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> BIOLOGY, MORPHOLOGY, AND SYSTEMATICS OF HYDROBIONTS

Taxonomic Status of Cestodes of the Genus *Paracaryophyllaeus* Kulakowskaja, 1961 (Caryophyllidea: Caryophyllaeidae)

E. N. Protasova^a, S. G. Sokolov^a, A. P. Kalmykov^b, and A. E. Zhokhov^c

^aCenter of Parasitology, Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences, Leninskii pr. 33, Moscow, 119071 Russia

e-mail: protasova39@mail.ru ^bAstrakhan State Biosphere Reserve, nab. Reki Tsarev 119, Astrakhan, 414021 Russia ^cPapanin Institute for Biology of Inland Waters, Russian Academy of Sciences, Borok, Nekouzskii raion, Yaroslavl oblast, 152742 Russia Received February 13, 2013

Abstarct—A taxonomic revision of cestodes of the genus *Paracaryophyllaeus* Kulakowskaja, 1961, parasites of cobitid fishes, has been performed. Three species (*Paracaryophyllaeus gotoi* (Motomura, 1927), *P. kula-kowskae* sp. n., and *P. misgurni* sp. n.) are considered valid species; two are described as new species. *P. dubi-ninorum* Kulakowskaja, 1961 is a young synonym of *P. gotoi*. The taxonomic status for *P. gotoi* sensu Scholz, 1989, *P. gotoi* sensu Scholz et al., 2001, and *Paracaryophyllaeus* sp. 1 and *Paracaryophyllaeus* sp. 2 (described in present work) needs specification.

Keywords: cestodes, Caryophyllidea, *Paracaryophyllaeus gotoi*, *P. dubininae*, *P. dubininorum*, *P. kulakowskae*, *P. misgurni*, new species, *Cobitis*, *Misgurnus* Sakhalin, Primor'ye, Volga River basin **DOI:** 10.1134/S199508291403016X

INTRODUCTION

The genus Paracaryophyllaeus Kulakowskaja, 1961 combines monotonic cestodes of cobitid fishes (Cobitidae). There are three nominal species within the genus: P. dubininorum Kulakowskaja, 1961, P. gotoi (Motomura, 1927) and P. lepidocephali (Kundu, 1985). The type of species-P. dubininorum—is described on the basis of syntypes collected from the Japanese weather loach Misgurnus anguillicaudatus (Cantor, 1842) from the estuary of the River Budunda (current called River Ivanovka of the River Zeya basin) and from the spined loach (in O.P. Kulakovskaya [3] the species is not indicated, but in [4] by the same author it is a Cobitis taenia Linne, 1758) from the Carpathian water bodies. In the original description, the parasite was called Paracaryophyllaeus dubininae. According to the article 31.1.2 of the fourth edition of the International Code of Zoological Nomenclature, the name was corrected as *P. dubininorum* [7]. The species *P. gotoi* is described from the Japanese weather loach from the Kumkan River in Korea and in the original description it is related to the genus Caryophyllaeus Gmelin, 1790 [11]. V.A. Roitman [6] reasonably placed it within the genus Paracaryophyllaeus. However, this step does not have nomenclature force. M.N. Dubinina [1], based on Roitman's opinion. published the name P. gotoi for the first time and, formally, she is the author of the new combination of the species and genus names of the parasite. She synonymized *P. dubininorum* (*P. dubininae* in V.A. Roitman [6]) and *P. gotoi*, leaving the last one valid [1]. This point of view is accepted by some researches [2, 10, 13, 14]. However, both species are described insufficiently; for that reason, the relevance of present synonimization is in doubts [5, 7]. The material type of *P. dubininorum* (=*P. dubininae*) and *P. gotoi* (=*Caryophyllaeus gotoi*) has been not preserved, which excludes the objective decision of this question. The finding of *Paracaryophyllaeus lepidocephali* from *Lepidocephalus guntea* (Hamilton, 1822) of the northern part of India within this genus is not justified.

The authors have cestode material of the genus *Paracaryophyllaeus* from loaches from the basins of Volga and Amur rivers, Peter the Great Bay, and Far Eastern water bodies, the study of which allowed us to describe new representatives of the genus.

MATERIALS AND METHODS

The original material on cestodes is collected from three species of loach fishes, the spined loach *Cobitis taenia* Linne, 1758 from the River Ild (the Volga River basin) in June 2004 and in June–July 2010; Luther's spiny loach *Cobitis lutheri* Rendahl, 1935 from a dammed nameless stream flowing into Peter the Great Bay (Primorskii krai RF) in June 2010; and *Misgurnus nikolskyi* Vasil'eva, 2001 from Lake Sladkoe (northwestern Sakhalin) in July, 2009 and from the preestuary area of the Kedrovaya River (basin of Peter the Great Bay) in July, 2010.

Additionally, material of the species *Paracaryo-phyllaeus dubininae* was collected by V.A. Roitman in the basin of the River Zeya in 1958–1959 and preserved at the Museum of Helminthologial Collections of the Center of Parasitology, Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences, Moscow (further indicated as MHC CP IPEE RAS).

Cestodes extracted from fish intestines were washed in fresh water, fixed in 70% ethanol, dyed by acetic acid Carmine, and mounted in Canada balsam. Morphology was studied with the use of light microscopes Amplival (Carl Zeiss, Jena) with drawing-overhead projector and an Imager Al (AXIO). All measurements are given in millimeters. The position of genital openings was measured from the posterior body end to the mid-distance between uterovaginal and male pores.

RESULTS

Description of *Paracaryophyllaeus kulakowskae* sp. n. (Fig. 1).

S y n o n i m. *Paracaryophyllaeus dubininae* Kulakowskaja, 1961 sensu Roytman, 1963.

Type host. Cobitis lutheri.

Other host species. *Cobitis* sp. (in V.A. Roitman [2] as *C. taenia*).

Localization. Intestine.

Ty p e 1 o c a 1 i t y. An artificial reservoir appeared upon the damming of a nameless stream flowing into Peter the Great Bay by a gravel mound in the neighborhood of the village Primorskii (Primorskii krai RF); $43^{\circ}4'15.68''$ N and $131^{\circ}36'20.98''$ E.

Other places of finds. Rivers Zeya (near the village of Potyemkino), Tashchenko (River Zeya basin), and Mogot and flood-plain lakes in the neighborhood of the city Svobodnyi (River Zeya basin).

Type material. Holotype no. 1218 (July 24, 2010, collector C.G. Sokolov): on the permanent slide it is encircled and paratypes nos. 1218–1222 (July 24, 2010, collector C.G. Sokolov) deposited in the MHC CP IPEE RAS.

A d d i t i o n a l m a t e r i a l. Slides no. 62 (July 1954, collector V.A. Roitman), no. 63 (June 1954, collector V.A. Roitman), no. 64 (August 1954, collector V.A. Roitman), deposited in the MHC CP IPEE RAS.

Occurrence. In one individual of Luther's spiny loach from the type locality.

Intensity of invasion. Ten specimens.

E t y m o l o g y. The species is named in honor of Olga Petrovna Kulakovskaya, who contributed greatly to the study of caryophyllid cestodes.

D e s c r i p t i o n. Based on nine mature specimens (holotype measurements are given in brackets). Body length 4.56-8.39 (6.09); width at ovary level 0.399-

0.641 (0.399). Anterior end slightly widened, almost rectangular, with conical apical projection (when relaxed) or skin-deep cross-elongated terminal hollow (when contracted). Width of anterior body end is 0.405-0.526 (0.405). Posterior body end rounded, with elongated excretory vesicle, opening by terminal excretory pore. Testes rounded, their number is 21-31 (24). length 0.094-0.151 (0.098-0.117), width 0.094-0.143 (0.098–0.113), positioned in medullar parenchyma by two longitudinal rows, reaching the level of distal loops of the uterus. Distance from anterior end to beginning of testes is 1.503–2.772 (2.333), or 32.4– 42.8% (38.3%) of body length. Vas deferens convoluted, external seminal vesicle absent. Vas deferens narrows before the entrance in bursa cirrus and widens again inside its proximal part, forming internal seminal vesicle. Bursa cirrus oval, weakly muscular, length 0.181-0.245 (0.211), width 0.124-0.170 (0.124). Male genital opening and opening of the uterovaginal canal are positioned on the bottom of the common genital atrium. Distance from the common genital atrium to posterior body end is 1.298-2.607 (1.850), which is 24.1-32.0% (30.4%) of body length. Vitelline follicles considerably numerous, oval-shaped, large, positioned in medullar parenchyma by two lateral fields, reach the level of distal uterine loops, in lateral fields at ovary area absent. Distance from anterior body end to beginning of vitelline follicles 0.368-0.473(0.473) or 6.1-8.1%(7.8%) of body length. Postovarial group of vitelline follicles is numerous. Length of postovarial body region 0.765-1.587 (0.983) or 14.6–20.7% (16.1%) of body length. Ovary H-shaped, symmetrical. Ovary width 0.326-0.504 (0.326), isthmus length 0.121-0.189 (0.143), length of the right ovary ala 0.473-0.865 (0.725) and of the left ala 0.536–0.958 (0.725). Vagina tubular, convoluted, narrowed in anterior part and widened in posterior part. Seminal receptacle positioned dorsally relatively to ovarian isthmus. Narrow canal deviates from the seminal receptacle and falls into ootype. Uterus tubular; its proximal part forms few loops in the space between posterior portions of ovary alae. Distal part of uterine loops slightly protrudes anterior beyond the bursa cirrus. Uterus and vagina open in elongated uterovaginal canal. Eggs numerous, oval, with operculum; their length in distal loops of the uterus is 0.0522-0.0548 (0.0522), width 0.033–0.0357 (0.0357).

R e m a r k s. V.A. Roitman [6] found "*P. dubini-nae*" in a loach from the basin of the River Zeya. Collection material of this author is presented by one individual, available for study and badly preserved fragments of some more individuals. Length of indicated specimen is 9.16. Anterior body end rectangular with skin-deep transversely elongated terminal hollow, 0.718 wide. Only 14 testes visible distinctly. Ovary H-shaped, length of the left ala 0.893. Vitelline follicles positioned in medullar parenchyma, reach the level of distal loops of the uterus, in ovary region absent. Length of postovarial body region is 1.795,



Fig. 1. *Paracaryophyllaeus kulakowskae* sp. n. from *Cobitis lutheri*, holotype (a, d, e) and paratypes nos. 1218 (b), 1219 (c): (a, b) anterior body end; (c) bursa cirrus and distal part of the female reproductive system, laterally; (d) body fragment with ovary, canals of female reproductive system and bursa cirrus, ventrally; and (e) general view of the mature individual. (BC) bursa cirrus, (O) ootype, (U) uterus, (V) vagina, (UVD) uterovaginal duct, (AG) common genital atrium, (VD) vitelline duct, (VR) vitelline reservoir, and (RS) seminal receptacle.

which is 19.6% of body length. Distal loops of the uterus protrude anterior beyond bursa cirrus considerably. On the slide it is impossible to observe a number of some characters: exact number of testes and anterior border of their position, contours of bursa cirrus, presence or absence of the common genital atrium. Testes absent on the distance 2.468 from anterior end, comprising 26.9% of body length.

P. dubininae sensu Roytman, 1963 and *P. kula-kowskae* sp. n. are similar by the shape of anterior body end, length of vitelline follicles, and distal loops of the uterus. In the authors' opinion, *P. dubininae* sensu Roytman, 1963 is a synonym of *P. kulakowskae* sp. n.

Description of *Paracaryophyllaeus misgurni* sp. n. (Fig. 2).

Synonims. *Paracaryophyllaeus* sp. Sokolov et al., 2012

Type host. Misgurnus nikolskyi.

Localization. Intestine.

Type location. Lake Sladkoe (northwestern Sakhalin), 53°23'7.45" N, 142°1'1.06" E.

Type material. Holotype no. 1223 (22.07.2009, collector C.G. Sokolov) and paratype no. 1224 (22.07.2009, collector C.G. Sokolov), deposited in the MHC CP IPEE RAS).

Occurrence. In three individuals among 21 studied loaches (14.3%).

Intensity of invasion. One specimen.

E t y m o l o g y. The species name is given on the basis of the genus name of the host.

Description. Based on two mature specimens (holotype measurements are given in brackets). Body length 11.02 (15.87), width at ovary level (1.17). Anterior end trapezium-shaped with rounded anterior side, with weakly pronounced rugosity, its width 0.9(1.32). Posterior body end rounded with elongated excretory vesicle opening by terminal excretory pore. Testes rounded or almost oval, their number is 44 (41), length 0.150-0.179 (0.145-0.222), width (0.153-0.207). They are located in medullar parenchyma by two longitudinal rows reaching the level of distal loops of the uterus. Distance from the anterior body end to beginning of testes is 4.89 (7.29) or 44.4% (45.9%) of body length. Bursa cirrus is weakly muscular, oval; length 0.369 (0.452), width (0.315). Vas deferens narrows before the entrance in bursa cirrus and widens again inside its proximal part, forming an internal seminal vesicle. External seminal vesicle absent. Common genital atrium is absent. Male genital opening and opening of the uterovaginal canal are positioned on the ventral body surface. Distance from genital openings to posterior body end is 2.019 (2.995), or 18.3% (18.9%) of body length. Vitelline follicles considerably numerous, rounded, or oval-shaped. They are positioned in medullar parenchyma by two lateral fields, conniving in posterior body half; they reach the level of bursa cirrus and in lateral fields at ovary area are absent. Distance from anterior body end to beginning

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of vitelline follicles is 1.84 (2.54), 16.7% (16.0%) of body length. Postovarial vitelline follicles numerous, beginning at level of posterior side of ovary ala. Length of postovarial body region (1.574) or (9.92%) of body length. Ovary H-shaped, symmetrical, its width (0.979), isthmus length (0.315), length of the left ovary ala (1.451), of the right ala (1.516). Vagina tubular, convoluted, narrowed in proximal part and widened in distal part. Seminal receptacle positioned dorsally relatively to ovarian isthmus. Uterus is tubular, strongly convoluted; distal loops of the uterus protrude anterior beyond the bursa cirrus. Uterus and vagina open in elongated uterovaginal canal. Eggs with operculum, their size in distal loops of the uterus is 0.045×0.035 .

Description of *Paracaryophyllaeus* sp. 1 (Figs. 3a–3c).

Host Cobitis taenia.

L o c a t i o n. River Ild (Volga River basin), in the neighborhood of the village of Kozhevnikovo (Yaroslavl oblast RF), $58^{\circ}0'47.76''$ N and $38^{\circ}9'29.23''$ E.

Localization. Intestine.

M a t e r i a l. Slides nos. 3966, 3970 (June 3, 2010, collector A.E. Zhokhov), 3967 (22.06.2010, collector A.E. Zhokhov), 3968 (July 26, 2010, collector A.E. Zhokhov), 3969 (July 1, 2004, collector A.E. Zhokhov) deposited in the MHC CP IPEE RAS.

Description. Based on 11 mature type specimens with few eggs in uterus. Body length 4.37 - 8.74, width at ovary level 0.410-0.887. Anterior body end slightly widened with rounded side, smooth, its width 0.405–0.791. Posterior body end rounded, with elongated excretory vesicle, opening by terminal excretory pore. Testes rounded, their number is 30-36, size $(0.063-0.155) \times (0.075-0.130)$, positioned in medullar parenchyma by two longitudinal rows, reaching the level of frontal side of bursa cirrus. Distance from the anterior end to testes beginning is 1.205–2.192 or 23.0-29.1% of body length. External seminal vesicle absent. Vas deferens distinctly narrows before the entrance in bursa cirrus and widens again inside its proximal part, forming thin-walled internal seminal vesicle. Bursa cirrus is weakly muscular, pear-shaped, $(0.198-0.263) \times (0.146-0.168)$. Common genital atrium absent. Male genital opening and opening of the uterovaginal canal are positioned on ventral body surface on pronounced distance from each other. Distance from genital openings to posterior body end is 0.930-1.688 or 17.2-23.2% of body length. Vitelline follicles considerably numerous, rounded, or ovalshaped, positioned in medullar parenchyma, reach the level of anterior side of ovary alae, in lateral fields at ovary area are absent. Distance from anterior body end to beginning of vitelline follicles is 0.472–0.773 or 8.2–15.0% of body length. Postovarial vitelline follicles numerous, beginning at level of posterior side of ovary alae. Length of postovarial body region 0.613-1.024 or 9.9–14.0% of body length. Ovary H-shaped, symmetrical, its width 0.307–0.472, isthmus length 0.092–0.110. Length of the left ovary ala 0.589–0.902,



Fig. 2. *Paracaryophyllaeus misgurni* sp. n. from *Misgurnus nikolskyi*, holotype (a, c) and paratype (b): (a) posterior body end; (b) bursa cirrus and distal part of the female reproductive system, laterally; and (c) general view of the mature individual. The rest of the indications are the same as in Fig. 1.



Fig. 3. *Paracaryophyllaeus* sp.1 from *Cobitis taenia* (a-c) and *Paracaryophyllaeus* sp. 2 from *Misgurnus nikolskyi* (d): (a, c) general view of the mature individual; (b) anterior body end; and (c) bursa cirrus and distal part of the female reproductive system, laterally. The rest of the indications are the same as in Fig. 1.

of the right ala 0.644–0.883. Vagina tubular, strongly convoluted in proximal part, distal part widened. Seminal receptacle present. Uterus tubular, few loops lie in the space between anterior portions of ovary alae and continue anteriorly, reaching anterior side of bursa cirrus. Uterus and vagina open in elongated uterovaginal canal. Eggs numerous, with operculum, their size in distal loops of the uterus is $(0.052-0.055) \times (0.037-0.039)$.

Description of Paracaryophyllaeus sp. 2 (Fig. 3d).

Host. Misgurnus nikolskyi.

Localization. Intestine.

Location. Left-bank channel-shaped bay of preestuary region of the Kedrovaya River (basin of Peter the Great Bay), the neighborhood of the village Primorskii, 43°4′41.97″ N, 131°36′45.08″ E.

M a t e r i a l. Slide no. 3971 (12.07.2010, collector A.E. Zhokhov), deposited in the MHC CP IPEE RAS.

Description. Based on 1 mature specimen. Body length 3.34, width at ovary level 0.449. Anterior body end comparatively wider of rest body, with rounded smooth anterior side, its width 0.673. Posterior body end rounded, with elongated excretory vesicle, opening by terminal excretory pore. Testes rounded, their number is 27, size $(0.067-0.074) \times$ (0.063-0.074), positioned in medullar parenchyma without distinct separation on longitudinal rows, tightly adjoining in posterior part of occupied by them body region, reach the level of distal loops of the uterus. Distance from anterior body end to testes beginning is 1.486 or 44.5% of body length. Bursa cirrus is ovoid, 0.166×0.117 , weakly muscular, with internal seminal vesicle in proximal part. Common genital atrium absent. Male genital opening placed in front of elongated opening of the uterovaginal canal, in proximal part of which uterus and vagina open. Distance from genital openings to posterior body end is 0.801, or 24% of body length. Vitelline follicles are numerous, rounded or oval. They are positioned in medullar parenchyma in the whole body width but more numerous in lateral fields, reach the level of anterior sides of ovary alae, in lateral body fields they are absent. Distance from anterior body end to beginning of vitelline follicles is 0.937 or 28.1% of body length. Postovarial group of yolk follicles is numerous; adjoining posterior sides of ovary alae. Length of postovarial body region is 0.529 or 15.8% of body length. Ovary H-shaped, symmetrical, its width 0.375, isthmus length 0.049. Length of the left ovary ala is 0.375, of the right ala 0.35. Vagina tubular, its proximal part and seminal receptacle are not visible. Uterus tubular, convoluted, its distal loops protrude beyond bursa cirrus anteriorly. Eggs with operculum, their length in distal loops of uterus is 0.041–0.049 (width was not measured due to strong shrinking in balsam).

DISCUSSION

The original description of *P. dubininorum* is made on three individuals collected from the Japanese weather loach from the Zeya River basin and a number of specimens from the spined loach [1, 3, 4] from Carpathian water bodies not given by authors. From M.N. Dubinina's text [1, P. 82]: "O.P. Kulakovskaya (1961) on the basis of a study of our specimens and additional material of V.M. Ivasik from loaches ... distinguished caryophyllideans from cobitid fishes in a new genus Paracaryophyllaeus ... and described a new species: *P. dubininae*," it is possible to conclude that individuals from the loach comprised the main material on the basis of which the present species was described. Hence, the syntype P. dubininorum, drawn by O.P. Kulakowskaya [3, Figs. 4, 5], is an individual from the loach. Morphologically this specimen is similar to P. gotoi s. str. [11, 12, 15]. In Motomura [11] and Yamaguti [15], the present species is considered within the genus Caryophyllaeus.

Scholtz [13] describes Paracaryophyllaeus gotoi on the basis of material from the spined loach from the Tisa River in Hungary. The studied cestodes are similar in several morphological characters with P. gotoi s. str. and the syntype P. dubininorum, shown by Kulakovskaya [3]. However, P. gotoi sensu Scholz, 1989 is distinguished from the two mentioned parasites by the position of uterine loops relatively bursa cirrus, as well as by the position of testes relative to the anterior end. Scholtz, 1989 shows [13] that uterine loops in studied cestodes reach the anterior ridge of the bursa cirrus, but in his drawing it can be distinctly seen [13, Fig. 4A] that they reach only midlevel of the bursa cirrus. Also, according to this drawing, in P. gotoi sensu Scholz, 1989 the distance from the anterior end to testes beginning is $\sim 17\%$ of the body length vs. 26-30% in P. gotoi s. str and syntype P. dubininorum, i.e., testes in P. gotoi sensu Scholz, 1989 are placed closer to the anterior end than in two last. The authors have two specimens of cestodes from the Siberian spined loach Cobitis melanoleuca Nichols, 1925 (identified by N.G. Bogutskii, Zoological Institute, Russian Academy of Sciences) from the Obzhorovo canal (estuary of the Volga River collected on September 3, 2009), which corresponds to P. gotoi sensu Scholz, 1989 in the position of the testes relative to the anterior body end and uterine loops relative to the bursa, as well as in the shape of anterior end and proportions of ovary. The body length of these parasites is 4.25 and 6.23; width at ovary level is 0.546 and 0.600. Width of anterior body end is 0.472 and 0.620. Distance from anterior body end to testes beginning is 0.797 and 0.963 or 18.8 and 15.4% of body length. Number of testes is 31 and 22; their size is $(0.125-0.150) \times (0.155-0.163)$ and $(0.137-0.205) \times (0.155-0.170)$, correspondingly. Bursa cirrus is 0.312×0.250 (in individuals with a length of 6.23). Distance from genital openings to posterior end is 1.7 or 27.3% of body length (in individual with length 6.23). Distance from anterior end to

beginning of vitelline follicles is 0.472 and 0.613 or 11.1 and 9.8% of body length. Ovary H-shaped, its width is 0.540 and 0.568; isthmus length 0.100 and 0.188, length of the left ala is 0.423 and 0.530, of right ala 0.325 and 0.550. Length of postovarial body area is 0.797 and 1.255, or 18.8 and 20.1%. Distal loops of the uterus reach midlevel of the bursa cirrus. Further these cestodes are considered within the taxon *P. gotoi* sensu Scholz, 1989.

Paracaryophyllaeus sp. 1, described from the spined loach from the Ild River (European Russia), which is in the shape of anterior body end, position of frontal borders of vitelline follicles and testes is similar with the syntype *P. dubininorum*, shown on the original drawing of O.P. Kulakovskaya, and *P. gotoi* s.str. At the same time, *Paracaryophyllaeus* sp. 1 is roughly distinguished from these two parasites by proportions of the ovary. In *Paracaryophyllaeus* sp. 1 ovary width is considerably smaller than its length, in *P. gotoi* s. str. and syntype *P. dubibinorum* ovary width is equal or exceeds its length. Ovary alae in *Paracaryophyllaeus* sp. 1 are narrower and longer than in comparing parasites.

Demonstrated morphological differences of Paracaryophyllaeus sp. 1 and P. gotoi sensu Scholz, 1989 from loaches of the European water bodies from *P. gotoi* s. str. and the syntype *P. dubininorum*, shown in the manuscript with the original description of the species [3], assume that O.P. Kulakovskaya had mixed material in which cestodes from cobitids related to different species. The absence of reliable data on the registration of cestodes of the genus *Paracaryophyllaeus* in loaches in water bodies of Europe is also evident of such assumption. Probably, individuals from loaches comprising type series of P. dubininorum are conspecific with P. gotoi sensu Scholz, 1989. Cestodes with the phenotype of P. gotoi sensu Scholz, 1989 are similar with the syntype P. dubininorum shown by O.P. Kulakovskaya [3] in morphological characters and ovary proportions (ovary width is larger its length). The present similarity could be a formal occasion for combining parasites of cobitids in type series P. dubininorum. An additional argument for this assumption is the territorial neighborhood (or relation to one river basin) of water bodies from where syntypes P. dubininorum from loaches (the Carpathian water bodies) and P. gotoi sensu Scholz, 1989 (the River Tisa) are collected. However, relative positions of uterine loops and the bursa cirrus in *P. gotoi* sensu Scholz, 1989 do not correspond to the diagnosis of the genus Paracaryophyllaeus. Additional studies are needed for the specification of the taxonomic status. Considering that the original description of P. dubininorum is based mainly on characters of syntypes from the Japanese weather loach, the authors consider the synonimization of P. dubininorum and P. gotoi s. str. [1] to be justified. The absence of mature specimens of *Paracarvophyllaeus* sp. 1 with large number of eggs in the uterus does not allow one to describe this parasite as valid species.

In the original description, the species P. lepidocephali is placed within the genus Lytocestoides Baylis, 1928 [9]. Hafeezullah [8] replaced it in the genus Paracaryophyllaeus. According to the data of Kundu [9], in this species preovarial vitelline follicles are placed in the cortical layer of parenchyma. Single follicles present in lateral body fields in the region of ovary [9]. In the description of *P. lepidocephali*, made by Hafeezullah [8] on the type and original material, data on position of vitelline follicles in medullar or cortical parenchyma are absent. Hafeezullah approves the presence of follicles in lateral body fields at ovary area in the holotype [8, Fig. 13; 9, Fig. 1]. At the same time, they are not shown on a drawing of an individual from the original material of this scientist [8, Fig. 14]. In the drawings of *P. lepidocephali* made by both authors [8, Figs. 13, 14; 9, Fig. 1], preovarial vitelline follicles are placed by a flat field from the anterior body end to the beginning of testes; further they are strengthened by narrow lateral belts. Such a distribution of follicles is possible in their cortical position. Thereupon, the authors do not doubt of Kundu's data [9]. The main diagnostic character of the family Caryophyllaeidae, to which the genus Paracaryophyllaeus is related, is the position of preovarial yolk follicles in medullar parenchyma. Thus, P. lepidocephali does not relate to the diagnosis of the genus Paracaryophyllaeus and the family Caryophyllaeidae as a whole. Authors place "Lytocestoides" lepidocephali Kundu, 1985 in the group Lytocestidae incertae sedis as a species of unclear genus.

The species *Paracaryophyllae kulakowskae* sp. n. and *P. misgurni* sp. n. correspond with the diagnosis of the genus *Paracaryophyllaeus* on their main morphological characters: absence of vitelline follicles in lateral body fields at ovary area, position of testes behind frontal border of vitelline follicles, and position of distal uterine loops in front of the bursa cirrus.

Paracaryiphyllaeus kulakowskae sp.n. is distinguished from P. gotoi by the shape of anterior body end, position of vitelline follicles and testes relative to the anterior body end, number of testes (21-31, mean)25 in P. kulakowskae vs 30 in P. gotoi), proportions of ovary, and presence of the genital atrium. Anterior body end of *P. kulakowskae* sp. n. is slightly widened, almost rectangular; in relaxed condition it is with conical apical projection. In *P. gotoi* it is rounded, slightly widened, with smooth or weak wrinkled edge. Distance from anterior body length to beginning of vitelline follicles in *P. kulakowskae* sp. n. is 6.1–8.1% (mean 7.1%) of body length vs 10.9–14.2% in *P. gotoi* (according to drawings [3] and [11]), to beginning of testes 32.4–42.8% (mean 35.8%) and 26–30%, correspondingly. In P. kulakowskae sp. n. ovary length is considerably longer than its width, in *P. gotoi* ovary length is shorter than or equals its width.

P. kulakowskae sp. n. is distinguished from *P. mis*gurni sp. n. by a considerably shorter body length (4.56-8.38, mean 5.86 vs. 11.02-15.87), shape of anterior body end (trapezium-shaped with rounded anterior side and weak rugosity in *P. misgurni* sp. n.), closer position of vitelline follicles and testes to anterior body end, lower number of testes (21-31 vs. 41-44), presence of genital atrium and greater length of eggs (0.052-0.055 vs 0.045). In *P. kulakowskae* sp. n. distance to vitelline follicles is 6.1-8.1% of body length; to testes it is 32.4-42.8%; In *P. misgurni* sp. n. it is 16.0-16.7% and 44.4-45.9%, correspondingly.

P. misgurni sp. n. is distinguished from *P. gotoi* by body length (11.02–15.87 vs 2.6–9.0), shape of anterior body end, more distant position of vitelline follicles and greater number of testes (41-44 vs 30-40), proportions of ovary and shorter egg length (0.045 vs.)0.050-0.058). Anterior body end in P. misgurni sp. n. is trapezium-shaped with rounded anterior side and weak rugosity; in P. gotoi it is rounded, slightly widened with smooth or weak wrinkle edge. Distance from anterior body end to beginning of vitelline follicles in P. misgirni sp. n. is 16.0-16.7% of body length vs. 10.9-14.2% in *P. gotoi*; to beginning of testes it is 44.4-45.9% and 26-30%, correspondingly. Ovary length in *P. misgurni* sp. n. is greater its width; in the meantime in *P. gotoi* ovary length is shorter than or equals its length.

P. misgurni sp. n. in scolex shape and position of frontal borders of vitelline follicles and testes is similar to *P. gotoi* sensu Scholz et al., 2001 from the Japanese weather loach from Japan [14], but it is distinguished from this parasite by considerably greater body sizes and internal organs and greater number of testes. Probably *P. gotoi* sensu Scholz et al., 2001 is independent species. For the final answer to this question, additional material on cestodes from cobitids from Japan is needed.

The studied individual *Paracaryophyllaeus* sp. 2 is more similar to *P. gotoi*. However, the specimen of the authors is distinguished from this species by its greater length between testes to the anterior body end and their position, the smaller size of the bursa cirrus, and more numerous postovarial vitelline follicles.

On the basis of received data, the authors specified the diagnosis of the genus *Paracaryophyllaeus* Kula-kovskaya, 1961.

D i a g n o s i s. Caryophyllaeidae. Anterior body end is clavate, trapezium-shaped with rounded anterior end or almost rectangular with conical apical projection; smooth or with weak rugosity. Posterior body end is rounded with elongated excretory vesicle; opening by terminal excretory pore. Testes in medullar parenchyma, beginning behind anterior border of vitelline follicles, terminating at level of distal uterine loops. Bursa cirrus is weakly muscular with internal seminal vesicle. External seminal vesicle is absent. Male reproductive opening and opening of the uterovaginal canal are positioned on body surface or on the bottom of the common genital atrium. Preovarial vitelline follicles in medullar parenchyma are numerous and reach the level of distal uterine loops; in lateral body fields at ovary area they are absent. Postovarial groups of vitelline follicles are numerous. Ovary H-shaped, symmetrical. Vagina tubular, convoluted, seminal receptacle present. Uterus is tubular, strongly convoluted; its distal loops protrude beyond bursa cirrus. Eggs with operculum. Adult cestodes are parasites of cobitid fishes, *Cobitidae*. Species type is *Paracaryophyllaeus dubininorum* Kulakovskaja, 1961.

CONCLUSIONS

P. dubininorum is a young synonym of *P. gotoi*. In loaches of Eastern Europe only one representative of the genus Paracaryophyllaeus—Paracaryophyllaeus sp. n. 1—is registered. Its description as an independent species is delayed until the study of mature individuals with a larger number of eggs in the uterus. P. kulakowskae sp. n. parasitizes in loaches of the basin of the Amur River and water bodies of Primorskii krai RF. Cestodes with the phenotype of P. gotoi sensu Scholz, 1989 found in loaches from the delta of the Volga River; Tisa River on the territory of Hungary; and, probably, water bodies of the Ukrainian Carpathians need a specification of the taxonomic status. In loaches of water bodies of the Far East, two species of the studied genus have been found: P. gotoi, P. misgurni sp. n. and two forms Paracaryophyllaeus sp. 2, P. gotoi sensu Scholz et al., 2001, the species identity of which is needed. There are no reliable data on the registration of cestodes of the genus Paracarvophyl*laeus* in loaches of water bodies in Europe.

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