

A Checklist of Cestodes (Platyhelminthes: Cestoda) of Waterfowl (Aves: Anseriformes) in Bulgaria

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Abstract: A survey of cestodes (Platyhelminthes: Cestoda) recorded from the waterfowl (Aves: Anseriformes) in Bulgaria is presented. Up to now, 52 cestode species of the order Cyclophyllidea, belonging to the families Dilepididae (3 species) and Hymenolepididae (49 species), have been recorded from various localities in the country. As hosts of cestodes, 16 wild waterfowl species were recorded. The most species-rich cestode assemblages have been recorded in *Anas platyrhynchos* (26 species), *A. querquedula* (20) and *A. crecca* (14); 18 and 9 cestode species were recorded in domestic ducks and geese, respectively.

Key words: Cestoda, waterfowl, Anseriformes, Bulgaria, bibliography

Introduction

The order Anseriformes consists of about 150 bird species classified in two extant families: Anhimidae (screamers) and Anatidae. The latter family includes over 140 species of waterfowl, including ducks, geese and swans (HOWARD, MOORE 1980). According to MICHEV *et al.* (2012), 40 species of anseriform birds are nesting and (or) migrating in the Balkan Peninsula, including in Bulgaria; further 12 species are registered as rare or potentially occurring as single individuals. Despite the well-presented diversity of this avian group in the region, its cestode fauna has not been sufficiently studied in almost all Balkan countries. There are a few records of cestodes mainly from domesticated anatids from Turkey (five cestode species, see KURTPINAR, MERDIVENCI 1956, GICIK, ARSLAN 2003), Romania (two species, see CHIRIAC 1960) and Greece (two species, see PAPAZHARIADOU *et al.* 2008). Cestodes of the waterfowl of the former Yugoslavia are relatively well studied (MIKACIC, ERLICH 1940, 1941, BRGLEZ 1981). In his review on

the helminth parasites of birds in Slovenia, BRGLEZ (1981) reported 38 cestode species of 19 genera, collected from 13 species of the order Anseriformes. The aim of the present review is to summarise the information of cestode parasites of anseriform birds, which have been recorded in Bulgaria until 2012.

Materials and Methods

The cestode species are arranged according to the classification adopted by the database of Fauna Europaea (<http://www.faunaeur.org>). The list of the localities in Bulgaria follows the biogeographical units described by GRUEV & KUZMANOV (1994). The following abbreviations are used: BSR, Black Sea Region; MBR, Middle-Bulgarian Region; NBR, North-Bulgarian Region; SBR, South-Bulgarian Region. The nomenclature of the birds follows HOWARD & MOORE (1980). Synonyms used in the Bulgarian helminthological literature only are in-

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cluded. The reports in which the relevant species has been mentioned under a synonymous name (in addition to the valid name) are marked by asterisk (*).

Results

Checklist of cestodes from Anseriformes in Bulgaria

Phylum Platyhelminthes

Class Cestoda

Order Cyclophyllidea BRAUN, 1900

Family Dilepididae FUHRMANN, 1907

Genus *Anomotaenia* COHN, 1900

(1) *Anomotaenia* sp.

Report: PASPALOV, PASPALOVA (1965).

Host: *Anas platyrhynchos*.

Distribution in Bulgaria: SBR: Petrich Region.

Genus *Dilepis* WEINLAND, 1858

(2) *Dilepis undula* (SCHRANK, 1788) WEINLAND, 1858

Report: PASPALOV, PASPALOVA (1965).

Host: *Anas platyrhynchos*.

Distribution in Bulgaria: SBR: Petrich Region, Gotse Delchev Region.

General distribution: Holarctic (SCHMIDT 1986).

Remarks: Typically, *D. undula* is a parasite of passeriform birds. PASPALOV & PASPALOVA (1965) recorded it also from *Turdus merula*, *T. viscivorus*, *Corvus cornix*, *Passer montanus* and *Sturnus vulgaris* in Southern Bulgaria.

Genus *Platyscolex* SPASSKAYA, 1962

(3) *Platyscolex ciliata* (FUHRMANN, 1913) SPASSKAYA, 1962

Report: VASILEV (1973).

Host: *Anas platyrhynchos f. dom.*

Distribution in Bulgaria: NBR: marshes along the Danube, Northeastern Bulgaria.

General distribution: Holarctic (SCHMIDT 1986, EWART, McLAUGHLIN 1990, HANZELOVA, RYSAVY 1999).

Family Hymenolepididae ARIOLA, 1899

Genus *Aploparaksis* CLERC, 1903

(4) *Aploparaksis furcigera* (RUDOLPHI, 1819) FUHRMANN, 1926

Report: KORNUSHIN *et al.* (1984).

Host: *Anas platyrhynchos*.

Distribution in Bulgaria: BSR: Dolno Ezerovo (Burgas Region).

General distribution: Holarctic (SPASSKAYA 1966, SCHMIDT 1986).

(5) *Aploparaksis filum* (GOEZE, 1782) CLERC, 1903

Report: KAMBUIROV, VASILEV (1972).

Host: *Mergus serrator*.

Distribution in Bulgaria: NBR: Sofia.

General distribution: Holarctic and Afrotropic

(SPASSKAYA 1966, SCHMIDT 1986, MAKSIMOVA 1989).

Remarks: In addition to *M. serrator*, this species has been reported from charadriiform birds in Bulgaria, i.e. *Gallinago media* (see PETROVA 1977) and *Gallinago gallinago* (see PETROVA 1978).

Genus *Cloacotaenia* WOLFFHÜGEL, 1938

(6) *Cloacotaenia megalops* (NITZSCH IN CREPLIN, 1829) WOLFFHÜGEL, 1938

Reports: [1] KAMBUIROV, VASILEV (1972); [2] VASILEV (1973); [3] KORNUSHIN *et al.* (1984).

Hosts: *Anas platyrhynchos* [1, 3]; *A. platyrhynchos f. dom.* [2]; *A. clypeata* [1, 3]; *A. penelope* [1]; *A. acuta* [1]; *A. crecca* [1, 3]; *A. querquedula* [1, 3]; *Aythya nyroca* [1, 3]; *A. ferina* [1]; *Mergus serrator* [1].

Distribution in Bulgaria: MBR: Pazardzhik [1]; NBR: Sofia, Dobrich Region [1], River Danube [2], Srebarna (Silistra Region) [3], Dolno Tserovene (Montana Region) [3]; BSR: Dolno Ezerovo (Burgas Region) [3].

General distribution: Cosmopolitan (SPASSKAYA 1966, SCHMIDT 1986).

Remarks: STOIMENOV (1957) recorded this species as *Hymenolepis megalops* from *Gallus gallus f. dom.* from Shumen Region, North Bulgaria.

Genus *Dicranotaenia* RAILLIET, 1892

(7) *Dicranotaenia coronula* (DUJARDIN, 1845) RAILLIET, 1892

Reports: [1] VASILEV (1962a); [2] KAMBUIROV, VASILEV (1972); [3] VASILEV (1973); [4] KORNUSHIN *et al.* (1984).

Hosts: *Anser anser f. dom.* [1]; *A. albifrons* [2]; *Anas penelope* [2]; *A. platyrhynchos* [2, 4]; *A. platyrhynchos f. dom.* [3]; *A. crecca* [4]; *Aythya nyroca* [2].

Distribution in Bulgaria: NBR: River Rositsa [1], Pleven Region [2], Sofia Region [2], Dobrich Region [2], River Danube [3], Furen, Marchevo (Montana Region) [4]; MBR: Pazardzhik Region [2], Yambol Region [2]; BSR: Dolno Ezerovo (Burgas Region) [4], Vaklino and Durankulak (Dobrich Region) [4].

General distribution: Holarctic, Neotropical and Australian Regions (SPASSKAYA 1966, SCHMIDT 1986, MACKO 1991).

Genus *Diorchis* CLERC, 1903

(8) *Diorchis danutae* (CZAPLINSKI, 1956) SPASSKY, 1963

Report: KAMBUIROV, VASILEV (1972).

Host: *Anas platyrhynchos*.

Distribution in Bulgaria: NBR: Sofia; BSR: Dobrich.

General distribution: Palaearctic (SCHMIDT 1986, CZAPLINSKI, SZELENBAUM-CIELECKA 1986).

(9) *Diorchis elisae* (SKRJABIN, 1914) SPASSKY *et* FREZE, 1961

Synonym: *Diorchis vigisi* KROTOV, 1949 [1*].

Reports: [1] KAMBUIROV, VASILEV (1972); [2] VASILEV (1973); [3] KORNUSHIN *et al.* (1984).

Hosts: *Anas querquedula* [1]; *A. platyrhynchos* [1],

A. platyrhynchos f. dom. [2]; *Tadorna tadorna* [3].

Distribution in Bulgaria: NBR: Belene [1], Pleven Region [1]; MBR: Yambol Region [1], Nova Zagora, Stara Zagora [2]; BSR: Krapec (Dobrich Region) [3].

General distribution: Palaearctic (SPASSKAYA 1966, SCHMIDT 1986).

Remarks: On the basis of the re-examination of the type-specimens of *D. vigisi*, TOLKACHEVA (1991) considered this species as a synonym of *D. elisae*.

(10) *Diorchis longiovum* SCHILLER, 1953

Report: KORNYUSHIN *et al.* (1984).

Host: *Anas crecca*.

Distribution in Bulgaria: BSR: Dolno Ezerovo (Burgas Region).

General distribution: Palaearctic and Afrotropic (SCHMIDT 1986, ALEXANDER, McLAUGHLIN 1997).

(11) *Diorchis nyrocae* YAMAGUTI, 1935

Report: KAMBUROV, VASILEV (1972).

Host: *Anas querquedula*.

Distribution in Bulgaria: MBR: Pazardzhik Region.

General distribution: Japan (YAMAGUTI 1935).

Remarks: The validity of this species is questionable. SPASSKAYA (1966) regarded it as a synonym of *D. elisae*. According to TOLKACHEVA (1991), all the hymenolepidids reported as *D. nyrocae* from waterfowl in the former USSR belong to *D. elisae*. BAER (1962) and McLAUGHLIN & BURT (1979) considered *D. nyrocae* as a synonym of the North-American species *D. microcirrosa* MAYHEW, 1929. Until now, the type-specimens of *D. nyrocae* have not been re-examined. In our opinion, the clarification of the taxonomic status of this species needs a detailed re-examination of its type series.

(12) *Diorchis parvogenitalis* MATHEVOSSIAN in SKRJABIN ET MATHEVOSSIAN, 1945

Report: KORNYUSHIN *et al.* (1984).

Host: *Anas querquedula*.

Distribution in Bulgaria: BSR: Dolno Ezerovo (Burgas Region).

General distribution: Palaearctic (SPASSKAYA 1966, SCHMIDT 1986, MAKSIMOVA 1989, TOLKACHEVA 1991).

Remarks: SPASSKAYA (1966) considered *D. parvogenitalis* as a synonym of *D. ransomi*. We follow the conclusions of CZAPLINSKI & SZELENBAUM (1974), which have redescribed and validated this species. Its validity has also been confirmed by TOLKACHEVA (1991).

(13) *Diorchis ransomi* JOHRI, 1939

Report: KAMBUROV, VASILEV (1972).

Host: *Anas querquedula*.

Distribution in Bulgaria: NBR: Sofia Region.

General distribution: Holarctic (SPASSKAYA 1966, SCHMIDT 1986, TOLKACHEVA 1991).

(14) *Diorchis spinata* MAYHEW, 1929

Report: VASILEV (1973).

Host: *Anas platyrhynchos f. dom.*

Distribution in Bulgaria: NBR: River Danube (Dobrich Region).

General distribution: Holarctic (SPASSKAYA 1966, SCHMIDT 1986, TOLKACHEVA 1991).

(15) *Diorchis stefanskii* CZAPLINSKI, 1956

Reports: [1] VASILEV (1962a); [2] KAMBUROV, VASILEV (1972); [3] VASILEV (1973); [4] KORNYUSHIN *et al.* (1984).

Hosts: *Anser anser f. dom.* [1]; *A. anser* [4]; *Anas querquedula* [2]; *A. penelope* [2]; *A. acuta* [2]; *A. platyrhynchos* [2, 4]; *A. platyrhynchos f. dom.* [3]; *A. crecca* [2]; *A. clypeata* [2]; *Netta rufina* [2].

Distribution in Bulgaria: "entire country" [3]; NBR: River Rositsa [1], Berkovitsa (Montana Region) [4], Plevn Region [2], Sofia Region [2]; MBR: Pazardzhik Region [2]; BSR: Dobrich Region [2], Dolno Ezerovo (Burgas Region) [4].

General distribution: Holarctic (SPASSKAYA 1966, SCHMIDT 1986, TOLKACHEVA 1991).

Genus *Diploposthe* JACOBI, 1896

(16) *Diploposthe laevis* (BLOCH, 1782) JACOBI, 1896

Reports: [1] VASILEV, KAMBUROV (1970); [2] KAMBUROV, VASILEV (1972); [3] VASILEV (1973); [4] PETROVA (1978); [5] KORNYUSHIN *et al.* (1984).

Hosts: *Anas penelope* [1, 2]; *A. platyrhynchos* [1, 2, 5]; *A. platyrhynchos f. dom.* [3]; *A. crecca* [5]; *A. strepera* [1, 2]; *A. acuta* [1, 2]; *A. querquedula* [1, 2, 5]; *Aythya nyroca* [1, 2, 4]; *A. ferina* [1, 2, 4]; *Netta rufina* [1, 2].

Distribution in Bulgaria: not mentioned [1]; NBR: Plevn, Sofia and Dobrich Region [2], Northeastern Bulgaria [3], Kalimantsi (Montana Region) [5], Garvan (Silistra Region) [5]; MBR: Pazardzhik Region [2, 4]; SBR: Topolovgrad Region [4]; BSR: Burgas Region [2], Dolno Ezerovo (Burgas Region) [5].

General distribution: Cosmopolitan (SPASSKAYA 1966, SCHMIDT 1986).

(17) *Diploposthe monoposthe* (DUBININA, 1953) SPASSKAYA, 1966

Reports: [1] VASILEV, KAMBUROV (1970); [2] KAMBUROV, VASILEV (1972).

Hosts: *Anas platyrhynchos* [1]; *Netta rufina* [1, 2].

Distribution in Bulgaria: not mentioned [1]; BSR: Shabla [2]; SBR: Blatnitsa [2].

General distribution: Palaearctic (DUBININA 1953, SPASSKAYA 1966).

(18) *Diploposthe skrjabini* MATHEVOSSIAN, 1942

Reports: [1] VASILEV, KAMBUROV (1970); [2] KAMBUROV, VASILEV (1972); [3] KORNYUSHIN *et al.* (1984).

Hosts: *Anas penelope* [1, 2]; *A. platyrhynchos* [1, 2]; *A. acuta* [1, 2]; *A. querquedula* [1, 2]; *Aythya nyroca* [1, 2, 3]; *A. ferina* [1, 2].

Distribution in Bulgaria: not mentioned [1]; NBR: Plevn, Sofia and Dobrich Region [2]; Sofia Zoo [3]; MBR: Pazardzhik [2].

General distribution: Palaearctic (SPASSKAYA 1966, SCHMIDT 1986).

Genus *Drepanidotaenia* RAILLIET, 1892

(19) *Drepanidotaenia lanceolata* (BLOCH, 1782)

RAILLIET, 1892

Reports: [1] GEORGIEV, DENEV (1959); [2] VASILEV (1962a); [3] VASILEV (1973).

Hosts: *Anser anser f. dom.* [1]; *Anas platyrhynchos f. dom.* [2, 3].

Distribution in Bulgaria: “entire country” [2]; NBR: Pavlikeni Region [1], Gorna Oryachovitsa Region [1]; Sofia Region [3].

General distribution: Cosmopolitan (SPASSKAYA 1966, SCHMIDT 1986).

Genus *Echinocotyle* BLANCHARD, 1891

(20) *Echinocotyle rosseteri* BLANCHARD, 1891

Report: KAMBUROV, VASILEV (1972).

Hosts: *Anas platyrhynchos*, *A. penelope*, *A. crecca*, *A. querquedula*.

Distribution in Bulgaria: MBR: Pazardzhik Region [1], NBR: Sofia Region [1].

General distribution: Holarctic, Indomalaya (SPASSKAYA 1966, SCHMIDT 1986).

Genus *Fimbriaria* FRÖLICH, 1802

(21) *Fimbriaria fasciolaris* (PALLAS, 1781)

FRÖLICH, 1802

Reports: [1] VASILEV (1962a); [2] KAMBUROV, VASILEV (1972); [3] VASILEV (1973); [4] KORNYUSHIN *et al.* (1984).

Hosts: *Anser anser f. dom.* [1]; *Anas platyrhynchos f. dom.* [3]; *A. platyrhynchos* [2, 4]; *A. crecca* [2, 4]; *A. strepera* [2]; *A. acuta* [2]; *A. penelope* [2]; *A. querquedula* [2, 4]; *Aythya nyroca* [2]; *Netta rufina* [2].

Distribution in Bulgaria: “entire country” [3]; NBR: river Rositsa [1], Pleven [2], Sofia Region [2], Dobrich [2], Garvan (Silistra Region) [4]; MBR: Stara Zagora [2], Yambol Region [2]; BSR: Dolno Ezerovo (Burgas Region) [4], Vaklino, Durankulak (Dobrich) [4].

General distribution: Cosmopolitan (SPASSKAYA 1966, SCHMIDT 1986).

Remarks: In addition to birds of the order Anseriformes, *F. fasciolaris* has been reported from galliform birds from various localities in Bulgaria, i.e. in *Meleagris gallopavo* from “a farm adjacent to Maritsa River” (VASILEV 1962b), *Gallus gallus f. dom.* from entire country (VASILEV 1963) and *Numida meleagris* from Vidin, Pleven, Shumen, Varna, Kyustendil and Stara Zagora Regions (VASILEV 1970).

Genus *Gastrotaenia* WOLFFHÜGEL, 1938

(22) *Gastrotaenia dogieli* (GYNETSINSKAYA, 1944)

SPASSKY, 1958

Report: KAMBUROV, VASILEV (1972).

Hosts: *Anas clypeata*, *A. querquedula*.

Distribution in Bulgaria: MBR: Pazardzhik Region [1]; NBR: Sofia Region [1].

General distribution: Palaearctic (SPASSKAYA 1966).

Genus *Microsomacanthus* LOPEZ – NEYRA, 1942

(23) *Microsomacanthus abortiva* (VON LINSTOW, 1904) LOPEZ-NEYRA, 1942

Synonym: *Hymenolepis abortiva* VON LINSTOW, 1904 [1].

Reports: [1] VASILEV (1962a); [2] KAMBUROV, VASILEV (1972); [3] VASILEV (1973).

Hosts: *Anser anser f. dom.* [1]; *Anas platyrhynchos* [2]; *A. platyrhynchos f. dom.* [3]; *A. acuta* [2].

Distribution in Bulgaria: NBR: river Rositsa [1, 3], Pleven Region [2], Sofia Region [2], lower Iskar river, Yantra river (Veliko Tarnovo) [3], Vratsa Region [3]; MBR: Stara Zagora Region [2], Yambol Region [2]; BSR: Dobrich [2].

General distribution: Holarctic (SPASSKAYA 1966, SCHMIDT 1986).

(24) *Microsomacanthus arcuata* (KOWALEWSKI, 1904) SPASSKY et SPASSKAYA, 1954

Reports: [1] KAMBUROV, VASILEV (1972); [2] KORNYUSHIN *et al.* (1984).

Hosts: *Aythya nyroca* [1]; *Anas querquedula* [2].

Distribution in Bulgaria: NBR: Pleven Region [1]; BSR: Dolno Ezerovo (Burgas Region) [2].

General distribution: Palaearctic (SPASSKAYA 1966, SCHMIDT 1986).

(25) *Microsomacanthus baeri* CZAPLINSKI et VAUCHER, 1977

Report: KORNYUSHIN *et al.* (1984).

Host: *Anas platyrhynchos*.

Distribution in Bulgaria: NBR: Furen (Vratsa Region), Berkovitsa (Montana Region).

General distribution: Palaearctic (SCHMIDT 1986).

Remarks: This species is described on the basis of the description of specimens identified by SPASSKAYA & SPASSKY (1961) as *Microsomacanthus fausti* (TSENG-SHEN, 1932) LOPEZ-NEYRA, 1942 from *Aythya fuligula* in Tuva (CZAPLINSKI, VAUCHER 1977). The same authors proposed a revision of *Furmaniella fausti* TSENG-SHEN, 1932 (see below).

(26) *Microsomacanthus compressa* (LINTON, 1892) LOPEZ-NEYRA, 1942

Reports: [1] KAMBUROV, VASILEV (1972); [2] VASILEV (1973).

Hosts: *Anas querquedula* [1]; *A. strepera* [1]; *A. platyrhynchos f. dom.* [2]; *Aythya nyroca* [1].

Distribution in Bulgaria: NBR: Pleven Region, Dobrich Region [1], marshes along the Danube River [2]; MBR: Yambol Region [1].

General distribution: Holarctic (SPASSKAYA 1986, SCHMIDT 1986).

(27) *Microsomacanthus fausti* (TSENG-SHEN, 1932) LOPEZ-NEYRA, 1942

Reports: [1] KAMBUROV, VASILEV (1972); [2] VASILEV (1973).

Hosts: *Anas platyrhynchos* [1]; *A. platyrhynchos f. dom.* [2]; *A. penelope* [1]; *Aythya nyroca* [1].

Distribution in Bulgaria: NBR: Pleven and Sofia Regions [1], marshes along the Danube River (Northeastern Bulgaria) [2]; MBR: Yambol Region [1].

General distribution: Palaearctic (SPASSKAYA 1966, SCHMIDT 1986).

Remarks: The validity of this species is questionable. CZAPLINSKI & VAUCHER (1977) revised *Furmaniella fausti* and revealed that the species had been described on the basis of specimens of two species, i.e. strobila of *Hymenolepis paramicrosoma* GAŠOWSKA, 1932 and a scolex of *Hymenolepis spiralibursata* CZAPLINSKI, 1956. The clarification of the taxonomic status of *M. fausti* as well as the exact identification of the specimens reported from Bulgaria need additional studies.

(28) *Microsomacanthus formosa* (DUBININA, 1953) YAMAGUTI, 1959

Reports: [1] KAMBUROV, VASILEV (1972); [2] KORNYUSHIN *et al.* (1984).

Hosts: *Anas platyrhynchos* [1, 2]; *A. crecca* [1].

Distribution in Bulgaria: NBR: Sofia Region [1]; BSR: Dolno Ezerovo (Burgas Region) [2].

General distribution: Palaearctic (SPASSKAYA 1966, SCHMIDT 1986).

(29) *Microsomacanthus formosoides* SPASSKAYA et SPASSKY, 1961

Report: KAMBUROV, VASILEV (1972).

Host: *Anas querquedula*.

Distribution in Bulgaria: MBR: Pazardzhik Region.

General distribution: Eastern Palaearctic (SPASSKAYA, SPASSKY 1961, SPASSKAYA 1966).

(30) *Microsomacanthus hopkinsi* (SCHILLER, 1951) SPASSKAYA, 1966

Reports: [1] KAMBUROV, VASILEV (1972); [2] KORNYUSHIN *et al.* (1984).

Host: *Anas platyrhynchos* [1, 2].

Distribution in Bulgaria: NBR: Sofia Region, MBR: Yambol Region [1]; BSR: Dolno Ezerovo (Burgas Region), Vaklino (Dobrich) [2].

General distribution: Holarctic (McLAUGHLIN, BURT 1970, MAKSIMOVA 1989).

(31) *Microsomacanthus paracompressa* (CZAPLINSKI, 1956) SPASSKAYA et SPASSKY, 1961

Reports: [1] KAMBUROV, VASILEV (1972); [2] VASILEV (1973); [3] KORNYUSHIN *et al.* (1984).

Hosts: *Anas platyrhynchos* [1, 3]; *A. platyrhynchos f. dom.* [2].

Distribution in Bulgaria: NBR: Pleven [1], Sofia Region [1], Dobrich Region [1], Northeastern Bulgaria, marshes along the Danube river and Northern Black Sea coast [2]; BSR: Durankulak (Dobrich Region) [3].

General distribution: Palaearctic (SPASSKAYA 1966, SCHMIDT, 1986).

Remarks: In addition to the anseriform birds reported as hosts of this species, VASILEV (1969) recorded it in *Meleagris gallopavo*.

(32) *Microsomacanthus paramicrosoma* (GAŠOWSKA, 1931) YAMAGUTI, 1959

Reports: [1] KAMBUROV, VASILEV (1972); [2] VASILEV (1973).

Hosts: *Anas querquedula* [1]; *A. platyrhynchos f. dom.* [2].

Distribution in Bulgaria: NBR: Sofia Region [1], marshes along the Danube River [2], MBR: Pazardzhik Region [1].

General distribution: Holarctic (SPASSKAYA 1966, SCHMIDT 1986).

(33) *Microsomacanthus parvula* (KOWALEWSKI, 1904) SPASSKAYA, 1966

Reports: [1] KAMBUROV, VASILEV (1972); [2] VASILEV (1973).

Hosts: *Anas platyrhynchos f. dom.* [2]; *A. platyrhynchos* [1]; *A. querquedula* [1]; *Aythya ferina* [1]; *A. nyroca* [1].

Distribution in Bulgaria: NBR: Sofia Region [1], Pleven Region [1], Vratsa [2], Veliko Tarnovo [2].

General distribution: Holarctic (SPASSKAYA 1966, SCHMIDT 1986).

(34) *Microsomacanthus spiralicirrata* MAKSIMOVA, 1963

Reports: [1] KAMBUROV, VASILEV (1972); [2] KORNYUSHIN *et al.* (1984).

Hosts: *Anas platyrhynchos* [1, 2]; *A. crecca* [2].

Distribution in Bulgaria: NBR: Dobrich Region [1]; BSR: Dolno Ezerovo (Burgas Region) [2].

General distribution: Palaearctic (MAKSIMOVA 1989).

(35) *Microsomacanthus* sp.

Report: KORNYUSHIN *et al.* (1984).

Hosts: *Anas crecca*, *A. platyrhynchos*.

Distribution in Bulgaria: BSR: Dolno Ezerovo (Burgas Region), Vaklino (Dobrich Region).

Remarks: According to KORNYUSHIN *et al.* (1984), the poor condition of the specimens studied did not allow exact identification of this material.

Genus *Monosaccanthes* CZAPLINSKI, 1967

(36) *Monosaccanthes kazachstanica* (MAKSIMOVA, 1963) CZAPLINSKI, 1967

Report: KORNYUSHIN *et al.* (1984).

Host: *Cygnus cygnus*.

Distribution in Bulgaria: BSR: Nesebar (Burgas Region).

General distribution: Palaearctic (MAKSIMOVA 1989).

Remarks: The species has been reported with an erroneous spelling as '*Monosaccanthos kazachstanica*' (see KORNYUSHIN *et al.* 1984).

Genus *Monotestilepis* GVOZDEV, MAKSIMOVA & KORNYUSHIN, 1971

(37) *Monotestilepis tadornae* GVOZDEV, MAKSIMOVA & KORNYUSHIN, 1971

Report: KORNYUSHIN *et al.* (1984).

Host: *Tadorna tadorna*.

Distribution in Bulgaria: BSR: Durankulak (Dobrich Region).

General distribution: Palaearctic (MAKSIMOVA 1989).

Genus *Retinometra* SPASSKY, 1955

(38) *Retinometra giranensis* (SUGIMOTO, 1934) SPASSKY, 1963

Report: KORNYUSHIN *et al.* (1984).

Host: *Anas querquedula*.

Distribution in Bulgaria: BSR: Dolno Ezerovo (Burgas Region).

General distribution: Palaearctic, Indomalaya (SPASSKAYA 1966, SCHMIDT 1986).

(39) *Retinometra longicirrosa* (FUHRMANN, 1906) SPASSKY, 1963

Synonym: *Hymenolepis fasciculata* RANSOM, 1909 [1].

Reports: [1] VASILEV (1962a); [2] KORNYUSHIN *et al.* (1984).

Hosts: *Anser anser f. dom.* [1]; *A. anser* [2].

Distribution in Bulgaria: "entire country" [1]; BSR: Krapec, Durankulak (Dobrich Region) [2].

General distribution: Palaearctic, Indomalaya (SPASSKAYA 1966, SCHMIDT 1986).

Remarks: The synonymy of *Hymenolepis fasciculata* RANSOM, 1909 and *Retinometra longicirrosa* has been proposed by SPASSKY (1963).

(40) *Retinometra macracanthos* (VON LINSTOW, 1877) SPASSKY, 1963

Report: KORNYUSHIN *et al.* (1984).

Host: *Anas querquedula*.

Distribution in Bulgaria: BSR: Dolno Ezerovo (Burgas Region).

General distribution: Holarctic (SPASSKAYA 1966, SCHMIDT 1986).

(41) *Retinometra skrjabini* (MATHEVOSYAN, 1945) SPASSKY, 1963

Report: KORNYUSHIN *et al.* (1984).

Host: *Anas querquedula*.

Distribution in Bulgaria: BSR: Dolno Ezerovo (Burgas Region).

General distribution: Palaearctic (SPASSKAYA 1966).

(42) *Retinometra* sp.

Report: KORNYUSHIN *et al.* (1984).

Host: *Anas querquedula*.

Distribution in Bulgaria: BSR: Dolno Ezerovo (Burgas Region).

Remarks: KORNYUSHIN *et al.* (1984) considered that this material differed from all known *Retinometra* spp. However, the quality of the specimens was not sufficient to propose a new species. The exact identification of this material needs additional investigations.

Genus *Sobolevicanthus* SPASSKY et SPASSKAYA, 1954

(43) *Sobolevicanthus dafilae* (POLK, 1942) YAMAGUTI, 1959

Report: KORNYUSHIN *et al.* (1984).

Host: *Anas crecca*.

Distribution in Bulgaria: BSR: Dolno Ezerovo (Burgas Region).

General distribution: Holarctic (SPASSKAYA 1966, SCHMIDT 1986).

(44) *Sobolevicanthus fragilis* (KRABBE, 1869) SPASSKY et SPASSKAYA, 1954

Report: KAMBUROV, VASILEV (1972).

Host: *Anas crecca*.

Distribution in Bulgaria: NBR: Sofia Region.

General distribution: Palaearctic (SPASSKAYA 1966, SCHMIDT 1986).

(45) *Sobolevicanthus gracilis* (ZEDER, 1803) SPASSKY et SPASSKAYA, 1954

Reports: [1] VASILEV (1962a); [2] KAMBUROV, VASILEV (1972); [3] VASILEV (1973); [4] KORNYUSHIN *et al.* (1984).

Hosts: *Anser anser f. dom.* [1]; *Anas platyrhynchos* [2, 4]; *A. platyrhynchos f. dom.* [3]; *A. acuta* [2, 4]; *A. clypeata* [2]; *A. crecca* [2]; *A. querquedula* [2]; *Aythya ferina* [2].

Distribution in Bulgaria: NBR: River Rositsa [1]; Pleven Region [2], Sofia Region [2], Garvan (Silistra Region) [4], Furen, Marchevo (Montana Region) [4]; MBR: Stara Zagora Region [2], Yambol Region [2]; BSR: Vaklino, Durankulak (Dobrich Region) [4], Dolno Ezerovo (Burgas Region) [4]; not mentioned [3].

General distribution: Holarctic, Indomalaya (SPASSKAYA 1966, SCHMIDT 1986).

Remarks: In addition to the above mentioned anseriform hosts, *S. gracilis* has also been recorded in some Galliformes from Bulgaria. VASILEV (1962b) recorded '*Hymenolepis (s. lato) meleagridis* (CLERC, 1902)' from *Meleagris gallopavo*. However, the author mentioned that the hermaphroditic proglottides are identical with those in *Hymenolepis gracilis*. The same author reported '*Hymenolepis gracilis* (ZEDER, 1803)' (syn. *Sobolevicanthus gracilis*) from *Gallus gallus dom.* from the territory of the entire country (VASILEV 1963).

(46) *Sobolevicanthus krabbeella* (HUGHES, 1940) RYJIKOV, 1956

Reports: [1] KAMBUROV, VASILEV (1972); [2] KORNYUSHIN *et al.* (1984)

Hosts: *Anas platyrhynchos* [2]; *A. crecca* [1, 2].

Distribution in Bulgaria: NBR: Pleven and Sofia Regions [1]; BSR: Dolno Ezerovo (Burgas Region), Vaklino (Dobrich Region) [2].

General distribution: Palaearctic (SPASSKAYA 1966, SCHMIDT 1986).

(47) *Sobolevicanthus octacantha* (KRABBE, 1869) SPASSKY et SPASSKAYA, 1954

Reports: [1] KAMBUROV, VASILEV (1972); [2]

KORNYUSHIN *et al.* (1984).

Hosts: *Anser albifrons* [1]; *Anas platyrhynchos* [1, 2]; *A. crecca* [1]; *Aythya nyroca* [1].

Distribution in Bulgaria: NBR: Pleven Region [1], Sofia Region [1], Dobrich Region [1], Furen (Montana Region) [2]; BSR: Dolno Ezerovo (Burgas Region) [2].

General distribution: Palaearctic (SPASSKAYA 1966, SCHMIDT 1986).

(48) *Sobolevicanthus spasskii* KORNYUSHIN, 1969

Report: KORNYUSHIN *et al.* (1984)

Host: *Tadorna tadorna*.

Distribution in Bulgaria: BSR: Durankulak (Dobrich Region).

General distribution: Palaearctic (SCHMIDT 1986).

(49) *Sobolevicanthus stolli* (BROCK, 1941) CZAPLINSKI, 1956

Report: KORNYUSHIN *et al.* (1984).

Host: *Anas platyrhynchos*.

Distribution in Bulgaria: BSR: Dolno Ezerovo (Burgas Region), Vaklino (Dobrich Region).

General distribution: Holarctic (SPASSKAYA 1966, SCHMIDT 1986).

Genus *Tschertkovilepis* SPASSKY et SPASSKAYA, 1954

(50) *Tschertkovilepis krabbei* (KOWALEWSKI, 1895) CZAPLINSKI et JARECKA, 1967

Synonyms: *Drepanidotaenia przewalskii* (SKRJABIN, 1914) LOPEZ – NEYRA, 1942 [1, 2]; *Tschertkovilepis przewalskii* (SKRJABIN, 1914) SMOGORZHEVSKAYA, 1976 [4].

Reports: [1] VASILEV (1962a); [2] KAMBUROV, VASILEV (1972); [3] VASILEV (1973); [4] KORNYUSHIN *et al.* (1984).

Hosts: *Anser anser f. dom.* [1]; *A. anser* [2, 4]; *A. albifrons* [2]; *A. erythropus* [2]; *Anas platyrhynchos* [2]; *A. platyrhynchos f. dom.* [3]; *Aythya nyroca* [2].

Distribution in Bulgaria: “entire country” [1, 3]; NBR: Pleven, Sofia Region, Dobrich Region [2]; MBR: Stara

Zagora, Region, Yambol Region [2]; BSR: Dolno Ezerovo (Burgas Region), Durankulak (Dobrich Region) [4].

General distribution: Holarctic (CZAPLINSKI, JARECKA 1967, SCHMIDT 1986).

Remarks: The synonymy of *Drepanidotaenia przewalskii* and *Tschertkovilepis krabbei* has been proposed by CZAPLINSKI & JARECKA (1967). In addition to the anseriform hosts, this species has been reported as *Drepanidotaenia przewalskii* in *Meleagris gallopavo* from Pazardzhik (VASILEV 1962b).

(51) *Tschertkovilepis setigera* (FRÖLICH, 1789) SPASSKY et SPASSKAYA, 1954

Synonyms: *Hymenolepis setigera* (FRÖLICH, 1789) RAILLIET, 1899 [1, 2]; *Hymenolepis anseris* SKRJABIN et MATHEVOSSIAN, 1942 [2*].

Reports: [1] GEORGIEV, DENEV (1959); [2] VASILEV (1962a); [3] VASILEV (1973).

Hosts: *Anas platyrhynchos f. dom.* [1, 3]; *Anser anser f. dom.* [1, 2*].

Distribution in Bulgaria: “entire country” [2*, 3]; NBR: Pavlikeni Region [1], Veliko Tarnovo Region [1], Elena Region [1].

General distribution: Palaearctic, Indomalaya (SPASSKAYA 1966, SCHMIDT 1986).

Remark: The synonymy of *H. setigera* and *H. anseris* has been proposed by SPASSKY & SPASSKAYA (1954).

Genus *Wardium* MAYHEW, 1925

(52) *Wardium arctica* (SCHILLER, 1955) SPASSKY, 1959

Synonym: *Decacanthus arcticus* (SCHILLER, 1955) YAMAGUTI, 1959.

Report: KORNYUSHIN *et al.* (1984).

Host: *Anas platyrhynchos*.

Distribution in Bulgaria: NBR: Furen (Montana Region).

General distribution: Holarctic (SPASSKAYA 1966, SCHMIDT 1986).

Host – parasite checklist

***Anser albifrons* (Scopoli)**

Dicranotaenia coronula
Sobolevicanthus octacantha
Tschertkovilepis krabbei

***Anser anser* (L.)**

Diorchis stefanskii
Retinometra longicirrosa
Tschertkovilepis krabbei

***Anser anser* (L.) f. dom.**

Dicranotaenia coronula
Diorchis stefanskii
Drepanidotaenia lanceolata
Fimbriaria fasciolaris
Microsomacanthus abortiva
Retinometra longicirrosa
Sobolevicanthus gracilis
Tschertkovilepis krabbei
Tschertkovilepis setigera

***Anser erythropus* (L.)**

Tschertkovilepis krabbei

***Anas acuta* L.**

Cloacotaenia megalops
Diorchis stefanskii
Diploposthe laevis
Diploposthe skryabini
Fimbriaria fasciolaris
Microsomacanthus abortiva
Sobolevicanthus gracilis

***Anas clypeata* L.**

Cloacotaenia megalops
Diorchis stefanskii
Gastrotaenia dogieli
Sobolevicanthus gracilis

***Anas crecca* L.**

Cloacotaenia megalops
Dicranotaenia coronula

Diorchis longiovum

Diorchis stefanskii
Diploposthe laevis
Echinocotyle rosseteri
Fimbriaria fasciolaris
Microsomacanthus formosa
Microsomacanthus spiralicirrata
Sobolevicanthus dafilae
Sobolevicanthus fragilis
Sobolevicanthus gracilis
Sobolevicanthus krabbeella
Sobolevicanthus octacantha

***Anas penelope* L.**

Cloacotaenia megalops
Dicranotaenia coronula
Diorchis stefanskii
Diploposthe laevis
Diploposthe skryabini

- Echinocotyle rosseteri*
Fimbriaria fasciolaris
Microsomacanthus fausti
Anas platyrhynchos L.
Dilepis undula
Aploparaksis furcigera
Cloacotaenia megalops
Dicranotaenia coronula
Diorchis danutae
Diorchis elisae
Diorchis stefanskii
Diploposthe laevis
Diploposthe monoposthe
Diploposthe skrjabini
Echinocotyle rosseteri
Fimbriaria fasciolaris
Microsomacanthus abortiva
Microsomacanthus baeri
Microsomacanthus fausti
Microsomacanthus formosa
Microsomacanthus hopkinsi
Microsomacanthus paracompressa
Microsomacanthus parvula
Microsomacanthus spiralicirrata
Sobolevicanthus gracilis
Sobolevicanthus krabbeella
Sobolevicanthus octacantha
Sobolevicanthus stollii
Tschertkovilepis krabbei
Wardium arctica
Anas platyrhynchos L. f. dom.
Platyscolex ciliata
Cloacotaenia megalops
Dicranotaenia coronula
Diorchis elisae
Diorchis spinata
- Diorchis stefanskii*
Diploposthe laevis
Drepanidotaenia lanceolata
Fimbriaria fasciolaris
Microsomacanthus abortiva
Microsomacanthus compressa
Microsomacanthus fausti
Microsomacanthus paracompressa
Microsomacanthus paramicrosoma
Microsomacanthus parvula
Sobolevicanthus gracilis
Tschertkovilepis krabbei
Tschertkovilepis setigera
Anas querquedula L.
Cloacotaenia megalops
Diorchis elisae
Diorchis nyrocae
Diorchis parvogenitalis
Diorchis ransomi
Diorchis stefanskii
Diploposthe laevis
Diploposthe skrjabini
Echinocotyle rosseteri
Fimbriaria fasciolaris
Gastrotaenia dogieli
Microsomacanthus arcuata
Microsomacanthus compressa
Microsomacanthus formosoides
Microsomacanthus paramicrosoma
Microsomacanthus parvula
Retinometra giranensis
Retinometra macracanthos
Retinometra skrjabini
Sobolevicanthus gracilis
Anas strepera L.
Diploposthe laevis
- Fimbriaria fasciolaris*
Microsomacanthus compressa
Aythya ferina (L.)
Cloacotaenia megalops
Diploposthe laevis
Diploposthe skrjabini
Microsomacanthus parvula
Sobolevicanthus gracilis
Aythya nyroca (Güldenstädt)
Cloacotaenia megalops
Dicranotaenia coronula
Diploposthe laevis
Diploposthe skrjabini
Fimbriaria fasciolaris
Microsomacanthus arcuata
Microsomacanthus compressa
Microsomacanthus fausti
Microsomacanthus parvula
Sobolevicanthus octacantha
Tschertkovilepis krabbei
Mergus serrator L.
Aploparaksis filum
Cloacotaenia megalops
Netta rufina (Pallas)
Diorchis stefanskii
Diploposthe laevis
Diploposthe monoposthe
Fimbriaria fasciolaris
Tadorna tadorna (L.)
Diorchis elisae
Monotestilepis tadornae
Sobolevicanthus spasskii
Cygnus cygnus (L.)
Monosaccanthes kazachstanica

Discussion

In total, 40 wild species of the family Anatidae occur regularly in Bulgaria; these vary from frequently recorded birds, some of them having the status of game waterfowl (10 species), rare species with conservational status (15) and species known from the area on the basis of few records only (NANKINOV *et al.* 1997, MICHEV *et al.* 2012). These differences in the distribution and the density of birds are a prerequisite for the unequal level of the knowledge on their helminth parasites. Thus, the most extensive study on helminth parasite of waterfowl in Bulgaria (KAMBUROV, VASILEV 1972) was based on the examination of 614 individuals belonging to 16 species; out of them, more than half belonged to two species, i.e. 262 mallards (*Anas platyrhynchos*) and 129 garganeys (*A. querquedula*). Similarly, KORNUSHIN *et al.* (1984) reported results of the study of cestode

parasites collected from 129 individuals of waterfowl of 11 species, with mallards (*A. platyrhynchos*) being almost half (62) and common teals (*A. crecca*) representing substantial part of the sample (33); the remaining host species were studied on the basis of single individuals. More than half of waterfowl species recorded in Bulgaria have never been examined for helminth parasites. In addition, two domesticated host species were subjects of extensive studies (VASILEV 1962a, 1973).

The present review demonstrates that the most species-rich cestode assemblages have been recorded in the most studied game waterfowl, i.e. *A. platyrhynchos* (26 species), *A. querquedula* (20) and *A. crecca* (14). Also, the extensive collecting on helminth parasites of domesticated waterfowl revealed 18 cestode species in ducks and 9 in geese.

Concerning the remaining species, it can be assumed that the species diversity of their cestode parasites is incompletely studied.

The most species-rich cestode genera recorded from waterfowl in Bulgaria are *Microsomacanthus* (12 species), *Diorchis* (8) and *Sobolevicanthus* (7), all belonging to the family Hymenolepididae. It should be mentioned, however, that most of the identifications have been published 30-50 years ago, before a period of substantial developments of cestode taxonomy. Recent studies demonstrated complexes of morphologically similar but distinct species in several genera as well as issues associated with the validity of a number of species. Such taxonomic developments are related to the genera *Aploparaksis* (see BONDARENKO, KONTRIMAVICHUS 2006), *Dicranotaenia* (see MACKO 1992), *Diorchis* (see CZAPLINSKI, SZELENBAUM – CIELECKA 1986, TOLKACHEVA 1991, ALEXANDER,

McLAUGHLIN 1997), *Microsomacanthus* (see REGEL 2005, GALKIN *et al.* 2006, 2008), *Retinometra* (see MACKO *et al.* 2000a, b), *Sobolevicanthus* (see MACKO *et al.* 1992) and *Tschertkovilepis* (see GALKIN 1998). The re-evaluation of the published records is difficult because the publications from Bulgaria do not contain morphological data about the cestodes reported. The only exception is the article by VASILEV, KAMBUROV (1970) on the species of the genus *Diploposthe*. Therefore, more detailed examinations of the cestode fauna of waterfowl are needed in order to obtain complete information on the species diversity of this group in Bulgaria.

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