LARVAL TREMATODES (DIGENEA) OF THE GREAT POND SNAIL, LYMNAEA STAGNALIS (L.), (GASTROPODA, PULMONATA) IN CENTRAL EUROPE: A SURVEY OF SPECIES AND KEY TO THEIR IDENTIFICATION

FALTÝNKOVÁ A.*, NAŠINCOVÁ V.* & KABLÁSKOVÁ L.*

Summary:
A survey of cercariae and metacercariae [Trematoda, Digenea] from the great pond snail (Lymnaea stagnalis) in Central Europe (Austria, Czech Republic, South-East Germany, Poland and Slovak Republic) is presented, based on a study of 3,628 snails examined from 1998 to 2005. A total of 953 (26.3 %) L. stagnalis were infected with 24 trematode species comprising 19 species of cercariae and 11 species of metacercariae (six species occurred both as cercarie and metacercarie) of eight families. The dominant cercariae were those of Opisthodiscus ranae (159 hosts infected), Plagiorchis elegans (141) (both family Plagiorchiidae) and Echinoparyphium aconiatum (153) (Echinostomatidae); 14 double infections were found. The most frequent metacercariae were those of Neoglyphea locellus (71) (Omphalometridae), E. aconiatum (66), Echinostoma sp. (59) and Molinillia anceps (48) (Echinostomatidae). In the previous studies carried out in Central Europe, a very similar spectrum of nine trematode families of 22 cercariae determined to species level and 43 types of cercariae reported under generic or provisional names, which can be in many cases conspecific with the previous taxa, were found. A simple key to identification of cercariae and metacercariae, together with their illustrations, is provided.

KEY WORDS: Trematoda, Mollusca, Basommatophora, cercariae, metacercariae, life cycle, prevalence, great pond snail, Lymnaea stagnalis.

INTRODUCTION

The great pond snail (Lymnaea stagnalis) is one of the best known aquatic molluscs with holarctic distribution, occurring in Europe, Asia, North Africa and North America (Jackiewicz, 2000; Beran, 2002; Glöer, 2002). In Europe, it is widely distributed and lives even in some parts of the Baltic sea with low salinity (Jackiewicz, 2000). It can be found predominantly in lower altitudes (150-250 m) where it inhabits slowly flowing or still waters, ponds, blind arms, pools and also periodic swamps, and it is able to survive short dry periods (Jackiewicz, 2000; Beran, 2002). Being the most common and conspicuous snail, together with Planorbis corneus (Planorbidae), L. stagnalis was examined in the very first larval trematode investigations of Nitzsch (1817), La Valette (1855), Pagenstecher (1857) and later Lühe (1909). Until today, L. stagnalis is still of interest, being the intermediate host not only of a wide variety of larval trematodes, which are among the most common species (Echinoparyphium aconiatum, Opisthodiscus ranae, Diplostomum pseudospathaceum) in Central Europe (Faltýnková & Haas, 2006), but also of the causative agents of cercarial dermatitis – cercariae of bird schistosomes (genus Trichobilharzia), which are studied quite intensively in Austria, Czech Republic, Germany and Poland (Allgöwer, 1990; Kolářová et al 1997; Kolářová &

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Résumé : Larves de trematodes (Digenea) de Lymnaea stagnalis (L.), (Gastropoda, Pulmonata) en Europe Centrale : étude des espèces et clé pour leur identification


MOTS CLÉS : Trematode, Mollusque, Basommatopodiforme, cercaire, métacercarie, cycle parasitaire, prévalence, escargot d’eau douce, Lymnaea stagnalis.
Horák, 1996; Konecny et al., 1999; Dvorák et al., 1999; Kalbe et al., 2000; Zbikowska, 2003, 2004; Sattmann et al., 2004; Horák & Kolářová, 2005; Rudolfová et al., 2005; Hertel et al., 2006).

Loy & Haas (2001) found 18 species of trematode larvae during their long-time investigation into the behaviour of cercariae from *L. stagnalis* in Germany. They found out that the spectrum did not change over the period of 20 years. The species composition was also similar to reports from the 19th century (see references above). However, a substantial part of the cercariae found by Loy & Haas (2001) were not determined to species. Cercariae with invalid or provisional names were often listed in articles dealing with the trematode fauna of *L. stagnalis* published in hardly accessible journals of regional importance. In some countries only few records of cercariae other than bird schistosomes exist (Konecny et al., 1999). Several attempts to compile an atlas of cercariae (Combes, 1980) or keys to identification of different types of cercariae (Odening, 1962a; Palm, 1966a, Blair, 1977) were made, but these are of difficult use. And recently, there is no updated and comprehensive information about larval trematodes of the great pond snail.

Because of the large size of the great pond snail, producing large amounts of cercariae over a long period, it is a favoured model organism for studies on parasite-host physiology, immunology and behaviour. However, correct identification of larval trematodes is the premise for any studies and also the knowledge of species composition is important for studies on the epidemiology of veterinary or medically important trematodes and for ecology of trematode communities. Therefore, a survey of larval trematodes in the great pond snail in Central Europe, based on original data from five countries and revised records from literature, is presented here, together with a simple key to identification suitable also for non-trematodologists and illustrations of the most common species. Detailed morphological descriptions of larval trematodes with more information about their distribution and life cycles will be presented in a separate monograph.

### MATERIAL AND METHODS

**Sampling and Handling of Snails**

Snails of *Lymnaea stagnalis* were sampled from April 1998 to October 2005 in still and slightly flowing water bodies of drainage areas of major rivers of Central Europe (Danube, Elbe, Main, Odra, Tisa). The regions studied comprised pond systems of South Bohemia and Moravia in the Czech Republic (see Faltýnková, 2005), in South-East Germany (see Faltýnková & Haas, 2006), in the reserve of Milicz in Poland and ponds near Danube in Germany; blind arms of Danube in Austria and the Slovak Republic and channels along the Tisa River in East Slovakia (Fig. 1).

Molluscs (n = 3,628) were sampled with a strainer or hand picked on shores. In the laboratory, they were separated into glass containers with tap water (100 ml). Shedding of cercariae was stimulated by light and heat for 4-6 hours. The internal morphology of cercariae and metacercariae was documented by drawings...
with aid of a drawing tube. Neutral red (to observe paraoesophageal glands of echinostomatids) and Nile blue were used for vital staining; urine solution was used to study the excretory system. For measurements, cercariae were fixed in hot 4 % formaldehyde solution. Afterwards, a part of the molluscs were dissected to detect larval stages other than cercariae. Cercariae were identified with help of publications of Combes (1980), Niewiadomska (1986), Našínková (1992) and Niewiadomska et al. (1997). The system proposed by Gibson et al. (2002), Jones et al. (2005) and Bray et al. (2007) is followed.

**Survey of literary data**

To provide a complete survey of larval trematodes from *Lymnaea stagnalis*, literary data from Austria, Czech and Slovak Republics, Germany, Hungary and Poland were compiled to supplement the original data obtained during the present survey and in recent records of Falíňková (2005) and Falíňková & Haas (2006). Records based on experimental infections were not considered. For better orientation, valid names of adult trematodes were provided together with original invalid or provisional names appearing in the literature.

A simple key to species of cercariae and metacercariae from *L. stagnalis* (Table II) is presented. Larval stages not identified at least to genus (Table III) are not included in the key, except for *Cercaria spinulosa* Ginetsinskaya, 1959. Only illustrations of common species recorded in the present study are presented; further figures can be found in publications of authors listed in Tables II and III.

**RESULTS**

In the present survey, a total of 26.3 % *Lymnaea stagnalis* were infected (Table I) with 24 trematode species comprising 19 species of cercariae and 11 species of metacercariae (six species occurred both as cercarie and metacercarie) of eight families (Table II). The dominant cercariae were those of *Opisthioglyphe ranae* (159 hosts infected), *Plagiorchis elegans* (141) (both Plagiorchiidae) and *Echinoparyphium aconiatum* (153) (Echinostomatidae). The most frequent metacercariae were those of *Neoglyphe locellus* (71) (Omphalometridae), *E. aconiatum* (66), *Echinostoma sp.* (59) and *Moltiella aniceps* (48) (Echinostomatidae). Metacercariae of *O. ranae* (3), *P. elegans* (1) and strigeids (1) were found less frequently.

In the previous studies carried out in Central Europe, as many as 22 cercariae determined to species level and 43 taxa recorded under generic or provisional names of nine families were reported from *L. stagnalis* (Tables II, III).

**Key to cercariae**

1 Cercaria without tail (cercariaeum); intestinal caeca form cyclocoel ..................... *Cyclocoelum microstomum*
2 Tail long, simple .................................................. 3
3 Cercaria with two suckers, ventral sucker more or less equatorial ............................................. 4
   Monostomous cercaria .............................................
   ................................................................. *Notocotylus attenuatus* (Fig. 5A)
4 Collar and collar spines present; excretory granules (between oral and ventral sucker); excretory vesicle more or less spherical .................................................. 5
   Collar and collar spines and excretory granules absent; stylet on dorsal part of oral sucker; excretory vesicle Y-shaped ............................................. 12
5 Dorsal collar spines arranged in one row ........... 6
   Dorsal collar spines in two rows; number of collar spines different ................................................ 7
   6 Cercaria large (body 400-500 µm long); excretory canals form finger-like processes anteriorly; excretory granules conspicuous; 47-50 collar spines ....................... 7
   ................................................................. *Cathaoeomia bians* (Fig. 3C-E)
7 Tail with fin folds; paraoesophageal glands may be present (stain intensively with neutral red) ............... 8
   Tail without fin folds; no paraoesophageal glands.... 9

<table>
<thead>
<tr>
<th>Country</th>
<th>Examined</th>
<th>Infected</th>
<th>%</th>
<th>Cercariae</th>
<th>Metacercariae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>203</td>
<td>22</td>
<td>10.8</td>
<td>3</td>
<td>–</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>1,078</td>
<td>409</td>
<td>37.9</td>
<td>14</td>
<td>7</td>
</tr>
<tr>
<td>Germany</td>
<td>1,219</td>
<td>187</td>
<td>15.3</td>
<td>10</td>
<td>–</td>
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<tr>
<td>Poland</td>
<td>669</td>
<td>273</td>
<td>40.8</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>Slovak Republic</td>
<td>459</td>
<td>62</td>
<td>13.5</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3,628</strong></td>
<td><strong>953</strong></td>
<td><strong>26.3</strong></td>
<td><strong>19</strong></td>
<td><strong>11</strong></td>
</tr>
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</table>

Table I. – Survey of *Lymnaea stagnalis* examined.
### Table II

<table>
<thead>
<tr>
<th>Valid name</th>
<th>Distribution</th>
<th>Original names and authorities</th>
</tr>
</thead>
</table>
| **Cyclocoelidae Stossich, 1902**  
* Cyclocoelum microstomum (Creplin, 1829)  
Niewiadomska, 1984 | CZ** | Žilská (1963) |
| **Diplostomidae Poier, 1886**  
| **Tybodelphys clavata** (Nordmann, 1832) | CZ | Našincová (1992) |
| **Strigeidae Railliet, 1919**  
* Australapatemon minor (Yamaguti, 1933) | CZ | Australapatemon minor of Zajíček (1971), Našincová (1992), Apatemon minor of Zajíček & Valenta (1964); Apatemon gracilis gracilis of Vojtek & Vojtková (1971); Apatemon minor of Loy & Haas (2001); Faltynková & Haas (2006), present results |
| **Cotylurus brevis** (Dubois et Rausch, 1950) | CZ, D | Odening (1965a), Zajíček (1971) |
| **Sanguinicola von Graff, 1907**  
* Sanguinicola inermis Plehn, 1905 | CZ, D | Sanguinicola sp. (inermis) of Gelnar (1980); Scheuring (1922), Odening (1965a) |
| **Echinostomatidae Stiles & Hassall, 1898**  
| **Isthmiophora melis** (Schrank, 1788) | CZ, D, PL | Euparyphium melis of Žilská (1946b); Grabda-Kazubska & Laskowski (1996), Loy & Haas (2001), present study |
| **Molitriella acuta** (Molin, 1858) | CZ, D | Odening (1964b), Faltynková (2005) present study |
| **Pharyphostrongylus radiatus** (Dujardin, 1845) | CZ, PL | Cercaria sp. 2 of Balášek & Vojtek (1973); Grabda-Kazubska et al. (1990) |
| **Cathaemalesaia Fuhrmann, 1928**  
Cathaemalesaia bians (Rudolphi, 1809) | CZ, PL | Cercaria sp. 2 of Balášek & Vojtek (1973); Grabda-Kazubska et al. (1990) |
| **Notocotylidae Lühe, 1909**  
* Notocotylus attenuatus (Rudolphi, 1809) | A, CZ, D, PL | Cercaria attenuatus of Zajíček (1963); Cercaria monostomi of Zajíček (1963); Cercaria sp. of Konecny et al. (1999); Žilská (1963), Nezvalová (1970) in part, Balášek & Vojtek (1973), Gelnar (1980), Našincová (1992), Faltynková (2005), present study |

*Table II (to be continued).*
### Table II. – Survey of species of cercariae reported from Lymnaea stagnalis in Europe.

<table>
<thead>
<tr>
<th>Valid name</th>
<th>Distribution</th>
<th>Original names and authorities</th>
</tr>
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<tbody>
<tr>
<td>Plagiorchidae Lühe, 1901</td>
<td></td>
<td></td>
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<tr>
<td><em>Haematoloechus similis</em> (Looss, 1899)</td>
<td>CZ</td>
<td>present study</td>
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<tr>
<td><em>Opisthotyglophyra ranae</em> (Frohlich, 1791)</td>
<td>A, CZ, D, PL, SK</td>
<td>Cercaria armata of Pagenstecher (1857); Cercaria armata Siebold of La Valette (1855), Lühe (1909); <em>Xiphidiocercaria</em> sp. 2 of Odening (1962b); <em>Cercaria opisthotyglophyra-ranae</em> of Zajíček (1965); <em>Cercaria sp.</em> 7 of Burnjian-Hartung (1965); Styczynska-Jurewicz (1961), Žálerská (1963, 1964a) in part, Palm (1966b), Grabda-Kazubka (1969), Nezvalová (1970), Gelnar (1980), Dimitrov et al. (1969), Našincová (1992), Faltýnková (2005), Faltýnková &amp; Haas (2006), present study</td>
</tr>
<tr>
<td><em>Plagiorchis elegans</em> (Rudolph, 1802)</td>
<td>A, CZ, D, PL, SK</td>
<td>Cercaria sp. 6 of Burnjian-Hartung (1965); Styczynska-Jurewicz (1961), Našincová (1992), Faltýnková (2005), Faltýnková &amp; Haas (2006), present study</td>
</tr>
<tr>
<td>Plagiorchis laricola Skyabin, 1924</td>
<td>CZ</td>
<td>Žálerská (1966), Samnalen et al. (1983), Gelnar (1980)</td>
</tr>
<tr>
<td>Omphalometridae Odening, 1960</td>
<td></td>
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<tr>
<td><em>Neoglyphe sobolevi</em> Shaldybin, 1953</td>
<td>CZ, D, PL</td>
<td>Našincová <em>et al.</em> (1989), Našincová (1992), present study</td>
</tr>
</tbody>
</table>

*Species found in recent studies.*

**A** – Austria, **CZ** – Czech Republic, **D** – Germany, **PL** – Poland, **SK** – Slovak Republic.
<table>
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<th>Family/Generic name</th>
<th>Distribution</th>
<th>Original names and authorities</th>
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<tr>
<td><strong>Diplostomidae Poirier, 1886</strong></td>
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<tr>
<td><em>Diplostomum</em> sp.</td>
<td>CZ</td>
<td><em>Diplostomum</em> sp. (= <em>Cercaria chromatophora</em> Brown, 1931) of Zajíček &amp; Valenta (1964)</td>
</tr>
<tr>
<td><strong>Strigeidae Railliet, 1919</strong></td>
<td></td>
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</tr>
<tr>
<td>?<em>Australapatemon</em> sp.</td>
<td>D</td>
<td><em>Cercaria furcata</em> Nitzsch, 1807 of Nitzsch (1817), La Valette (1855), Lühe (1900)</td>
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<tr>
<td><em>Cotylurus</em> sp.</td>
<td>CZ</td>
<td><em>Cotylurus erraticus</em> (Rudophi, 1809) of Zajíček &amp; Valenta (1964), Vojtek &amp; Vojtková (1971)</td>
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<tr>
<td>?<em>Ichthyocotylurus</em> sp.</td>
<td>CZ</td>
<td><em>Cercaria spinulosa</em> Ginetsinskaya, 1959 of Zajíček &amp; Valenta (1964)</td>
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<tr>
<td><strong>Schistosomatidae Stiles &amp; Hassal, 1898</strong></td>
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<tr>
<td><em>Trichobilharzia</em> sp.</td>
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<td><strong>Sanguinicolidae von Graff, 1907</strong></td>
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<td><em>Sanguinicola</em> spp.</td>
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<td>Rudolfová et al. (2005)</td>
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<td><strong>Echinostomatidae Looss, 1899</strong></td>
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<tr>
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<td>CZ</td>
<td><em>Cercaria echinoparyphii</em> sp. 1 of Zajíček (1963), Nezvalová (1970)</td>
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<td><em>Paryphostomum</em> sp. 2 of Nasíncová (1992)</td>
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<td><em>Echinoparyphium aconiatum</em></td>
<td>D</td>
<td><em>Cercaria fallax</em> Pagenstecher, 1857, Lühe (1909), Bursian-Hartung (1965)</td>
</tr>
<tr>
<td><strong>Notocotylidae Lühe, 1909</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Plagiorchis</em> sp.</td>
<td>D, SK</td>
<td>present study</td>
</tr>
<tr>
<td><em>Plagiorchis</em> sp.</td>
<td>SK</td>
<td>present study</td>
</tr>
<tr>
<td><em>Plagiorchis</em> sp.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Lissorchiidae Poche, 1926</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Asymphylodora</em> sp.</td>
<td>A, D</td>
<td>Unidentified echinostomous cercariae of Konecny et al. (1999), Loy &amp; Haas (2001)</td>
</tr>
<tr>
<td><em>Echinocotylium</em> sp.</td>
<td>A, D</td>
<td>Unidentified furcocercariae of Konecny et al. (1999), Loy &amp; Haas (2001)</td>
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<td>Unidentified xiphidiocercariae of Konecny et al. (1999), Loy &amp; Haas (2001)</td>
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<tr>
<td><em>furcocercaria</em></td>
<td>D</td>
<td><em>Cercaria bucculata</em> La Valette, 1855 of Lühe (1909)</td>
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<td>misidentified</td>
<td>CZ</td>
<td><em>Cercaria gracilis</em> Wesenberg-Lund, 1934 of Bertman (1980)</td>
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<tr>
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<td><em>Cercaria onusta</em> Zdun of Bertman &amp; Wojciechowska (1974)</td>
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<tr>
<td>misidentified</td>
<td>PL</td>
<td>*Cercaria Petersen 1 Petersen of Bertman &amp; Wojciechowska (1974)</td>
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<tr>
<td>misidentified</td>
<td>CZ, D</td>
<td><em>Xiphidiocercaria</em> sp. VII Odening 1962 of Nezvalová (1970) in part</td>
</tr>
</tbody>
</table>

Table III – Survey of species of cercariae identified to genus or with provisional names reported from *Lymnaea stagnalis* in Europe.
LARVAL TREMATODES OF *L. stagnalis* IN CENTRAL EUROPE

**Fig. 2.** – *Diplostomum pseudospathaceum* (A, B); *Australapatemon burti* (C, D); *Australapatemon minor* (E, F); *Tylodelphys clavata* (G, H); *Cotylurus cornutus* (I); A, C, E, G, I – detail of body, scale bars: A, C, E, I – 50 µm, G – 100 µm; B, D, F, H – whole cercaria, scale bars: B, H – 100 µm, D, F – 50 µm.

**Fig. 3.** – *Trichobilharzia szidati* (A, B); *Cathaemasia bians* (C, D, E); *Echinoparyphium aconiatum* (F, G); *Echinoparyphium recurvatum* (H); A, C – detail of body, scale bars: A – 100 µm, C – 200 µm; B, E, F, H – whole cercaria, scale bars: B, H – 100 µm, E, F – 200 µm; G, D – detail of anterior part with collar spines, scale bar: 50 µm.
23 Two pairs of large postacetabular penetration glands; anterior organ with large conspicuous spines; caeca long, reach to body end; flame cell formula $2 [(1 + 1 + 1) + (1 + 1 + 1) + (2)] = 16$ ..........................

$Diplostomum pseudospathaceum$ (Fig. 2A, B)

Four pairs of small, poorly visible postacetabular penetration glands; anterior organ with fine spines; caeca short, reach to posterior end of ventral sucker; flame cell formula $2 [2 + (2 + 2 + (1))] = 14$ ................................. 24

24 Body spined only on its anterior part ..........................

$Australapatemon burti$ (Fig. 2C, D)

Whole body spinose

$Australapatemon minor$ (Fig. 2E, F)

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**KEY TO METACERCARIAE**

1 Metacercaria spherical ................................. 2

Metacercaria oval ........................................ 8

2 Cyst thick-walled; excretory granules and collar spines present; encysted in pericardium, kidney, less often in musculature ........................................ 3

Cyst thin-walled; collar spines absent .......... 6

3 Metacercaria large (about 270-380 µm in diameter) ........................................... 4

4 Collar of excysted metacercaria narrower than long body, with 35 spines of same length; three spherical anlagen of reproductive organs ..............................

$Molinia anceps$ (Fig. 6D)

Collar of excysted metacercaria of same width as short body; 37 collar spines, with conspicuous, larger angle spines .............................

$Echinoparyphium aconiatum$ (Fig. 6A)

Cercaria with 37 collar spines; excretory granules larger .............................

$Echinostoma$ sp. (Fig. 6C)

Cercaria with 45 collar spines; excretory granules smaller ....

$Echinoparyphium recurvatum$ (Fig. 6B)

6 Refractile granules in Y-shaped excretory vesicle; released stylet floating in cyst; anlagen of reproductive organs absent; encysted mainly in musculature .... 7

Refractile granules and stylet absent; anlagen of reproductive organs present ....... $Asymphylodora$ sp.

7 Metacercaria large (200 µm), shape of stylet – see Fig. 5E .......................... $Ophioglyphe ranae$ (Fig. 6E)

Metacercaria small (130 µm); shape of stylet – see Fig. 5G ........................... $Plagiorchis$ sp. (Fig. 6F)

8 Cyst thin-walled; encysted in musculature (edge of mantle); Y-shaped transparent excretory vesicle ............

$Neoglyphe locellus$ (Kossack, 1910) (Fig. 6G)

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Fig. 4. – $Echinostoma revolutum$ (A, E); $Hyopderaeum conoideum$ (B, F); $Molinia anceps$ (C, G); $Paryphostomum radiatum$ (D, H); A-D – whole cercaria, scale bars: A, B, D – 100 µm, C - 200 µm; E-H – detail of anterior part with collar spines, scale bar: 50 µm.
LARVAL TREMATODES OF L. STAGNALIS IN CENTRAL EUROPE

Mémoire

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DISCUSSION

In Lymnaea stagnalis a total of 24 trematode species comprising 19 species of cercariae and 11 species of metacercariae of eight families were found recently. A rather similar fauna of 22 cercariae determined to species level and 43 cercariae reported under generic or provisional names of nine trematode families were found in former studies carried out in Central Europe.

However, it must be assumed that the real number of existing species is almost certainly much lower than the latter number of 43 taxa, because some species are most probably conspecific with the determined ones. Especially xiphidiocercariae (Plagiorchiidae) with quite similar morphological characteristics were reported under several provisional names; in Table III trematodes with insufficient, dubious or missing descriptions were included. Unfortunately, the real identity of these records cannot be worked out because of insufficient or lacking descriptions. In the group of Species incertae sedis, mainly cercariae obviously misidentified without any descriptions were included, because they were assigned to species being specific only for planorbid snails that never occur in lymnaeids.

The dominant cercariae were those of Opisthioglyphe ranae, Echinoparyphium aconiatum and Plagiorchis elegans of the families Plagiorchiidae and Echinostomatidae. These three species are widely distributed in Europe and were found as the most frequent in all countries where samples were undertaken.

The second most common were metacercariae of the

Fig. 5 – Notocotylus attenuatus (A); Haematoloechus similis (B, C); Opisthioglyphe ranae (D, E), Plagiorchis elegans (F, G), Neoglyphe sobolevi (H, I); A, B, D, F, H – whole cercaria, scale bars: A – 200 µm, B – 50 µm, D, F, H – 100 µm; C, E, G, I – stylet, scale bars: C, E, I – 30 µm, G – 50 µm.

Fig. 6 – Echinoparyphium aconiatum (A), Echinoparyphium recurvatum (B), Echinostoma sp. (C), Molinella anceps (D), Opisthioglyphe ranae (E), Plagiorchis sp. (F), Neoglyphe locellus (G); scale bar 100 µm.
family Echinostomidae: *E. aconti*um, *Echinostoma* sp. and *Mollusella anceps*, which often occurred together. This family contains most species encysting in molluscs. Metacercariae of plagiorchids were found less frequently, since *Plagiorchis elegans* is reported to use snails accidentally. However, the common *Opisthoblastyle* ranae is known to encyst in molluscs. The stri-geid metacercariae could belong to a species of *Cotylurus*, which encyst frequently in molluscs (Našincová, 1992).

The highest species diversity of cercariae in *L. stagnalis* was found in the pond systems of the Czech Republic and Poland. The number of species found in Germany was slightly lower, but the spectrum of cercariae (18 species) in the same region found by Loy & Haas (2001), was not much higher. In Austria and the Slovak Republic more blind arms of the Danube river than ponds were examined and lower numbers of *L. stagnalis* could be sampled.

Only one species of the family Strigeidae, *Australapatemon burti*, was found in the present study. The genus *Australapatemon*, established by Sudarikov (1959), was regarded as a subgenus of *Apatemon* by Dubois (1968). For a long time the species of *Australapatemon* were reported as *Apatemon gracilis* (as listed in Table II), although the cercariae of *Australapatemon* differ in morphology and biology from those of *Apatemon* (long vs. rudimentary caeca, different flame cell formula and body spination, metacercariae of *Apatemon* and those without cristae could be *Ichthyocotylurus megalus*) (Cech & Valenta 1964). Their species actually belongs to the genus *Cotylurus* and probably repre-resents a separate species (Table III). It could not be assi-ned to any other known species of *Cotylurus* because of a different type of body spination (spination the same as in *C. cornutus* except for an aspinose part in the area of the excretory vesicle).

Schistosome cercariae occurring in *L. stagnalis* were identified as *Tricobilharzia szidati*, although Rudolfová et al. (2005) found another cryptic species in this snail host (listed in Table III). The prevalence of *T. szidati* was very similar in most countries (Czech Republic, Germany and Poland). It was not found in Austri-a, presumably because of a short sampling period. Nearly the same species composition of echinostomes as in previous surveys was found in the present study. Cercariae with cristae on suckers were considered as *Paryphostomum raidiatum* and those without cristae could be *Isthmioophora melis* (Table II). Grabda-Kazubska & Laskowski (1996) redescribed the life cycle of *I. melis* and found that it is difficult to separate these two species, even with the aid of chaetotaxy. However,

*P. radiatum* has a crista on the oral and ventral sucker (Našincová et al., 1993), which could be considered as a distinguishing feature, and the species characterized by Našincová (1992) as *Paryphostomum* sp. without cristae could be *I. melis*. Grabda-Kazubska & Laskowski (1996) noted that *Cercaria fallax* Pagen-techer, 1857 was very probably *I. melis*.

The spectrum of plagiorchiid species was also very similar as in former surveys, except for *Haematoloechus similis*, reported only from planorbid snails. The species of *Plagiorchis elegans* and *P. loricola* were both included in Table II, although it is still unclear if they are separate species or not (Našincová, 1992). Since there exist features to distinguish them, they were also included in the key, although the characters (number of penetration glands, column in stylet) are difficult to observe.

It can be assumed that the trematodes from *L. stag-nalis* are rather well known and their distribution exceeds the area of Central Europe. The same species were found for example in Great Britain (Khan, 1960) or Finland (Niewiadomska et al., 1997); this occurrence is connected with the large distribution area of the great pond snail in Europe.

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REFERENCES


Allgower R. Zur Trematomidfauna einiger Freiburger Baggerseen, mit besonderer Berücksichtigung des Erregers der

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