

Morphological features of *Cloacotaenia megalops* (Nitzsch in Creplin, 1829) (Cestoda, Hymenolepididae) from different hosts¹

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ABSTRACT. The tapeworm species *Cloacotaenia megalops* (Nitzsch in Creplin, 1829) is characterized by a very specific morphology. A particularly distinct feature is a large almost square scolex in which four fleshy suction cups are embedded and a rudimentary rostellum. During standard studies of wild duck cestode fauna in northwestern Poland, some morphological differences were observed among specimens, mainly in the shape of scolices and hermaphroditic proglottids of *C. megalops* isolated from different bird species. This paper attempts to demonstrate the impact of the host species on morphology of the parasite. The study material consisted of 39 individuals of *C. megalops* (19 from *Aythya fuligula*, 10 from *Anas platyrhynchos*, 4 from *Bucephala clangula*, 4 from *Aythya marila* and 2 from *A. ferina*). The isolated parasites were fixed and stored in 70% ethanol and solid preparations were made. Selected external and internal structures of the parasite were measured and photographed using a Zeiss microscope, a microscope camera Opta Tech 2.1 and Opta View 6.0.2.2. It was stated that the sizes of the most important elements of the parasite morphology are generally consistent with those presented in the available literature, nevertheless some differences were observed in both morphology and sizes of some anatomical structures, especially in the form of scolices and hermaphroditic proglottids between specimens isolated from hosts representing three different eco-tribes (Aythyini, Anatini and Mergini).

Key words: *Cloacotaenia megalops*, Anatinae, host impact, West Pomerania, Poland

Introduction

Cloacotaenia megalops (Nitzsch in Creplin, 1829) is a relatively well-known tapeworm found in water and marsh birds [1]. Its large and almost square scolex has four muscular and unarmed suckers and rudimentary, also unarmed rostellum. The hermaphroditic proglottids have three spherical testes, arranged in a line; a lobate ovary; a small vitellarium located under the ovary. The cirrus sac is tiny and reaches to the second antiporal testicle; the cirrus is small and covered with short hairs. A mature uterus fills the whole proglottid.

During this study of wild duck cestode fauna in northwestern Poland, we observed considerable

morphological variation in the shape of the scolex and hermaphroditic proglottids of this tapeworm that were isolated from various species of hosts. Analysis of available literature showed a great variability of morphotic and metric characteristics of this tapeworm, but it may have resulted from the fact that previous descriptions, including measurements of various structures, may in fact have been collective descriptions based on material from different hosts. In this study, we take into account the origin of the examined tapeworms and based on the comparison of morphometric characteristics we try to explain whether the observed differences in the morphology of *Cloacotaenia megalops* are related to the specific species of hosts.

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Table 1. Morphological features of *Cloacotaenia megalops* (Nitzsch in Creplin, 1829) (μm)

| Feature | Bezubik [7] Czapliński [8] | Ryzhikov [5] | Maksimova [4] | Muniz-Pereira [6] | Own material |
|--|-------------------------------|-------------------------|--------------------------|---------------------------|---|
| Sucker diameter | 490–600 | 500–600 | 500–600 | 531–659 | 530 (414–693) |
| Testis diameter | 100–160 | 110–120 | 100–140 | 102–183 | 94 (75–155) |
| Cirrus width | 30–32 | 30–32 | – | – | 27.5 (20–50) |
| Cirrus sac length | 320–600 | 460–520 | 405–630 | 590–1020 | 360 (250–500) |
| Cirrus sac width | 55–70 | 60 | 60–70 | – | 41 (25–75) |
| Ovary length \times width | 100 \times 200–300 | 90–120 \times 120–180 | 100–120 \times 150–180 | – | 62 \times 137 (50–90) \times (95–200) |
| Vitellarium diameter | 80–100 | 80–100 | 60–90 | 44–117 | 65 (32.5–105) |
| Uterine proglottid length \times width | – | – | – | 366–549 \times 860–1920 | 288 \times 979 (144–540) \times (630–1584) |
| Egg diameter | 40–52 | 46–55 | 60 | 42–46 | 33 (20–60) |

Materials and methods

The material consisted of 39 individuals of *C. megalops*: 19 collected from tufted ducks (*Aythya fuligula*), 10 from mallards (*Anas platyrhynchos*), 4 from goldeneyes (*Bucephala clangula*), 4 from greater scaups (*Aythya marila*), and 2 from common pochards (*Aythya ferina*). The isolated tapeworms were fixed and stored in 70% ethanol. The solid preparations of the parasites were stained in acetocarmine according to Goergiev et al. [2] or fixed on slides using Hoyer liquid [3]. The selected external and internal structures of the parasite (an average of 6 measurements of each internal organ from a single individual) were measured and photographed using a Zeiss optical microscope, an Opta Tech 2.1 microscope camera and Opta View 6.0.2.2 software.

Results and discussion

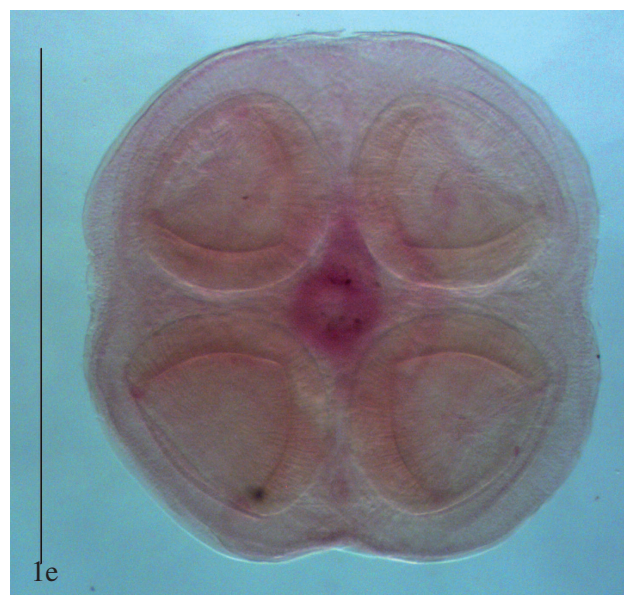
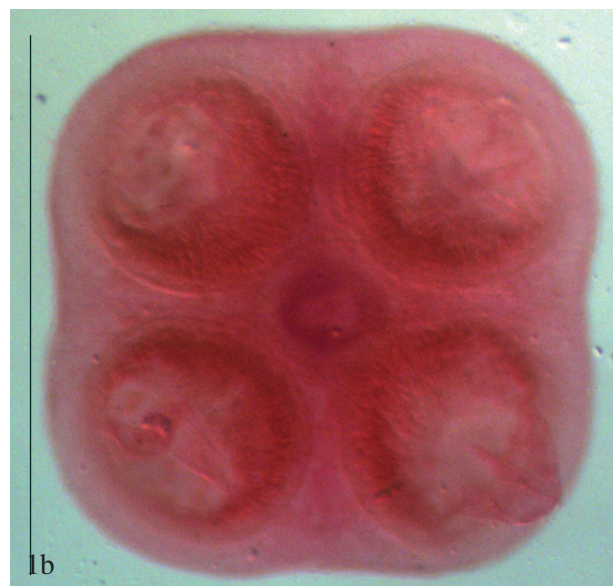
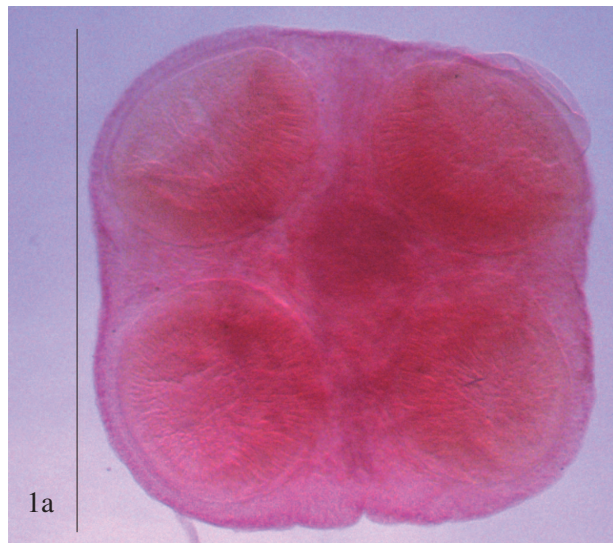
The basic dimensions of external and internal features of this parasite are presented in Table 1, and were in general similar to those specified in the available literature [1,4–8]. Yet in all cases the minimum size and often the average size were lower, which means that the majority of tapeworms examined in this paper were smaller than reported by other authors. Morphometric analysis of our material revealed the presence of some differences in the shape of the scolex and hermaphroditic

proglottids, and in dimensions of internal organs among the cestodes isolated from cloacas of different hosts (Fig. 1 and 2, Table 2).

External appearance

Scolex. All the isolated scolices were more or less square, with rounded edges (Fig. 1a–e). The squarest scolices were observed in tapeworms from the mallard (Fig. 1d); the scolices of cestodes from three species of *Aythya* ducks were also close to square, but with distinct indentation edges between suckers (Fig. 1a–c). Scolices of cestodes isolated from the cloaca in the goldeneye were distinctly fleshy and round (Fig. 1e). The smallest diameter was observed in scolices from three species of *Aythya* ducks (Fig. 1a–c), a longer diameter in scolices from the goldeneye and the longest from the mallard. There were certain differences in the diameter of the suckers and rostellum, depending on the host species (Table 2).

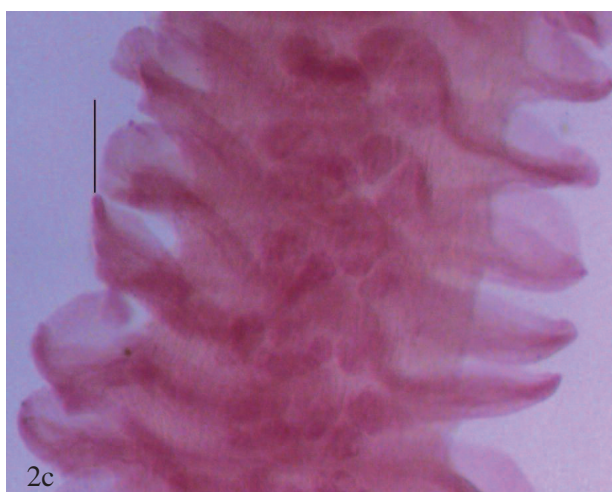
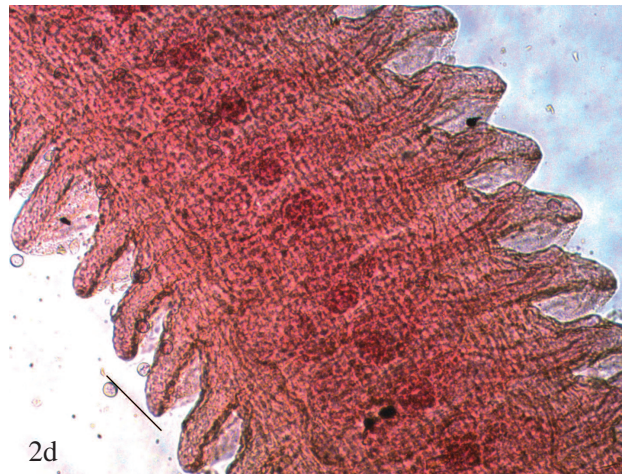
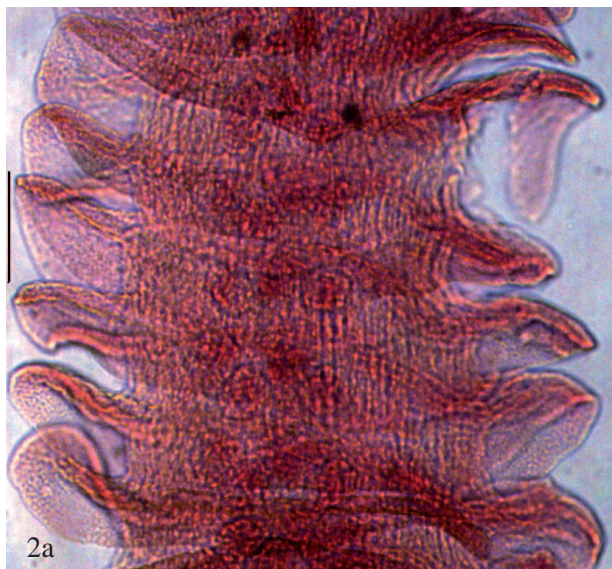
Strobila. According to various sources, the total length of strobila in *C. megalops* can be from 15 to 60 cm, [1,4–6]. In our study cestodes had very different length but the longest strobila, observed in *C. megalops* isolated from the cloaca of the mallard, was only about 30 cm long. The length of tapeworms isolated from other species of ducks ranged from 11.3 to 19.6 cm, which was below the average strobila length in the mallard (20 cm). We also isolated a dozen or so specimens of



Figs. 1a–e. Scolices of *Cloacotaenia megalops* (Nitzsch in Creplin, 1829) from different hosts. Scale bar: 1000 μm . 1a. *Aythya ferina*, 1b. *Aythya fuligula*, 1c. *Aythya marila*, 1d. *Anas platyrhynchos*, 1e. *Bucephala clangula*.

C. megalops with incomplete strobila, shorter than 9 cm, but they were not included in calculations of the mean length of strobila. The greatest tapeworm body width (1584 μm) was also observed in a tapeworm from a mallard (measured at the tapeworm uterine proglottids); a bit narrower were tapeworms from the goldeneye, and considerably narrower were cestodes from three species of *Aythya* ducks (Table 2).

There were also certain differences in the shape of hermaphroditic proglottids (Fig. 2a–e), especially in the shape of the velum covering the



Figs. 2a–e. Hermaphroditic proglottids of *Cloacotaenia megalops* (Nitzsch in Creplin, 1829) from different hosts. Scale bar: 250 μm .

2a. *Aythya ferina*, 2b. *Aythya fuligula*, 2c. *Aythya marila*, 2d. *Anas platyrhynchos*, 2e. *Bucephala clangula*.

anterior part of each next proglottid. In cestodes isolated from *Aythya* ducks, the posterior section of the proglottid was rapidly widening, forming long, quite pointed and clearly protruding spines on both sides of the strobila (they were the shortest in cestodes from the greater scaup) (Fig. 2a–c). Somewhat similar shape was observed for the proglottids of tapeworms from the mallard, but the spines were shorter (in relation to the width of the proglottid) and more rounded (Fig. 2d). The least-developed velum was in *C. megalops* from the goldeneye, proglottids had a trapezoidal shape with rounded side edges, and the velum only slightly covered the anterior edge of the next proglottid (Fig. 2e).

Table 2. Morphological features of *Cloacotaenia megalops* (Nitzsch in Creplin, 1829) from different hosts (μm)

| Feature | <i>Aythya ferina</i> | <i>A. fuligula</i> | <i>A. marila</i> | <i>Anas platyrhynchos</i> | <i>Bucephala clangula</i> |
|---------------------------|------------------------|------------------------|------------------------|---------------------------|---------------------------|
| Scolex diameter | 1125 (1044–1206) | 1256 (1044–1494) | 1202 (936–1386) | 1388 (1260–1890) | 1373 (1170–1620) |
| Strobila length | 16290 (15300–17280) | 15915 (12060–19080) | 14517 (11340–19620) | 20446 (12150–30420) | 15183 (11286–19080) |
| Rostellum diameter | 324 (270–378) | 316 (216–396) | 320 (252–360) | 387 (216–684) | 342 (270–414) |
| Sucker diameter | 513 (450–558) | 546 (495–693) | 520 (414–594) | 540 (459–689) | 533 (450–612) |
| Sucker wall diameter | 153 (135–171) | 174 (150–216) | 166 (125–207) | 145 (122–215) | 144 (99–176) |
| Testis diameter | 93 (90–100) | 87 (75–105) | 95 (90–100) | 127 (80–155) | 69 (65–75) |
| Cirrus length | – | 85 (75–110) | 137 (75–200) | 169 (75–200) | – |
| Cirrus sac length | – | 365 (270–500) | 306 (300–312,5) | 373 (250–468) | 397 (396–400) |
| Cirrus sac width | – | 45 (36–60) | 30 (25–35) | 53 (30–75) | 37 (30–45) |
| Ovary width | 150 (140–160) | 126 (97.5–200) | 160 (150–180) | 152 (120–200) | 95 (95–97.5) |
| Vitellarium diameter | 62.5 (40–85) | 66 (32.5–105) | 58 (50–65) | 74 (55–100) | – |
| Uterine proglottid length | 207 (198–216) | 290 (198–360) | 264 (216–360) | 319 (144–540) | 360 (150–460) |
| Uterine proglottid width | 765 (756–774) | 869 (630–1260) | 870 (738–936) | 1311 (1116–1584) | 1080 (996–1260) |
| Uterus length | 171 (162–180) | 236 (180–342) | 240 (144–360) | 270 (144–450) | 290 (180–350) |
| Uterus width | 333 (306–360) | 486 (360–900) | 456 (324–648) | 789 (486–990) | 720 (400–882) |
| Egg diameter | 21 (20–22) | 37 (25–60) | 30 (20–40) | 39 (35–50) | 40 (35–50) |

Internal structures

Male reproductive system. In this study, the largest diameter of the testicle (155.0 μm) was observed in the parasites of the mallard and the smallest (65.0 μm) in cestodes from the goldeneye (Table 2). The testes of all the parasites were spherical in shape, and their dimensions in cestodes isolated from tufted duck, goldeneye, common pochard and greater scaup were slightly smaller than in literature [4–8]. The cirrus sac was clearly visible, lie near aporal testicle and its average length (360 μm) was similar in all the isolated parasites. The width of the cirrus sac was from 25 to 75 μm (the highest average width for cestodes from the mallard). The longest and also narrowest cirrus was found in cestodes collected from mallards, while the shortest and widest in cestodes collected from tufted ducks; however, it is needs to be emphasized that the length of this organs depends on the degree of its inversion. A well-stained cirrus was visible in parasites of the three host species: tufted duck, mallard and greater scaup; it had a compact

cylindrical structure and was covered with short hairs.

Female reproductive system. The smallest ovary was observed in goldeneye parasites; its greatest width reached the smallest width of a tapeworm from the tufted duck (Table 2). The largest range in the size of the ovary was observed in tufted ducks, smaller in common pochard and mallard, and the lowest in greater scaup (Table 2), but the average values were similar for the tapeworms found in those hosts. The size of vitellarium was very different, regardless of the species of the host; its diameter ranged from 32.5 to 105 μm and its average diameter was greatest in tapeworm from the mallard (vitellarium was not observed in the goldeneye). In fully mature tapeworms, the uterus usually filled the entire segment; the greatest length and width of the uterus was recorded in *C. megalops* from the mallard and only slightly lower in the goldeneye (Table 2). The uterus was filled with spherical eggs 20 to 60 μm in diameter; their dimensions were slightly smaller than reported in literature (Table 1).

Summary

The results showed that the differences in appearance and size of various morphological structures of *C. megalops* are related to their hosts. These differences mainly concern their external characteristics: the size of scolex and to a lesser extent its shape, length and width of strobila, the shape of hermaphroditic proglottids, particularly the lateral edges of the velum. On this basis, we can distinguish three morphological types corresponding to the three tribes of the examined ducks: three species of the tribe Aythyini (*Aythya ferina*, *A. fuligula*, *A. marila*), one species of the tribe Anatini (*Anas platyrhynchos*) and one of the tribe Mergini (*Bucephala clangula*). Cestodes from *Aythya* ducks are the smallest, with clearly rounded edges of the scolex and indentation between suckers, with strongly elongated and pointed lateral edges of the velum. Tapeworms from the mallard were the largest, with an almost square scolex, and shorter and rounded lateral edges of velum in strobila. Cestodes from the goldeneye were almost as large as from the mallard, but scolex was almost circular, segments were trapezoidal and with a short velum. The observed differences in the elements of the reproductive systems cannot be divided in a similar manner. In all the hosts, the variability in the size of individual elements was high and the values tended to overlap among hosts; the size of many internal structures depends less on the origin than the size of the specimen. The only exception is the size of ovary in cestodes from the goldeneye; in these tapeworms the ovary is considerably smaller than in other hosts, including the smallest tapeworms from *Aythya* ducks.

Our report should be treated as a preliminary one, as the number of host species from individual tribes and the number of examined tapeworms of some hosts was quite small. Nonetheless, this study shows connections between the morphology of the *Cloacotaenia megalops* and its origin (host species).

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Charakterystyka morfometryczna *Cloacotaenia megalops* (Nitzsch in Creplin, 1829) (Cestoda, Hymenolepididae) z różnych żywicieli

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Cloacotaenia megalops jest pasożytem ptaków środowisk wodno-błotnych. Na dużym, kwadratowym skoleksie znajdują się 4 nieuzbrojone przyssawki oraz szczątkowy ryjek. W członach hermafrodytycznych widoczne są 3 kuliste jądra, ułożone w jednej linii, płatowaty jajnik i mały żółtnik; cirrus jest drobny i pokryty krótkimi włoskami. Dojrzała macica wypełnia cały człon.

Podczas badań cestodofauny dzikich kaczek północno-zachodniej Polski zaobserwowano wyraźne zróżnicowanie morfologiczne w kształcie skoleksów oraz członów hermafrodytycznych tego tasiemca wyizolowanego z różnych gatunków żywicieli.

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