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LIFE CYCLE OF THE TREMATODE *NOTOCOTYLUS INTESTINALIS* (DIGENEA, NOTOCOTYLIDAE) UNDER NATURAL CONDITIONS IN PRIMORYE REGION (RUSSIA)

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Life Cycle of the Trematode *Notocotylus intestinalis* (Digenea, Notocotylidae) under Natural Conditions in Primorye Region (Russia). Besprozvannykh V. V. — The redia, cercaria, adolescaria and adult trematodes *Notocotylus intestinalis* Tubangui, 1932 are described. It was established that under natural conditions of Primorye Region, the first intermediate hosts of this trematode are snails *Parafossarulus manchouricus* and *P. spiridonovi*. Adult worms were grown in the chicken.

Key words: *Notocotylus intestinalis*, cercaria, adolescaria, adult worms (marita), life cycle.

Жизненный цикл трематоды *Notocotylus intestinalis* (Digenea, Notocotylidae) в условиях Приморского края (Россия). Беспрозванных В. В. — Приведено описание редии, церкарии, адолескарии и мариты трематоды *Notocotylus intestinalis* Tubangui, 1932. Установлено, что в условиях Приморского края России роль первого промежуточного хозяина трематоды выполняют моллюски видов *Parafossarulus manchouricus* и *P. spiridonovi*. Половозрелые черви выращены у цыплят.

Ключевые слова: *Notocotylus intestinalis*, церкария, адолескария, марита, жизненный цикл.

Introduction

The trematode *Notocotylus intestinalis* Tubangui, 1932 was found in the first time in domestic duck (*Anas boschas domestica*) on the Philippine Islands (Skryabin, 1953). In 2001, in snails *Parafossarulus manchouricus* and *P. spiridonovi* from floodplain reservoirs of basins Ilistaya river and Arsenjevka river, we found out notocotylid parthenits and cercariae. We experimentally established that these trematodes belongs to species *Notocotylus intestinalis*.

Material and methods

Spontaneously infested and releasing notocotylid cercariae molluscs from genus *Parafossarulus* served as working material. Five hundred gastropods were examined, of which 5 were infected with notocotylids. Snails were kept in the laboratory at the temperature of water about 20–22°C. To determine reaction of cercariae to the light, narrow elongated glass vessels sized of 20 x 2 x 3 cm were used, 1/3 of which was closed with a black paper, with the bright point illumination of the opposite part of vessel. To establish diurnal rhythm of cercariae releasing from snails, the latter were placed into Petri dishes with water volume of 50 ml. Every 2 hours snails were moved to another dishes, and in previous dishes numbers of adolescariae appeared were determined. Cercaria's behaviour was observed on specimens which left snails during the peak emission and were placed into Petri dishes with high sides. As definitive hosts, chickens were used, incubated in laboratory. Partenitae, cercariae (preliminary immobilized) and adolescariae (10 spec. each) were measured being alive. Adult trematodes were placed into whole mounts. Preparations were stained with aluminous carmine.

Notocotylus intestinalis Tubangui, 1932 (fig. 1)

First intermediate hosts. *Parafossarulus manchouricus* and *P. spiridonovi* (Bithyniidae) (extensiveness of invasion 1.0%).

Places of finding. Floodplain reservoirs in the middle flow of the Ilistaya riverz (basin of Khanka lake) and Arsenjevka river (first-order tributary of Ussuri river).

Parthenita. Redia sized 0.64–0.76 x 0.20–0.24 mm (fig. 1, *a*). Pharynx 0.056–0.067 x 0.067–0.078 mm, intestine long, filled with food debris. Maternity pore on the level of the back edge of pharynx.

Cercaria. Body (fig. 1, *b*) sized 0.22–0.24 x 0.12–0.15 mm, filled with numerous cystogenous glands. On the anterior end of body, on level of oesophagus, there are 3 pigmented spots. Middle spot is less than lateral ones and often hardly distinguished. Oral sucker 0.027–0.030 x 0.027–0.038 mm. Intestinal caeca closed at the level of middle of excretory bladder, rounded in shape. Collective excretory channels form a ring clos-

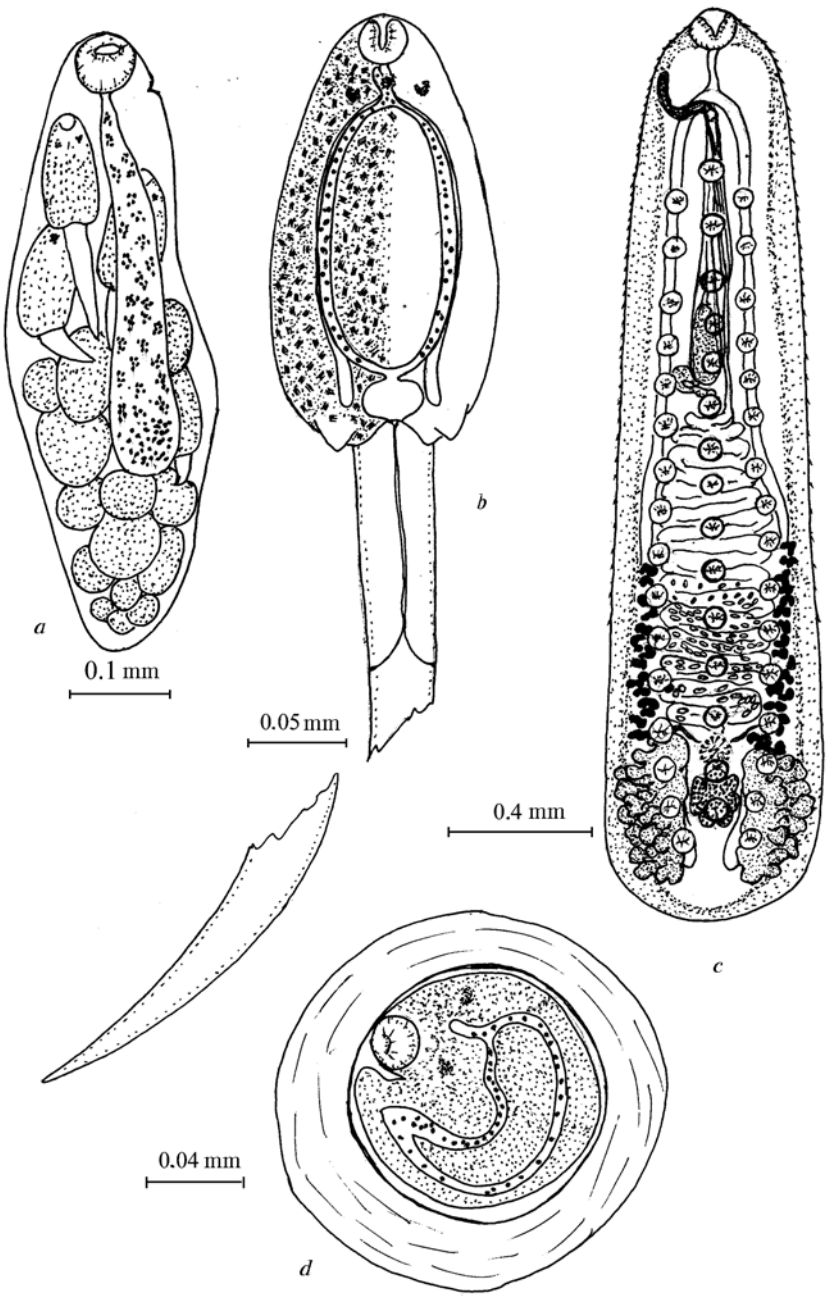

Fig. 1. *Notocotylus intestinalis*: *a* — redia; *b* — cercaria; *c* — adolescaria; *d* — marita.

Рис. 1. *Notocotylus intestinalis*: *a* — редия, *b* — церкария, *c* — адолескария, *d* — марита.

ing up at the level of intestinal bifurcation. From the place of channels closing, unpaired appendix, equal to oesophagus in length, goes away. The channel lumen is filled with numerous granules. Caudal channel is divided into two short branches in the distal end of tail. There are 2 processes on posterior end of body, used by cercariae for moving on substrate. Tail 0.50–0.56 x 0.044–0.056 mm.

Adolescaria. Adolescaria's cyst (fig. 1, *c*) is dome-shaped, 0.160–0.166 mm in diameter. Width of wall forming a dome 0.056–0.061 mm.

Definitive host. Chicken *Gallus gallus* dom. (experimentally).

Localization. Intestinal caeca.

Marita. Body 2.0–2.4 x 0.48–0.55 mm (here and further measurements of 5 spec.) (fig. 1, *d*), up to the level of middle vitelline glands covered with small spines most densely located on its anterior end. Body edges are folded ventrally. Ventral glands form three longitudinal rows. In median row 15, in lateral rows 16 glands in each. Anterior gland of middle row lies ahead of the first pair of glands of lateral rows, and posterior gland lies at the level of next to last pair of lateral glands (by 12 spec. of marites with glands). Distance from anterior end of body to the first gland of central row 0.36–0.47 mm, and between glands in rows 0.05–0.09 mm. Oral sucker 0.11–0.12 mm in diameter, oesophagus 0.11–0.14 mm of length. Intestinal caeca do not reach a little the level of back edge of testes. Testes 0.28–0.39 x 0.13–0.20 mm, on the external edge of lobes deep and small. They placed 0.084–0.10 mm from posterior end of body. Cirrus sac 0.60–0.81 x 0.06–0.08 mm, has large internal seminal vesicle and external convoluted seminal vesicle. Genital pore located on median line immediately after intestinal bifurcation. Cirrus is not armed, when everted, reaches 0.20 x 0.02 mm size. Ovary 0.10–0.15 x 0.10–0.13 mm, lobed, placed on median line between testicles, at their middle. Mehlis' gland 0.078–0.089 x 0.084–0.089 mm, lies ahead the ovary. Uterine loops do not cover intestinal caeca. Metraterm 0.30–0.46 mm of length. Vitelline glands lie on each side of body covering intestinal caeca, posteriorly they adjoin to anterior edge of testicles. Length of vitelline glands 0.40–0.56 mm. Eggs without filaments 0.019 x 0.011 mm.

Life cycle. The peak release of cercaria is observed in the midday (12 a.m.–1 p.m.). Cercariae have positive phototaxis and after short-term active swimming alternating with settling on substrate and crawling they encysted in the most lighted up areas of vessel. As we observed, they encysted not only on vessel walls, but also on the surface of mollusc shell and water vegetation (on parts of plants closest to water surface). Thus, even at the highest density of adolescariae in vessel, cercariae did not encyst on adolescariae.

Adolescariae obtained were fed to 4 chickens, 100 spec. each. Chickens were autopsied on 10th, 12th, and 16th days. All chickens were infected, however invasion intensity were different, from 1 to 37 trematodes. Marites localized in intestinal caeci and normal proportion of worms was 4–13, 1–15, 5–32. Trematodes became mature only on 16th day after the day of chickens infection.

Discussion

Up to date, systematic status of this trematode species remained debatable. Based on marite morphology, some authors recognize validity of *N. intestinalis* (Oshmarin et al., 1970), others treat it as a synonym of *N. attenuatus* (Dubois, 1951, cited by Filimonova, 1982, 1985). In our opinion, this species is independent undoubtedly. Morphologically marites of the species mentioned differ by the followings signs: presence of thorns on a body and absence of armament on cirrus in *N. intestinalis* as compared to *N. attenuatus*; testes structure (testes lobes in *N. attenuatus* large and poorly expressed, but in *N. intestinalis* they are small, numerous, and sections reach

longitudinal ax of testicle); length proportion of metraterm and bursa (in *N. attenuatus* metraterm does not reach the middle of bursa, and in *N. intestinalis* it goes behind the middle of bursa). Also, there are differences in the structure of cercariae. Collective excretory channels in cercariae *N. intestinalis*, in contrast to those in *N. attenuatus*, at the level of intestinal bifurcation form process equal to oesophagus in length. Moreover, it was earlier established that the first intermediate hosts of *N. attenuatus* are pulmonary molluscs from genus *Lymnaea* (Filimonova, 1982, 1985), and in *N. intestinalis*, according to results of our studies, this role play anterobranchial molluscs from genus *Parafossarulus*.

Consequently, along with morphological signs, independence of species *N. intestinalis* is also confirmed by peculiarities of its life cycle.

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