1958, which is much larger, measuring 374 – 431. Our specimens, however, are most similar to the species described by Kulachkova as *Levinseniella somateriae* with the body size 127 – 167  $\times$  92 – 136, small genital atrium and well developed prostatic glands. Nevertheless, the identity of *L. somateriae* has of-



Figs. 7 – 8. *Levinseniella somateriae* Kulatschkova, 1958? from *Pluvialis apricaria*. Variability in the body size and topography of internal organs. Scale-bar: 50  $\mu$ m

ten been questioned before (see Belopolskaya, 1963; Deblock, 1980). Galaktionov (1991) in his study on morphogenesis of the hermaphroditic generation of *Microphallus pirum* (Afanassyev, 1941) stated that *L. somateriae* is only a synonym of *M. pirum*. Because answering these questions goes beyond the scope of this study, we adopted the system by Belopolskaya (1963) and designated the trematode *Levinseniella somateriae* Kulachkova, 1958. A finding of *L. somateriae* is of great interest, as it a typical representative of the littoral helminth fauna within the continental Europe. *P. apricaria* represents a new host record.

## CESTODA

Family: Hymenolepididae Fuhrman, 1906

### 6. *Aploparaksis brachyphallos* (Krabbe, 1869)

Host: *Charadrius hiaticula*.

Locality: Chmelnica (eastern Slovakia).

Site of infection: small intestine.

Prevalence and intensity 22.2 % (2/9) and 3 specimens (immature).

Immature tapeworms with immature genitals. Scoleces deformed. Rostellum with 10 aploparaksoid hooks, 21 – 22 in length (Fig. 9). Blade 9, root 17, guard 8 – 9. Width of the hook 11.

### 7. *Aploparaksis crassirostris* (Krabbe, 1869) *sensu* Spaskey (1963)

Host: *Charadrius hiaticula*.

Locality: Chmelnica (eastern Slovakia).

Site of infection: small intestine.

Prevalence and intensity: 11.1 % (1/9) and 2 specimens (immature).

Mature hermaphroditic proglottides absent. Scolex 214 – 224 in wide, suckers 103 – 105 in diameter. Rostellum width at the level of hooks 119 – 121. Ten hooks of length 32 – 35 (Fig. 10). Blade 17 – 18, root 25 – 28, guard 15 –

16. Hook width 17. Cirrus not protruded.

Remarks: *A. crassirostris* was considered being a parasite of several charadriids. Krabbe (1869) described this species from several snipes and sandpipers, namely from *Scolopax gallinago* L., *S. major* (Latham, 1787), *S. media* (Latham, 1787), *S. rusticola* L. and *Totanus stagnatilis* (Bechstein, 1803). Recently, lots of them were re-classified and are members of genera *Gallinago* and *Tringa* (Ferianc, 1977). *A. crassirostris* was reported from many other charadriid species; Spassky (1963), for instance, quoted 24 host records, including *Charadrius hiaticula*. Bondarenko *et al.* (2002) and Bondarenko and Kontrimavichus (2003) re-described *A. crassirostris* on the basis of the type material and stated that *A. crassirostris* is a specific parasite of common snipe, *Gallinago gallinago* (L.). Tapeworms from *C. hiaticula* investigated in present paper were immature, hence their reliable determination was difficult. The size of rostellar hooks, their measurements and other characteristics correspond to *A. crassirostris* from North America (Bondarenko *et al.*, 2002).

8. *Aploparaksis pseudofilum* (Clerc, 1902) *sensu* Bondarenko (1990)

Host: *Charadrius hiaticula* - the new host species.

Locality: Chmelnica (eastern Slovakia).

Site of infection: small intestine.

Prevalence and intensity: 11.1 % (1/9) and 3 strobila without scolex.

Hermaphroditic proglottides with only one testis. Protruding cirrus 38 – 44 long and in the middle 17 – 18 wide. The surface of cirrus is typically armed (Fig. 12). Measurements of strobilar characters are within the wide range of variability of this species (Bondarenko, 1990).

9. *Aploparaksis* sp. (cfr. Spassky, 1966)

Host: *Charadrius hiaticula*.

Locality: Chmelnica (eastern Slovakia).

Site of infection: small intestine

Prevalence and intensity 11.1 % (1/9) and 2 specimens (immature).

Tapeworms up to 15.0 x 0.3 mm, genital organs poorly developed. Scoleces deformed, with 10 hooks, 27 – 29 in length (Fig. 11). Blade 14 – 17 root 18 – 21, guard 9 – 10, handle 45. Hook width 12. Primordium of cirrus-sac extends into the middle of proglottis. Testis oval. Distal part of cirrus narrow, with bulbous enlargement of the base, 7 in diameter.

Remarks: Measurements of hooks and the shape of the basal part of cirrus most correspond to *Aploparaksis andrei* Spassky, 1966, recorded from bird hosts of the genus *Tringa* from Kamchatka (Spasskaya, 1966).

Family: Dilepididae Railliet et Henry, 1909

10. *Anomotaenia* spp.

Host: *Charadrius dubius*.

Localities: Senné, Chmelnica, Bardejov (eastern Slovakia).

Site of infection: small intestine.

Prevalence: *C. dubius* - (*Anomotaenia* sp. 1) 3.6 % (2/56) and (*Anomotaenia* sp. 2) 35.7 % (20/56).

The two morphologically similar forms of *Anomotaenia* were found in *C. dubius*. In *Anomotaenia* sp. 1, rostellar hooks are 12 – 14 long (Fig. 14) and in shape, they are similar to type material of *A. microrhyncha* (Krabbe, 1869), (Fig. 13) from *Charadrius hiaticula*. In *Anomotaenia* sp. 2, hooks are 16 – 18 in length (Fig. 15) and by shape they resemble hooks of *A. tringae* (Burt, 1940), (Fig. 16). However, *Anomotaenia* sp. 2 differs from the latter taxon in greater number of testes. Both forms are difficultly distinguishable from both *A. microrhyncha* and *A. tringae* as well as from *A. microphallos* (Krabbe, 1869) (Fig. 17).

Remarks: A deeper taxonomic research of these tapeworms performed on newly collected material seems to be necessary, but it goes beyond the scope of present faunistic study. Data on *A. microrhyncha* from *P. pugnax* were previously presented by Macko (1963).

11. *Megalacanthus guiariti* (Tseng-Shen, 1932)

Hosts: *Charadrius dubius*; *C. hiaticula* – the new host species.

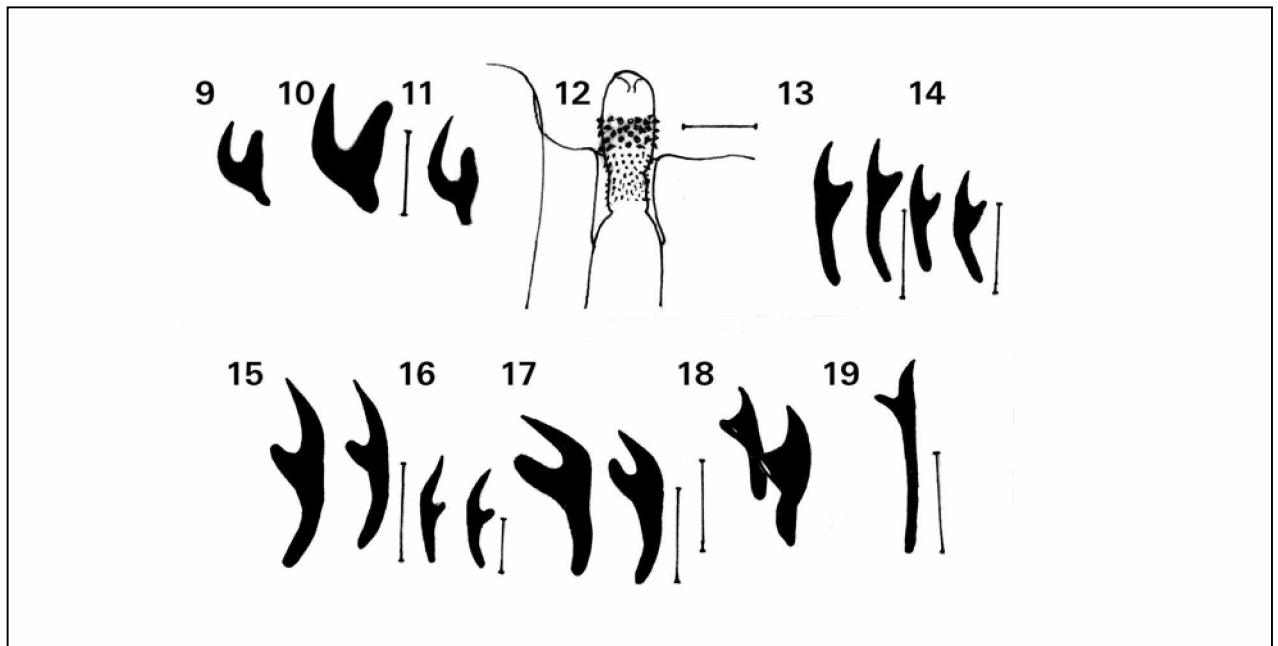
Localities: Senné, Bardejov, Chmelnica, Ostrov near Moča (eastern and south-western Slovakia).

Site of infection: small intestine.

Prevalence and intensity of infection: *C. dubius* 10.7 % (6/56) and 1 – 9 specimens; *C. hiaticula* 22.2 % (2/9) and 1 and 5 specimens.

Tapeworms 47 – 84 mm long and 1.6 – 1.9 mm wide. Scolex in natural state 561 – 655 wide, suckers 171 – 210 in diameter; scolex in permanent slides 612 – 912, suckers 188 – 226. Rostellar hooks (Fig. 20) 30 – 32 in number, spaced in two circles. Longer hooks 85 – 103, blade 38 – 46, root 52 – 55, width 17 – 19. Shorter hooks 81 – 91 in length, blade 41 – 48, root 38 – 48, width 14 – 16. Genital pores alternate irregularly. Number of testes varies in individual strobila (13 – 17; 14 – 16; 14 – 18; 18 – 21, rarely 18 – 24). Cirrus-sac in mature and postmature proglottides 183 – 328 x 27 – 35. Slightly spiny cirrus protruding at the most up to 74 – 82. Basal enlargement of cirrus 13 – 14, distal narrowing from 9 to 7 (Fig. 21). Ovary 265 – 295 in longer diameter. In premature proglottides ovary compact, more or less rounded. In mature proglottides, rarely slightly lobed (in *C. dubius*, Fig. 22) or lobed (in *C. hiaticula*, Fig. 23). Vitellarium circular or transversely oval, compact, or slightly lobed, rarely lobed, 93 – 156 in diameter. Uterus reticulate. Monoovular capsules 117 – 156 or up to 210 in diameter in gravid proglottides. Eggs 41 – 59 x 38 – 51 in size. Oncosphere 34 x 38. Central embryonic hooks 34 – 38; lateral hooks of unequal thickness, 22 – 25 long.

Remarks: Present data contribute to the knowledge on morphometric characters of strobila and hooks of *M. guiariti*. Matevosyan (1963), according to Tseng-Shen (1932), reported the size of this tapeworm being 17.0 x 0.68 mm, the number of hooks 30 and their size 84 – 96, however, measurements of parts of individual hooks are not given. The different number of testes (24) was found in present



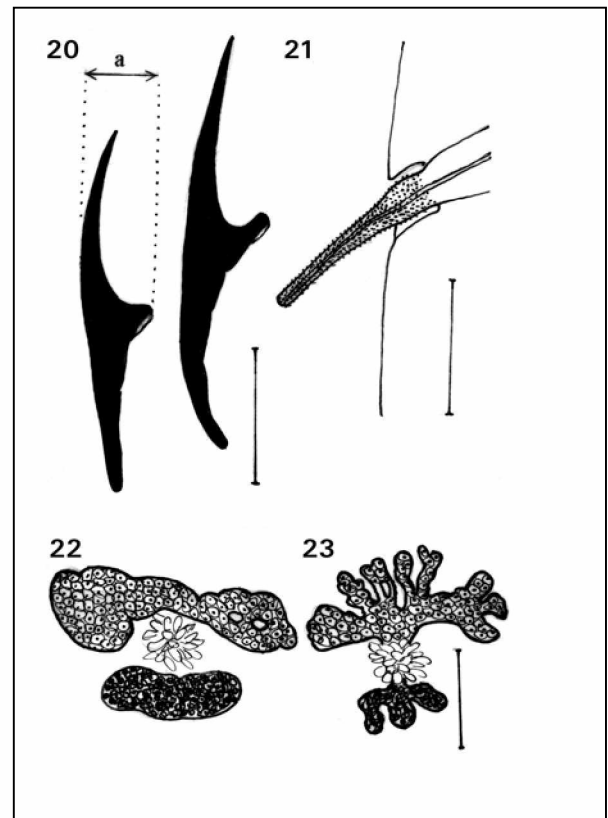
Figs. 9 – 19. Rostellar hooks of different tapeworms and the cirrus of *Aploparaksis pseudofilum* (Clerc, 1902). 9 – *Aploparaksis brachyphallos* (Krabbe, 1869) from *Charadrius hiaticula*; 10 – *Aploparaksis crassirostris* (Krabbe, 1869) from *C. hiaticula*; 11 – *Aploparaksis* sp. (cf. *A. andrei* Spassky, 1966) from *C. hiaticula*. Scale-bar (Figs. 9 – 11): 20  $\mu$ m; 12 – Cirrus of *Aploparaksis pseudofilum* from *Charadrius hiaticula*. Scale-bar: 20  $\mu$ m; 13 – *Anomotaenia microrhyncha* (Krabbe, 1869) from *Philomachus pugnax*; 14 – *Anomotaenia* sp. 1 from *Charadrius dubius*; 15 – *Anomotaenia* sp. 2 from *C. dubius*; 16 – *Anomotaenia tringae* Burt, 1940 from sandpipers of the genus *Tringa* (by Dubinina, 1953); 17 – *Anomotaenia microphallos* (Krabbe, 1869) from *Vanellus vanellus* (orig). Scale-bars (Figs. 13 – 17): 10  $\mu$ m; 18 – Dilepididae gen. sp. from *Charadrius dubius*; 19 – *Proterogynotaenia dougi* Sandeman, 1959 from *Philomachus pugnax*. Scale-bars (Figs 18 and 19): 20  $\mu$ m.

tapeworm material in comparison to literature-based data (20). The size and morphology of ovary and vitellarium have been specified. Dubinina (1953) reported 30 – 31 of rostellar hooks 82 – 98 long and testis number 12 – 20 in *M. guiarti*. Baer (1959) described a new subspecies *Monopylidium guiarti africanum* from long-toed lapwing – *Hemiparra crassirostris* on the basis of larger rostellar hooks measuring 114 – 127 and 116 – 130.

Family: Progynotaeniidae Fuhrman, 1936  
 12. *Proterogynotaenia dougi* Sandeman, 1959  
 Host: *Pluvialis apricaria*.  
 Locality: Senné (eastern Slovakia).  
 Site of infection: small intestine.

Prevalence and intensity of infection: 7.1 % (1/14) and 1 specimen.

A not preserved tapeworm 2.0  $\times$  1.0 mm in size, with 8 proglottides, the two additional proglottides (postmature and gravid) were separated from the strobila. Scolex width 386, suckers rounded, 137 in diameter. Rostellum with 2 circles of hooks, after staining hooks fell off, only one small hook, 14 in length was saved. Male gonads typical of the genus *Proterogynotaenia*. The size of cirrus-sac and testis number increases in maturing proglottides; cirrus-sac in the last proglottis 310  $\times$  120 in size. Fully protruded cirrus 269 long, armed with spines. Proximal part of cirrus enlarged, 52 in diameter, its distal part cylindrical, 34 in width. Uterus lobbed. Testes are located in two groups alongside uterus, 19 and 16 in number (total number 35). In separated proglottis 880  $\times$  707 cirrus-sac measured 467  $\times$  148, testes in two groups 18 a 22 (40). Eggs 38 – 58  $\times$  24



Figs. 20 – 23. *Megalacanthus guiarti* (Tseng-Shen, 1932) from *Charadrius dubius*. 20 – rostellar hooks, a – the hook width. Scale-bar: 30  $\mu$ m; 21 – cirrus. Scale-bar: 60  $\mu$ m; 22 – 23 – variability in female gonads. Scale-bar: 100  $\mu$ m

– 28. Embryophore  $61 \times 30$  and oncosphere  $19 - 28 \times 24 - 28$ . Embryonic hooks  $14 - 16$ .

Remarks: During investigations of *P. dougi* coming from various bird hosts and the same locality (Senné), a cestode of size  $2.6 \times 1.3$  mm was found in *Philomachus pugnax* (Macko and Špakulová, 1995). Strobila comprised of 9 proglottides, scolex 288, suckers unclear, about 86 in diameter. Rostellum width 117, 10 and 5 hooks measured 38 and 14, respectively (Fig. 19). Spiny cirrus protruded, 218. A finding of *P. dougi* in *P. pugnax* represented a new host record.

13. Dilepididae gen. sp.

Host: *Charadrius dubius*.

Locality: Bardejov (eastern Slovakia).

Site of infection: small intestine.

Prevalence and intensity: 1.8 % (1/56) and 3 specimens (immature).

Tapeworms  $3.0 - 3.5 \times 0.39 - 0.41$  mm in size, still without differentiated gonads. Scolex width 250 – 305. Suckers rounded, without armature. Deformed rostellum with approximately 38 – 40 hooks in two circles. Length of smaller hooks 30 – 32, blade 12 – 14, root 17 – 18. Hook width 8.5 (Fig. 18).

## Conclusion

The following new information on plathyhelminths of shorebirds has been gained through the present study:

- 1) seven new host-parasite combination were recorded for European fauna;
- 2) the study has revealed a high degree of phenotypical variability of the trematode *Brachylaema fuscatum*. Problems concerning the systematic status and validity of this taxon have been pointed out;
- 3) of great interest is a finding of the trematode *Levinseniella somateriae* (Microphallidae), a typical representative of the littoral helminth fauna, within the continental Europe;
- 4) the two new morphological forms of the tapeworm *Anomotaenia* sp. have been described in *Charadrius dubius*;
- 5) the study contributed significantly to the knowledge about morphology and morphometry of helminth parasites of shorebirds in the Slovak Republic.

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