RESEARCH NOTE

ECHINORHYNCHUS SALMONIS MÜLLER, 1784 ABSENT IN BRITAIN AND IRELAND: RE-IDENTIFICATION OF MUSEUM SPECIMENS

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Abstract. Collections of '*Echinorhynchus salmonis*' from Britain and Ireland deposited in The Natural History Museum, London (1921.7.19.3–12 and 1952.10.30.122–127) were re-identified as *Acanthocephalus clavula* and *Acanthocephalus lucii* respectively. The amphipod, *Pontoporeia affinis*, European intermediate host of *E. salmonis*, does not occur in the British Isles, so it is concluded that *E. salmonis* is absent from British and Irish freshwater fishes.

Seven species of Acanthocephala are recorded from freshwater fishes in the British Isles (Kennedy 1974). Brown et al. (1986) suggested that one of these, *Echinorhynchus salmonis* Müller, 1784, was incorrectly identified, as its intermediate host in northern Europe, *Pontoporeia affinis* (Lindström), is not found in the British Isles. Accordingly, voucher specimens of *E. salmonis* from Britain and Ireland kept in the The Natural History Museum, London were re-assessed.

Three samples were obtained on loan. 1. *E. salmonis* 1921.7.19.3–12, eel *Anguilla anguilla* (L.), Worcestershire, England (Baylis 1928) (4 pieces of intestine, with 11 worms attached, and 32 detached worms): permission to mount a male in glycerine jelly and to scan a female (SEM) was obtained. 2. *E. salmonis* 1952.10.30.122–127, brown trout *Salmo trutta* L., Lough Rea, County Galway, Ireland (Healy 1953) (12 poorly-fixed worms from trout stomach analyses). 3. *E. salmonis* 1981.3341–3349, whitefish *Coregonus nasus* (Pallas) sensu Svärdson, Hawkipudas, Gulf of Bothnia, Finland (E.T. Valtonen) (6 specimens). The third sample provided authenticated *E. salmonis* for comparison.

Worms were examined in 70% alcohol-glycerine. The female for SEM was dehydrated in an ethanol series, critical point dried (Polaron E3000), coated with 60% gold-palladium (Polaron E5100) and viewed in a Philips 501B SEM.

Sample 1921.7.19.3–12 permitted detailed measurements (Tables 1 and 2) that identified *Acanthocephalus clavula* (Dujardin, 1845) Grabda-Kazubska et Chubb, 1968. Everted proboscides had 18 longitudinal rows of hooks, 13 (occasionally 12 or 14) in each row, and the cerebral ganglion was at the base of the proboscis sac (Grabda-Kazubska and Chubb 1968). The sample becomes the oldest record of *A. clavula* in Britain. Eel, *A. anguilla*, is a principal host (Chubb 1964), but a range of freshwater fishes are infected. The intermediate host in Llyn Tegid, Wales (Rojanapaibul, 1976) is the isopod *Asellus meridianus* Racovitsa.

None of 12 specimens 1952.10.30.122–127 had proboscides fully extended and there was no genital maturation in the 8 females. Size and form of the hooks, and in particular, the shape of projecting flanges on the hook-base upper shoulder (see Meyer 1932, fig. 133) identified *Acanthocephalus lucii* (Müller, 1776). The cerebral ganglion was at the base of the proboscis sac, there were 16 longitudinal rows of hooks, but only a maximum of 6 of 7–9 hooks in each row were protruded. *Acanthocephalus lucii* is very wide-spread in freshwater fishes in the British Isles, was first recorded in Ireland by Bellingham (1844, as *Echinorhynchus angustatus*) and the intermediate host is the isopod *Asellus aquaticus* (Brattey 1983, Brown et al. 1986).

Authenticated *E. salmonis* 1981.3341–3349, one male and five females, had enlarged fore-bodies (see Meyer 1932, fig. 151; Golvan 1969, fig. 162) so were obviously different externally from the other acanthocephalans from Britain and Ireland, had 14 longitudinal rows of proboscis hooks, 9–11 each, with the cerebral ganglion situated mid-way along the proboscis sac typical of *Echinorhynchus* (Meyer 1932). The amphipod, *Pontoporeia affinis*, is intermediate host in northern Europe and Russia (Shtein 1959, Golvan 1969, Valtonen 1983). Pinkster (1978) showed that *P. affinis* is found only in the lowlands of northern Europe, the Baltic region, Fennoscandinavia and into Russia. *Pontoporeia affinis* does not occur in the British Isles, so it is concluded that *E. salmonis* is absent from British and Irish freshwater fishes. The re-examination of these voucher specimens thus solves a biogeographical anomaly.

The conservation in 1921 and 1932 of voucher specimens of Acanthocephala re-identified in this note shows the importance of museum collections. Grabda-Kazubska and Chubb (1968) first separated *E. clavula* sensu Dujardin, 1845 from *E. clavula* sensu Lühe, 1911 when unpublished drawings made by Dujardin and kept at Université de Rennes, France were seen to show that the cerebral ganglion in both the drawings and acanthocephalans from Llyn Tegid were at the base of the proboscis receptacle sac, characteristic of the genus *Acanthocephalus* not *Echinorhynchus*. Thus, preservation of Dujardin's drawings at Rennes, and worms in The Natural History Museum, allowed re-assessment of taxonomic priorities and identifications.

Acanthocephalan materials should be carefully cleaned prior to fixation (Bylund et al. 1980) and kept over-night in water in a refrigerator to extend the proboscis for accurate counting of hook rows and numbers. The current Museum samples had not been fixed to aid critical taxonomic study, especially those from trout stomachs (Healy 1953). The 1921 formalin-fixed materials (Baylis 1928) were suitable for SEM, indeed long-preserved helminths may also provide DNA for extraction and molecular characterisation (Li et al. 2000).

Dr. David I. Gibson, Department of Parasitic Worms, The Natural History Museum, London, is thanked for loan of the materials of Baylis and Healy, and for permission to mount one worm in glycerine jelly and view one by SEM.

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Table 1. Measurements of male *Acanthocephalus clavula* from Grabda-Kazubska and Chubb (1968) and '*Echinorhynchus salmonis*' 1921.7.19.3–12, *Anguilla anguilla*, Worcestershire, England (Baylis 1928) from The Natural History Museum, London. All measurements in mm.

Feature	Grabda-Kazubska and Chubb (1968) (n = 15)			Baylis (1928) materials from The Natural History Museum, London (n variable, see last column)				
	Minimum	Maximum	Mean (Median)	Minimum	Maximum	Mean (Median)	SD	n
Total body length	2.5	3.5	3.0	2.8	4.5	3.6	0.52	14
Body width	0.42	0.57	0.47	0.54	0.65	0.58	0.04	12
Length of proboscis	0.55	0.63	0.59	–	–	0.82	–	–
No. of longitudinal rows of hooks	16	20	(18)	18	18	(18)	–	6
No. of hooks in each row	13	14	(13)	13	14	(13)	–	3
Apical hook spine length	0.023	0.031	0.029	Not visible				
Medial hook spine length	0.036	0.054	0.040	–	–	0.054	–	1
Basal hook spine length	0.025	0.040	0.031	–	–	0.040	–	1
Neck length	0.108	0.202	0.161	–	–	0.170	–	1
Proboscis receptacle sac length	0.43	0.85	0.68	0.8	1.17	0.99	0.14	3
Lemniscus length	0.66	0.98	0.79	–	–	–	–	–
Lemniscus length (longest)	–	–	–	0.55	1.05	0.73	0.17	12
Lemniscus length (shortest)	–	–	–	0.45	1.00	0.66	0.18	12
Anterior testis length	0.29	0.42	0.37	0.31	0.50	0.40	0.061	13
Posterior testis length	0.28	0.40	0.35	0.30	0.48	0.38	0.069	12
Testis width max (both)	0.16	0.34	0.28	0.20	0.35	0.25	0.049	13
Cement glands length	0.12	0.27	0.21	0.20	0.37	0.29	0.069	11
Cement glands width	0.09	0.17	0.14	0.10	0.19	0.13	0.035	11

Table 2. Measurements of female *Acanthocephalus clavula* from Grabda-Kazubska and Chubb (1968) and '*Echinorhynchus salmonis*' 1921.7.19.3–12, *Anguilla anguilla*, Worcestershire, England (Baylis 1928) from The Natural History Museum, London. All measurements in mm.

Feature	Grabda-Kazubska and Chubb (1968) (n = 15)			Baylis (1928) materials from The Natural History Museum, London (n variable, see last column)				
	Minimum	Maximum	Mean (Median)	Minimum	Maximum	Mean (Median)	SD	n
Total body length	3.0	7.0	4.8	3.2	7.0	5.4	1.10	16
Body width	0.40	0.87	0.67	0.37	0.81	0.60	0.18	4
Length of proboscis	0.68	0.83	0.73	–	–	–	–	0
No. of longitudinal rows of hooks	17	18	(18)	16	18	(18)	–	6
No. of hooks in each row	14	16	(15)	13	15	–	–	2
Apical hook spine length	0.029	0.033	0.031	Not visible				
Medial hook spine length	0.039	0.051	0.045					
Basal hook spine length	0.025	0.041	0.031					
Neck length	0.128	0.168	0.147					
Proboscis receptacle sac length	0.70	1.02	0.87	0.9	1.29	1.00	0.20	3
Lemniscus length	0.81	1.17	1.06	–	–	–	–	–
Lemniscus length (longest)	–	–	–	0.52	0.67	0.60	0.075	3
Lemniscus length (shortest)	–	–	–	0.45	0.57	0.51	0.061	3
Genital ducts total length	0.69	1.03	0.93	0.82	0.95	0.90	0.065	3
Uterine bell	0.18	0.40	0.32	0.30	0.40	0.35	0.05	3
Uterus length	0.41	0.64	0.50	0.40	0.47	0.42	0.036	3
Vagina length	0.20	0.28	0.23	0.09	0.12	0.10	0.015	3
Posterior vagina length to waist	0.06	0.86	0.08	0.07	0.10	0.08	0.017	3
Shelled acanthor length	0.077	0.084	0.081	0.054	0.100	0.075	0.008	90
Acanthor length	0.044	0.050	0.046	0.043	0.055	0.046	0.004	10

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