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INTESTINAL HELMINTHS OF ITALIAN BARBEL, *BARBUS TYBERINUS* (CYPRINIFORMES: CYPRINIDAE), FROM THE TIBER RIVER AND FIRST REPORT OF *ACANTHOCEPHALUS CLAVULA* (ACANTHOCEPHALA) IN THE GENUS *BARBUS*

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The genus *Barbus* Cuvier, 1817 is among the most representative cyprinid fish in rivers of Europe. In 1995 a revision was carried out of the Italian species of *Barbus* based on the analyses of the variability in several morphological characters (Bianco P.G. 1995: Ichthyol. Explor. Freshwaters 6: 305-324.). Five species were recognised: two, *B. barbus* (L.) and *B. cyclolepis* Heckel, 1840, recently introduced by man from central and eastern Europe, three, *B. plebejus* (Bonaparte, 1839), *B. caninus* (Bonaparte, 1839) and *B. tyberinus* (Bonaparte, 1839), native to Italy, the last one being endemic to the Tuscano-Latium district.

Several studies have been carried out on the endohelminth fauna of *B. barbus* in Central Europe (Ergens R., Gussev V.A., Izyumova N.A., Molnár K. 1975: Academia, Prague, 117 pp.; Grabda-Kazubska B., Pilecka-Rapacz M. 1987: Acta Parasitol. Pol. 31: 219-230; Moravec F., Konečný R., Baska F., Rydlo M., Scholz T., Molnár K., Schiemer F. 1997: Studie AVČR No. 3, Academia, Prague, 96 pp.). By contrast, few data are available from other regions of Europe, in particular from Italy, and from other species of *Barbus.* In the present paper the results of a parasitological survey of the intestinal helminth fauna of *Barbus tyberinus* from the Tiber River, Central Italy, are reported. The aim was to investigate for the first time the parasite fauna of this cyprinid fish and so to make a further contribution to our knowledge of the distribution patterns of helminths in the genus *Barbus*.

Six sampling sites along the lower reach of the river were selected: two, Nazzano (NZ) and Ponte del Grillo (PG) upstream of Rome, four, Castel Giubileo (CG), Ponte Milvio (PM), Mezzocammino (MC) and Capo due Rami (CR) in the urban and suburban reach below Rome.

Between October 1997 and December 1998 61 barbels were sampled. Morphometric measurements were taken (Table 1) and stomach contents analysis was performed. All endo-helminths were removed and identified to species. Prevalence and intensity of infection were calculated. To analyse distribution patterns of helminths in *B. tyberinus* our data were compared with those from different species of the genus *Barbus* reported in the literature. A comparison of component community species richness (the total number of intestinal species in the sample) in barbels from different European localities was performed and similarities were calculated using Sørensen's index.

Composition of the community. Ten intestinal helminth species were gained: 2 digeneans, 2 cestodes, 3 nematodes and 3 acanthocephalans (Table 1). All species found represent new records for *B. tyberinus*. All but one parasite species have previously been recorded from other species and subspecies of the genus *Barbus,* such as *B. barbus*, *B. meridionalis petenyi, B. cyclolepis* and *B. barbus bocagei* in Austria, Czech Republic, Hungary, Bulgaria and Spain (Moravec et al. 1997, op. cit.).

The acanthocephalan *Acanthocephalus clavula* Dujardin, 1845 is here reported for the first time for the genus *Barbus*. Voucher material, consisting of 5 male and 5 female specimens, is deposited in the collection of the Cattedra di Parassitologia, Dipartimento di Sanità Pubblica e Biologia Cellulare, Università di Roma "Tor Vergata", collection Nos. 9 and 10. *Acanthocephalus clavula* is a parasite of a wide range of European freshwater fishes such as perch, flounder and eel (Kennedy C.R. 1985: Parasitology 90: 375-390; Kennedy C.R. 1993: Parasitology 107: 71-78; Callaghan R., McCarthy T.K. 1996: Arch. Rybactwa Pol. 4: 147-174; Saraiva A., Eiras J.C. 1996: Res. Rev. Parasitol. 56: 179-183; Borgsteede F.H.M., Haenen O.L.M., De Bree J., Lisitsina O.I. 1999: Helminthologia 36: 251-260). In Italy *A. clavula* has been recovered from *Anguilla anguilla* from the Adige River (Dezfuli B.S., Rossetti E., Zanini N., Rossi R. 1991: Parassitologia 33: 121-126), *Silurus glanis* from the Po River (Dezfuli B.S., Franzoi P., Trisolini R., Rossi R. 1990: Idrobiologia 29: 169-175) and *A. anguilla* in the region of the Tiber River sampled in the present research (Orecchia P., Bianchini M., Catalini N., Cataudella S., Paggi L. 1987: Parassitologia 29: 37-47; Kennedy C.R., Berrilli F., Di Cave D., De Liberato C., Orecchia P. 1998: J. Helminthol. 72: 301-306).

The analysis of stomach contents of barbels studied in the present research revealed the presence of isopods (*Asellus* sp. and *Proasellus coxalis*) and amphipods (*Echinogammarus* sp.). These crustaceans play an important role as intermediate

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Table 1. Prevalence (%) and mean intensity (I) of intestinal helminths observed in the total sample of *Barbus tyberinus* and in each sampling locality.

Sample site	NZ		PG		CG		PM		MC		CR		Total	
No. of fish examined	3		3		20		9		21		5		61	
Body length range (cm)	39-44		28-45		31-47		11-47		18-43		9-21		9-45	
Parasite	%	I	%	I	%	I	%	I	%	I	%	I	%	I
DIGENEA														
Allocreadium isoporum	–	–	–	–	5	17	–	–	–	–	–	–	2	17
Asymphylodora tincae	–	–	–	–	20	16	22	15	24	70	40	2	21	34
CESTODA														
Caryophyllaeus laticeps	–	–	–	–	20	1	11	1	–	–	–	–	8	1
Caryophyllaeus brachycollis	–	–	–	–	50	2	11	2	33	2	20	1	31	2
NEMATODA														
Raphidascaris acus		–	–	–	–		11	1	–	–	–	–	2	1
Rhabdochona denudata	33	1	–	–	–	–	–	–	–	–	–	–	2	1
Pseudocapillaria tomentosa	–	–	–	–	10	3	–	–	–	–	–	–	2	3
ACANTHOCEPHALA														
Acanthocephalus clavula	33	1	100	6	45	11	56	8	67	34	–	–	53	20
Acanthocephalus anguillae	–	–	–	–	30	3	11	2	19	2	–	–	15	2
Pomphorhynchus laevis	67	29	67	7	80	17	78	15	52	10	20	1	64	14

NZ – Nazzano, PG – Ponte del Grillo, CG – Castel Giubileo, PM – Ponte Milvio, MC – Mezzocammino, CR – Capo due Rami.

Table 2. Comparison between the number of intestinal helminths in *Barbus tyberinus* from the Tiber River and *Barbus* spp. from different European localities (data compiled from Moravec et al. 1997).

Host species	Localities	Sample size	No. of helminth species
Barbus tyberinus	Tiber River, near Rome, Italy	61	10
Barbus barbus	Danube River, near Budapest, Hungary	149	13
Barbus barbus	Danube River, near Vienna, Austria	143	10
Barbus barbus	Ischler Ache Brook, Austria	100	8
Barbus barbus	Jihlava River, Czech Republic	177	7
Barbus cyclolepis	Maritsa River, Bulgaria	–	10
Barbus barbus bocagei	North-western Spain	–	7

Table 3. Sørensen's index of similarity between intestinal helminth faunas in *Barbus* spp. from different European localities.

	Barbus tyberinus	*Barbus barbus* (A)	*Barbus barbus* (B)	*Barbus barbus* (C)	*Barbus barbus* (D)	*Barbus cyclolepis*	*Barbus b. bocagei*
Barbus tyberinus	–						
Barbus barbus (A)	0.43	–					
Barbus barbus (B)	0.40	0.61	–				
Barbus barbus (C)	0.44	0.57	0.89	–			
Barbus barbus (D)	0.30	0.35	0.60	0.67	–		
Barbus cyclolepis	0.40	0.26	0.40	0.44	0.30	–	
Barbus b. bocagei	0.35	0.10	0.12	0.13	0.12	0.35	–

(A) – Danube River, near Budapest, Hungary; (B) – Danube River, near Vienna, Austria; (C) – Ischler Ache Brook, Austria; (D) – Jihlava River, Czech Republic.

hosts in the life cycle of this acanthocephalan. Larval forms of *A. clavula* were reported in *P. coxalis* in Central Italy (Fresi E. 1967: Arch. Zool. It. 52: 277-287), in *Echinogammarus pungens* from the Adige River (Dezfuli et al. 1991, op. cit.) and in *E. stammeri* from the Brenta River (Dezfuli B.S., Giari L., Poulin R. 2000: Int. J. Parasitol 30: 1143-1146) in Northern Italy.

The component community was dominated by acanthocephalans. *Pomphorhynchus laevis* (Müller, 1776), a generalist species, was present in all localities and, with the exception of CR (20%), exhibited high values of prevalence (from 52% in MC to 80% in CG). *Acanthocephalus clavula* also exhibited high values of prevalence, ranging from 33% in NZ to 100% in PG (total 53%), but it was absent from CR.

These values are similar to those reported from the same reach of the Tiber River in other hosts, including *A. anguilla* (Orecchia et al. 1987, op. cit.; Kennedy et al. 1998, op. cit.), where *A. clavula* was also dominant, *Leuciscus cephalus* (Di Cave D., Berrilli F., De Liberato C., Russo R., Tancioni L. 2000: Atti dell'8° Convegno AIIAD, Codroipo, 29-30 giugno 2000, Abstracts of Papers, p. 33) and *Ictalurus melas* (Imbrenda P. 2000: Tesi di laurea, Università di Roma "Tor Vergata", Italia, 118 pp.). Values of prevalence of *Acanthocephalus anguillae* (Müller, 1780) appeared lower (total 15%) when compared with those of the other two acanthocephalan species, and this species was found in only three sampling localities. Two species of digeneans were found. Adult *Allocreadium isoporum* (Looss, 1894) were found in the stomach of only one fish from CG (total prevalence 2%), collected in spring. However, different developmental stages of *Asymphylodora tincae* (Modeer, 1790) occurred in barbel in four of the six localities all through the year, with higher values of total prevalence (21%). Only two cestodes, both of the genus *Caryophyllaeus,* were found: *C. laticeps* (Pallas, 1781), with a prevalence of 20% in CG and 11% in PM, and *C. brachycollis* Janiszewska, 1951, with a prevalence ranging from 11% (PM) to 50% (CG). The nematodes *Raphidascaris acus* (Bloch, 1779)*, Rhabdochona denudata* (Dujardin, 1845) and *Pseudocapillaria tomentosa* (Dujardin, 1843) can be considered accidental, since each species was recorded only once and in one locality with low total prevalence (2%).

Richness and similarity of the component communities. The total number of intestinal parasite species recovered was 10. Richness and similarity characteristics of the intestinal component community were compared with values obtained from other European regions and host species of the same genus (Moravec et al. 1997, op. cit.) (Table 2 and Table 3, respectively). In respect of species richness, the endoparasite fauna of *B. tyberinus* in the Tiber River was found to be fairly similar when compared with those from other species of *Barbus* investigated. In the Danube River system in Central Europe, the total endohelminth fauna of *B. barbus* comprises a total of 43 species, but when each sampling locality is considered separately, parasite component community richness appears to be comparable to our findings (Table 2) (Moravec et al. 1997, op. cit.). Richness also appears fairly similar when comparisons are made with other species of barbels, *B. cyclolepis* and *B. barbus bocagei*, which harbour 10 and 7 species of helminths, respectively (Table 2).

The parasite component community of *B. tyberinus* exhibits the highest values of similarity with those of *B. barbus* from Austria and Hungary (0.44 and 0.43, respectively) but in all the samples the values were never lower than 0.35. By contrast, similarity values of the parasite communities from the Central European localities are significantly lower when compared with that of the community in the Spanish *B. b. bocagei.* The parasite community of Italian barbel seems to be intermediate in richness and character between Central European barbel and Iberian one. These findings seem thus to confirm the suggestion of El Gharbi and Lambert (El Gharbi S., Lambert A. 1993: Second International Symposium on Monogenea, Université de Montpellier, 5-7 July 1993, Abstracts of Papers, pp. 37-38), based on a study of Dactylogyridae in *Barbus,* in which the parasite fauna of *Barbus* from Spain shows more affinity to those of African species of *Barbus* than those of European ones, suggesting that the Pyrenees are probably a good geographical barrier to fish helminths.

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