THE TAXONOMIC STATUS OF *PROTEOCEPHALUS DUBIUS* LA RUE, 1911 (CESTODA : PROTEOCEPHALIDAE), A PUZZLING PARASITE OF PERCH (*PERCA FLUVIATILIS* L.)

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Summary :

The taxonomic status of the fish cestode *Proteocephalus dubius* La Rue, 1911, a rare parasite of perch (*Perca fluviatilis*), is discussed on the basis of morphological and isoenzyme analyses. The results reveal that *P. dubius* represents only an infrequent morphological form of *P. percae* characterized by a small, rounded and shallow apical organ, elongate and/or rectangular proglottides and relatively long cirrus-sac reaching to the mid-line of the proglottis.

KEY WORDS : *Proteocephalus dubius*, *P. percae*, Cestoda, taxonomy, isoenzymes, perch.

Résumé : PLACE DE *PROTEOCEPHALUS DUBIUS* LA RUE, 1911 (CESTODA : PROTEOCEPHALIDAE), UN PARASITE DÉCONCERTANT DE LA PERCHE (*PERCA FLUVIATILIS* L.)

La place de *Proteocephalus dubius* La Rue, 1911, un cestode de poisson rare parasite de la perche (*Perca fluviatilis*), est discutée sur la base d'une analyse morphologique et isoenzymatique. Les résultats montrent que *P. dubius* ne représente qu'une forme morphologique peu fréquente de *P. percae*, caractérisée par un organe apical court, arrondi et de peu d'épaisseur, des proglottis allongés et/ou rectangulaires et une poche de cirre relativement longue atteignant le milieu du proglottis.

MOTS CLÉS : *Proteocephalus dubius*, *P. percae*, cestodes, taxonomie, isoenzymes, perche.

The validity of *Proteocephalus dubius* La Rue, 1911, a parasite of perch (*Perca fluviatilis* L.), has frequently been questioned since the time it was erected (La Rue, 1911, 1914). Some authors (Freze, 1965; Ergens and Lom, 1970; Scholz, 1989) considered this species to be conspecific with *P. percae*, a widely distributed parasite of the same fish host - perch. However, no revision has been carried out.

The holotype and paratype of *P. dubius* (U.S. National Museum, National Parasite Collection, Beltsville, Cat. Nos 49838 and 51188) and 11 phenotypically corresponding voucher specimens possessing elongate or rectangular proglottides and relatively long cirrus sac, reaching to the mid-line of the body, collected from perch from Dobsina Reservoir in Slovakia, were studied morphologically. In order to verify the affinities of *Proteocephalus* spp. from perch in Dobšiná, an additional 34 specimens were tested electrophoretically (see Šnábel *et al.*, 1994 for methodology).

Examination of the *P. dubius* type specimens revealed a striking similarity of their strobilar morphology to that of the related species, *P. exiguus* La Rue, 1911, an abundant parasite of salmonid and coregonid

fishes (Freze, 1965; Hanzelová *et al.*, 1995a). The type specimens of *P. dubius* had elongate hermaphroditic proglottides (the ratio of the proglottis length to its width being mostly > 1) and a relatively long cirrus-sac, reaching the median line of the proglottis (the ratio of the cirrus-sac length to the proglottis width ranging between 0.45-0.50) (Table I, Fig. 1). However, the morphology of the scolex with a rather small (25-29µm), rounded and shallow apical organ, well corresponds with that of *P. percae* as described by Andersen (1978) and Scholz (1989).

This fact indicates the conspecificity of *P. dubius* with *P. percae* because the scolex morphology (general appearance of the scolex, position of suckers, the structure of an apical organ, etc.) is considered by some authors to be of some taxonomic value (Andersen, 1978) or can be used for the identification of some *Proteocephalus* species (e.g. *P. macrocephalus* [Creplin, 1825], *P. cernuae* [Gmelin, 1790], *P. osculatus* [Goeze, 1782] – Scholz & Kepr, 1988; Scholz, 1989). On the other hand, strobilar morphology is subjected to high variation in some *Proteocephalus* taxa (Anikieva, 1991, 1993; Hanzelová & Špakulová, 1992; Šnábel *et al.*, 1994).

In order to support morphological results, a biochemical analysis has been carried out. Following 11 enzyme systems have been examined : acid phosphatase (ACP; E.C. 3.1.3.2), aldolase (ALD; E.C. 4.1.2.13), esterase (EST; E.C. 3.1.1.1), glucose-phosphate isomerase (GPI; E.C. 5.3.1.9), glutamate-oxaloacetate trans-

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Fig. 1. – Type specimens of *Proteocephalus dubius* La Rue, 1911 (USNM, National Parasite Collection, Beltsville, Coll. n^{os} 49838 and 51188). A – anterior end; B, C – scolex; D, E – mature segments; F – gravid segment. Scale bars in millimetres

	<i>P. dubius</i> *			<i>P. percae</i>		
	Mean	SD	Range	Mean	SD	Range
Width of scolex (WS)	128	19,80	114-142	188	12,73	179-197
Diameter of sucker (DS)	73	7,07	68-78	73	10,60	63-86
DS/WS	0,58	0,04	0,55-0,60	0,40	0,04	0,35-0,44
Diameter of apical organ (DAO)	27	2,83	25-29	29	2,12	27-30
DAO/DS	0,38	0,08	0,32-0,43	0,39	0,04	0,35-0,43
Width of neck	100	27,58	80-119	179	3,54	176-181
Length of hermaphroditic segment (LHS), (mm)	0,75	0,16	0,51-0,88	0,71	0,31	0,53-1,07
Width of hermaphroditic segment (WHS), (mm)	0,56	0,02	0,54-0,58	0,73	0,07	0,65-0,78
LHS/WHS	1,35	0,29	0,92-1,54	0,98	0,40	0,67-1,43
Length of gravid segment (LGS), (mm)	0,79	0,11	0,66-0,87			
Width of gravid segment (WGS), (mm)	0,89	0,01	0,88-0,90			
LGS/WGS	0,89	0,12	0,75-0,99			
Diameter of testis	65	10,28	51-73	72	10,33	70-76
Number of testes	61	10,40	47-72	56	24,91	40-85
Length of cirrus-sac (LCS)	267	11,79	251-279	261	15,04	244-271
Width of cirrus-sac (WCS)	68	4,72	61-72	89	6,81	84-97
Distal part of cirrus-sac (DPCS)	60	8,38	49-68	62	10,60	52-73
LCS/WCS	3,95	0,16	3,76-4,11	2,91	0,18	2,77-3,11
DPCS/LCS	0,23	0,02	0,20-0,25	0,23	0,03	0,21-0,27
LCS/WHS	0,48	0,02	0,45-0,50	0,36	0,02	0,35-0,38
Width of ovary	404	21,52	384-433	537	54,95	474-575
Length of ovarian lobe	141	12,01	126-155	170	17,06	151-184
Width of ovarian lobe	153	19,27	134-175	205	44,19	154-232
Isthmus of ovary	27	8,29	18-38	24	0,58	23-24
Diameter of vaginal sphincter	33	4,69	27-38	32	8,50	23-40
Number of uterine branches	17	1,00	16-18			

* *P. dubius* type specimens

Table I. – Comparison of biometric characters of *Proteocephalus dubius* and *P. percae*

aminase (GOT; E.C. 2.3.1.1), glyceraldehyde-phosphate isomerase (GAPD; E.C. 1.2.1.12), fructose-1, 6-diphosphatase (FDP; E.C. 3.1.3.11), malate dehydrogenase (MDH; E.C. 1.1.1.37), malic enzyme (ME; E.C. 1.1.1.40), peptidase-C (PEP-C; E.C. 3.4.13.11), phosphoglucosmutase (PGM; E.C. 2.7.5.1). Among 19 loci tested, fixed allelic differences between *P. percae* and *P. exiguus* at 6 loci (*Pgm-1*, *Pgm-2*, *Got*, *Est-1*, *Est-2*, and *Pep-C*; see Hanzelová *et al.*, 1995b) have been found. Allozyme characters show *P. percae* genotypes in all specimens, including those of *P. dubius* morphology.

On the basis of the above data, it seems so evident that *P. dubius* is not a valid taxon and represents in fact only a rare morphological form of *P. percae*.

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