

GYRODACTYLUS ANGUILLAE (MONOGENEA): THE STORY OF AN APPEARANCE AND A DISAPPEARANCE

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Following an investigation of the metazoan parasites of the European eel *Anguilla anguilla* (L.) in Italian coastal lagoons (Kennedy C.R., Di Cave D., Berrilli F., Orècchia P. 1997: J. Helminthol. 71: 35-40), the same authors commenced an investigation of the helminth parasites of eels of the River Tiber. The parasites of eels of the R. Tiber had been studied in 1980 (Orecchia P., Bianchini M., Catalini N., Cataudella S., Paggi L. 1987: Parassitologia 29: 37-47) and one of the aims of the current survey was to compare the findings of the two investigations. In 1980, the only species of monogenean found was *Gyrodactylus anguillae* Ergens, 1960 at prevalence levels ranging from 5.5% in autumn to 34.8% in summer. In 1996, however, this species was not found in the samples: instead, the species then found on eels were *Pseudodactylogyrus anguillae* (Yin et Sproston, 1948) and *P. bini* (Kikuchi, 1929) (Table 1). The disappearance of *G. anguillae* from the Tiber eels prompted us to re-investigate two localities in England, the R. Culm and the Exminster Marshes, both in the River Exe catchment, in which *G. anguillae* was known to be present and common in 1986. In both localities *G. anguillae* had disappeared, to be replaced by *P. anguillae* (Table 1). In the Exminster Marshes this replacement was very rapid, within one year, and *G. anguillae* has never subsequently been found in this locality (C.R. Kennedy, unpublished).

Although only recognised as a separate species nearly 40 years ago, *G. anguillae* has subsequently been reported from the gills of *A. anguilla* from several countries throughout Europe (Table 2). The species was thoroughly re-described by Malmberg (Malmberg G. 1970: Arkiv Zool. 23, 1: 1-235) and illustrated by Køie (Køie M. 1988: Ophelia 29: 93-118). The type material is deposited at the Institute of Parasitology, České Budějovice, Czech Republic, and reference specimens are deposited in the Department of Invertebrates, Riksmuseum, Stockholm and in the collections of Professor P. Orecchia, Rome: there can thus be no question about its correct identification. Malmberg (op. cit.) discusses several aspects of its ecology and from this and the other publications it is clear that it was widely distributed throughout Europe and could locally attain high levels of prevalence and intensity.

The record of J. Jackson in 1989 (Table 2) appears, however, to be the last known report of this species in Europe. Despite a considerable increase in interest in the parasites of eels over the last decade and a corresponding rise in the number of publications (see table III in Kennedy C.R. 1993: J. Fish Biol. 43: 287-301), there appear to be no published

records of *G. anguillae* in the 1990s. All recent studies, including those from Austria, Czech Republic, Denmark, France, Germany, Hungary, Ireland, Italy, Poland, Spain and the UK, report one or both of the species of *Pseudodactylogyrus* from the gills of eels and do not record *G. anguillae*. Indeed, since the first reports of *P. anguillae* and *P. bini* from Europe in the early 1980s, one or other of these two species has been recorded from virtually every country in Europe (see Buchmann K., Møllergaard S., Køie M. 1987: Dis. Aquat. Org. 3: 51-57 for details of the early spread of these species and Škorňková B., Scholz T., Moravec F. 1996: Folia Parasitol. 43: 155-156 for references to subsequent records of these two species). In the UK, *G. anguillae* has not been found elsewhere in recent years despite numerous surveys (C.R. Kennedy, unpublished; P. Harris, A. Shinn and W. Yeomans, pers. comm.).

In summary therefore, we find that:

1. *Gyrodactylus anguillae* was widespread and common in Europe up to and including the mid 1980s, but there is no published record of it in the 1990s.

2. *Pseudodactylogyrus* spp. were first reported from western Europe in the early 1980s, have subsequently spread to virtually every European country and currently appear to be the only monogenean species found on the gills of eels.

3. In three localities *G. anguillae* has disappeared and has been completely replaced by *P. anguillae* and *P. bini*.

We suggest that the decline and disappearance of *G. anguillae* and the contemporary appearance and spread of *Pseudodactylogyrus* spp. are not co-incidental. Rather, we suggest that the relationship may be causal and that *G. anguillae* and the species of *Pseudodactylogyrus* compete, to the detriment of the former species. All three species attach to the gill filaments of eels of a range of sizes and can live on eels in fresh-water or water of slightly raised salinity. They thus appear to occupy virtually identical niches and inter-specific competition for space would appear to be a distinct possibility. Inter-specific competition between a species of *Gyrodactylus* and one of the *Pseudodactylogyrus* has been suggested on a previous occasion. The equivalent congener *G. nipponensis* Ogawa et Egusa, 1978 appears to occupy a very similar niche on *Anguilla japonica* to that of *G. anguillae* on *A. anguilla*, and Chung et al. (Chung H.-Y., Lin I.-H., Kou G.-H. 1984: COA Fish. Ser. 10, Fish Dis. Res. VI: 24-33) have suggested that there is competitive exclusion between *G. nipponensis* and *P. bini* in Taiwan. Buchmann (Buchmann K. 1988: Bull.

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Table 1. The monogenean parasites of *Anguilla anguilla* in three selected localities sampled on two occasions.

Locality	R. Tiber	R. Culm	R. Exe (Exminster Marshes)
First sample			
Date	2-11/1980	9/1986	6/1986
Sample size	417	25	25
Species	<i>G. anguillae</i>	<i>G. anguillae</i>	<i>G. anguillae</i>
Prevalence	9.1	48	100
Mean intensity	Not determined	1.5	154
Authority	Orecchia et al. 1987	Kennedy unpubl.	Kennedy unpubl.
Second sample			
Date	6 & 10/1996	5/1997	5-9/1987
Sample size	101	32	64
Species	<i>P. anguillae</i> + <i>P. bini</i>	<i>P. anguillae</i>	<i>P. anguillae</i>
Prevalence	61.7 + 35.0	28.1	90.6
Mean intensity	2.4 + 2.9	11.4	25.8
Authority	Di Cave et al. unpubl.	Kennedy unpubl.	Nie and Kennedy 1991

Eur. Ass. Fish Pathol. 8: 98-100) has also suggested that *P. bini* competitively interacts with *P. anguillae*.

We believe that the decline and apparent disappearance of *G. anguillae* may provide a rare, but not unique, example of a native, endemic species being driven out by a competitively superior invader. It is possible that *G. anguillae* may be per-

Table 2. Published records of *Gyrodactylus anguillae* in Europe

Country	Locality	Year	Authority
Albania	Butrinsk Lake	1959	Ergens (1960) ¹
Sweden	R. Morup, Falkenberg, Halland	1959/1960	Malmberg (1970)
Russia	Kalininskaya	1977	Gusev (1985) ²
Italy	R. Tiber	1980	Orecchia et al. (1987)
Denmark	Iseffjord	1987	Køie (1988)
U.K.	R. Exe catchment	1986	Kennedy (unpubl.)
U.K.	R. Alun: Ogmore by Sea	1989	Jackson (pers. comm.)

¹Ergens R. 1960: Čs. parasitol. 7: 49-90; ²Gusev A.V. 1985: Opređelitel Parazitov Presnovodnykh Ryb Fauny SSSR. Vol. 2. AN SSSR Leningrad.

sisting in refuges somewhere and the authors would be particularly interested to hear of any recent records of the species. We fear otherwise that we may actually be documenting the extinction of a parasitic helminth species for the first time (Bush A.O., Kennedy C.R. 1994: Int. J. Parasitol. 24: 1333-1343).

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