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Digenean species diversity in teleost fish from a nature reserve off Corsica, France (Western Mediterranean), and a comparison with other Mediterranean regions

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Digenean species diversity in teleost fish from a nature reserve off Corsica, France (Western Mediterranean), and a comparison with other Mediterranean regions

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Abstract

Data on the digenean parasites of 2238 teleosts from the Scandola Nature Reserve off Corsica are presented. These represent the largest general survey of digenean parasites attempted in the Mediterranean region and is the result of major collections and systematic reports published over the past 20 years. The number of different digenean species recorded from 63 fish species was 102. Full parasite–host and host–parasite lists are presented, with information on the geographical distribution of the parasites, their site within the host and the prevalence, abundance and intensity of the infections. The digenean fauna of teleosts off Corsica is compared with that in other regions of the Mediterranean and the Black Sea. A more detailed analysis of the diversity of these parasites in sparid fishes indicates that the digenean diversity off Corsica is far greater than that in other parts of the Mediterranean.

Keywords: *Digenean diversity, teleosts, Western Mediterranean Nature Reserve*

Introduction

The present study is an attempt at a qualitative and quantitative approach to the study of the digenean fauna of marine teleosts from the Western Mediterranean. The study area is the Scandola Nature Reserve, located on the most western part of the coast of northern Corsica, France (42°23'N, 8°33'E). This nature reserve extends all along a steeply sloped, rocky, high-energy shore, widely exposed to the open sea, and is almost devoid of calm or euryhaline waters. This study is the result of a long research period, which began in 1986. During this period, numerous data have been published concerning the identification of the digeneans collected in teleosts from the Scandola Reserve (Bartoli 1987; Bartoli and Bray 1987, 1990, 1996, 2001; Bartoli et al. 1988, 1989a, 1989b, 1989c, 1989d, 1993, 1994, 2000a, 2000b, 2001, 2003a, 2003b; Bartoli and Gibson 1989, 1991, 1995, 1998, 2000, 2001; Gibson and Bray 1989; Holmes and Bartoli 1993; Bray and Bartoli 1996; Le Pommelet et al. 1997; Jousson and Bartoli 1999, 2000, 2001, 2002; Sasal et al. 1999; Jousson et al. 2000).

In the present study, we report on the quantitative results from 2238 autopsied fish belonging to 63 teleost species in which 102 digenean species have been recovered. In the literature, quantitative data on this group of parasites are usually reported from only a small number of host species. Nevertheless, more extensive data concerning the digenean fauna of teleosts from different areas of the Mediterranean and Black Seas are available in the literature (Vlassenko 1931; Pogorel'tseva 1952; Sey 1968, 1970; Papoutsoglou 1976; Orecchia and Paggi 1978; Fischthal 1980, 1982; Saad-Fares 1985; Radujkovic and Raibaut 1989; Radujkovic et al. 1989). In this study, we compare our data with those of these authors from different areas of the Mediterranean and Black Seas.

Material and methods

Sampling was carried out during summer (July to August) between 1986 and 2002, depending on the opportunities available for the collection of host fishes (by fishermen and diving colleagues). The autopsied fishes were always recently dead or killed using a heavy dose of anaesthetic, identified using Whitehead et al. (1986) and Froese and Pauly (2001), measured and weighed. The digestive tract was divided into various anatomical regions: stomach, pyloric caeca, duodenum, middle intestine, posterior intestine, rectum and gall-bladder. The digenean species were collected from each of these sections under a dissecting microscope. They were studied while still alive and later as permanent preparations. Individuals were fixed in Bouin's fluid between slide and coverglass without pressure, stained in acetic carmine and mounted in Canada balsam. Type material of new taxa and voucher specimens of poorly known species have been deposited at The Natural History Museum, London.

Parasitological indices were calculated following Margolis et al. (1982). Authorities for the parasite taxa are given in Table I.

Results and discussion

A large number (2238) of fish from the Scandola Nature Reserve was examined, comprising 63 species from 44 genera and 26 families. Among the 102 digenean species collected from these fishes, 99 have been identified to specific level and three to generic level. In one case, due to difficulties with the identification of the *Helicometra* species complex (see Palombi 1931; Reversat et al. 1989, 1991), we prefer to use the terminology *Helicometra* form 1, form 2, etc. These 102 digenean species belong to 62 genera and 17 families (Table I). This is the first time that such a large number of digenean species has been reported from a single region of the Mediterranean.

During this period of research, nine species have been, or are in the process of being, described as new: *Cainocreadium dentecis*, *Deretrema scorpaenicola*, *Folliculovarium mediterraneum*, *Genitocotyle mediterranea*, *Macvicaria maillardi*, *Metadena phoceae*, *Monorchis blennii*, *Stephanostomum gaidropsari* and *Wardula sarguicola*; and *Opecoeloides columbellae* was previously unknown at the adult stage. Some other species, described in previous centuries and never, or very rarely, reported since their original description, have been found commonly in the Scandola Natural Reserve. These include: *Ancylocoelium typicum*, *Anisocladium gracile*, *Holorchis legendrei*, *Lecithochirium grandiporum*, *Macvicaria dubia*, *M. mormyri*, *Pachycreadium carnosum*, *Peracreadium characis*, *Paracryptogonimus aloysiae*, *Tergestia acanthocephala* and *Wardula capitellata*. Other species, such as *Aphallus rubalo*, *Hemiurus communis*, *Homalometron galaicus*, *H. senegalensis* and *Pseudopecoeloides chloroscombri*,

Table I. Digenean species collected from teleost fishes off Scandola Nature Reserve in family order and their distribution (recent references with useful descriptions or illustrations are provided).

Species	Distribution	Reference
ACANTHOCOLPIDAE Lühe, 1909		
<i>Lepidauchen stenostoma</i> Nicoll, 1913	W	Bray and Bartoli (1996)
<i>Stephanostomum bicoronatum</i> (Stossich 1883)	W	Bartoli and Bray (2001)
<i>Stephanostomum cesticillum</i> (Molin 1858)	W	Bartoli and Bray (2001)
<i>Stephanostomum gaidropsari</i> Bartoli and Bray, 2001	M	Bartoli and Bray (2001)
<i>Stephanostomum minutum</i> (Looss 1901)	M	Bartoli and Bray (2001)
<i>Stephanostomum pristis</i> (Deslongchamps 1824)	W	Bartoli and Bray (2001)
ACANTHOSTOMIDAE Poche, 1926		
<i>Anisocladium fallax</i> (Rudolphi 1819)	M	Bartoli and Gibson (2000)
<i>Anisocladium gracile</i> (Looss 1901)	M	Bartoli and Gibson (2000)
<i>Anisocoelium capitellatum</i> (Rudolphi 1819)	M	Bartoli and Gibson (2000)
<i>Timoniella praeteritum</i> (Looss 1901)	M	Maillard (1974)
APOCREADIIDAE Skrjabin, 1942		
<i>Homalometron galaicus</i> Sanmartin, Alvarez, Quinteiro and Paniagua, 1995	NEA+M	Sanmartin et al. (1995)
<i>Homalometron senegalense</i> Fischthal and Thomas, 1972	NEA+M	Bartoli et al. (2001)
BUCEPHALIDAE Poche, 1907		
<i>Bucephalus baeri</i> Maillard, 1976	M	Maillard (1976)
<i>Bucephalus labracis</i> Paggi and Orecchia, 1965	M	Paggi and Orecchia (1965)
<i>Bucephalus marinus</i> Vlassenko, 1931	M	Vlassenko (1931)
<i>Bucephalus minimus</i> (Stossich 1887)	NEA+M	Maillard (1976)
<i>Folliculovarium mediterraneum</i>	M	Bartoli et al. (2003c)
<i>Prosorhynchoides gracilescens</i> (Rudolphi 1819)	W	Overstreet and Curran (2002)
<i>Prosorhynchus aculeatus</i> Odhner, 1905	W	Dawes (1968)
<i>Prosorhynchus crucibulum</i> (Rudolphi 1819)	W	Bray (1973)
CRYPTOGONIMIDAE Ward, 1917		
<i>Anoiktostoma coronatum</i> (Wagener 1852)	M	Bartoli and Gibson (1995)
<i>Aphallus rubalo</i> (Bray 1986)	W	Bray (1986)
<i>Aphallus tubarium</i> (Rudolphi 1819)	NEA+M	Bartoli and Bray (1987)
<i>Metadena depressa</i> (Stossich 1883)	M	Bartoli and Bray (1987)
<i>Metadena pauli</i> (Vlassenko 1931)	NEA+M	Bartoli and Gibson (1995)
<i>Metadena phoceae</i> Bartoli and Gibson, 2001	M	Bartoli and Gibson (2001)
<i>Paracryptogonimus aloysiae</i> (Stossich 1885)	M	Bartoli and Gibson (1995)
DEROGENIDAE Nicoll, 1910		
<i>Arnola microcirrus</i> (Vlassenko 1931)	M	Kostadinova et al. (2004)
<i>Derogenes latus</i> Janiszewska, 1953	M	Bartoli and Gibson (1991)
<i>Derogenes varicus</i> (Müller 1780)	W	Gibson (1976)
<i>Magnibursatus skrjabini</i> (Vlassenko 1931)	M	Kostadinova et al. (2003)
FAUSTULIDAE Poche, 1926		
<i>Bacciger bacciger</i> (Rudolphi 1819)	NEA+M	Bray and Gibson (1980)
<i>Bacciger israelensis</i> Fischthal, 1980	M	Dimitrov and Bray (1994)
FELLODISTOMIDAE Nicoll, 1913		
<i>Monascus filiformis</i> (Rudolphi 1819)	W	Bray and Gibson (1980)
<i>Proctoeces maculatus</i> (Looss 1901)	W	Bray and Gibson (1980)
<i>Tergestia acanthocephala</i> (Stossich 1887)	M	Bartoli et al. (2003a)
<i>Tergestia laticollis</i> (Rudolphi 1819)	W	Bartoli et al. (2003a)
HEMIURIDAE Lühe, 1901		
<i>Aphamurus stossichi</i> (Monticelli 1891)	W	Looss (1907)
<i>Dinosoma</i> sp.		
<i>Ectenurus lepidus</i> Looss, 1907	W	Gibson and Bray (1986)
<i>Hemiurus communis</i> Odhner, 1905	NEA+M	Gibson and Bray (1986)
<i>Hemiurus luehei</i> Odhner, 1905	NEA+M	Gibson and Bray (1986)
<i>Lecithochirium fusiforme</i> Lühe, 1901	NEA+M	Gibson and Bray (1986)

Table I. (Continued).

Species	Distribution	Reference
<i>Lecithochirium grandiporum</i> (Rudolphi 1819)	M	Looss (1907)
<i>Lecithochirium musculus</i> (Looss 1907)	NEA+M	Gibson and Bray (1986)
<i>Lecithochirium rufoviride</i> (Rudolphi 1819)	W	Gibson and Bray (1986)
<i>Synaptobothrium caudiporum</i> (Rudolphi 1819)	NEA+M	Gibson and Bray (1986)
LECITHASTERIDAE Odhner, 1905		
<i>Aponurus laguncula</i> Looss, 1907	W	Bray and MacKenzie (1990)
<i>Lecithaster stellatus</i> Looss, 1907	W	Bray et al. (1993)
<i>Lecithaster</i> sp.		
LEPOCREADIIDAE (Odhner 1905)		
<i>Holorchis legendrei</i> Dollfus, 1946	NEA+M	Bartoli and Bray (1996)
<i>Holorchis micracanthum</i> (Stossich 1888)	M	Bartoli and Bray (1996)
<i>Holorchis pycnopus</i> Stossich, 1901	M	Bartoli and Bray (1996)
<i>Lepocreadium album</i> (Stossich 1890)	NEA+M	Saad-Fares (1985)
<i>Lepocreadium pegorchis</i> (Stossich 1901)	M	Bartoli (1983)
<i>Prodistomum polonii</i> (Molin 1859)	NEA+M	Bray and Gibson (1990)
MESOMETRIDAE Poche, 1926		
<i>Centroderma spinosissima</i> (Stossich 1883)	NEA+M	Bartoli (1987)
<i>Elstia stossichianum</i> (Monticelli 1892)	W	Bartoli (1987)
<i>Mesometra brachycoelia</i> Lühe, 1901	NEA+M	Bartoli (1987)
<i>Mesometra orbicularis</i> (Rudolphi 1819)	NEA+M	Bartoli (1987)
<i>Wardula capitellata</i> (Rudolphi 1819)	NEA+M	Bartoli (1987)
<i>Wardula sarguicola</i> Bartoli and Gibson, 1989	NEA+M	Bartoli and Gibson (1989)
MONORCHIIDAE Odhner, 1911		
<i>Lasiotocus typicus</i> (Nicoll 1912)	NEA+M	Bartoli and Bray (2004)
<i>Lasiotocus mulli</i> (Stossich 1883)	M	Bartoli and Prévot (1966)
<i>Monorchis blennii</i> Jousson and Bartoli, 2002	M	Jousson and Bartoli (2002)
<i>Monorchis monorchis</i> (Stossich 1890)	NEA+M	Bartoli et al. (2000a)
<i>Monorchis parvus</i> Looss, 1902	NEA+M	Bartoli et al. (2000a)
<i>Proctotrema bacilliovatum</i> Odhner, 1911	M	Bartoli and Prévot (1966)
<i>Timonia mediterranea</i> Bartoli and Prévot, 1966	M	Bartoli and Prévot (1966)
OPECOELIDAE Ozaki, 1925		
<i>Allopodocotyle jaffensis</i> (Fischthal 1980)	M	Bartoli et al. (1989b)
<i>Allopodocotyle pedicellata</i> (Stossich 1887)	M	Bartoli et al. (1989b)
<i>Bathycreadium elongata</i> (Maillard 1970)	M	Maillard (1970)
<i>Cainocreadium dentecis</i> Jousson and Bartoli, 2001	M	Jousson and Bartoli (2001)
<i>Cainocreadium labracis</i> (Dujardin 1845)	NEA+M	Bartoli et al. (1989c)
<i>Gaevskajatrema perezi</i> (Mathias 1926)	NEA+M	Gibson and Bray (1982)
<i>Genitocotyle mediterranea</i> Bartoli, Gibson, and Riutort, 1994	NEA+M	Bartoli et al. (1994)
<i>Helicometra</i> Odhner, 1902, form 1		
<i>Helicometra</i> Odhner, 1902, form 2		
<i>Helicometra</i> Odhner, 1902, form 3		
<i>Helicometra</i> Odhner, 1902, form 4		
<i>Macvicaria alacris</i> (Looss 1901)	NEA+M	Gibson and Bray (1982)
<i>Macvicaria crassigula</i> (Linton 1910)	W	Bartoli et al. (1989a)
<i>Macvicaria dubia</i> (Stossich 1905)	M	Bartoli et al. (1989a)
<i>Macvicaria maillardi</i> Bartoli, Bray, and Gibson, 1989	M	Bartoli et al. (1989a)
<i>Macvicaria mormyri</i> (Stossich 1885)	M	Bartoli et al. (1993)
<i>Macvicaria obovata</i> (Molin 1859)	M	Bartoli et al. (1989a)
<i>Opecoeloides columbellae</i> (Pagenstecher 1863)	M	Jousson and Bartoli (2000)
<i>Opecoeloides furcatus</i> (Bremser in Rudolphi 1819)	W	Bartoli and Gibson (1991)
<i>Pachycreadium carnosum</i> (Rudolphi 1819)	M	Bartoli et al. (1988)
<i>Peracreadium characis</i> (Stossich 1886)	M	Bartoli et al. (1989c)
<i>Peracreadium genu</i> Nicoll, 1909	NEA+M	Gibson and Bray (1982)
<i>Podocotyle novella</i> (Maillard and Lambert 1978)	M	Bartoli et al. (2003b)

Table I. (Continued).

Species	Distribution	Reference
<i>Podocotyle scorpaenae</i> (Rudolphi 1819)	M	Bartoli and Gibson (1991)
<i>Podocotyle temensis</i> Fischthal and Thomas, 1970	NEA+M	Bartoli et al. (2003b)
<i>Poracanthium furcatum</i> Dollfus, 1948	M	Bartoli and Gibson (1991)
<i>Pseudopecoeloides chloroscombri</i> (Fischthal and Thomas 1970)	NEA+M	Bartoli et al. (2003b)
<i>Pseudopycnadena fischthali</i> Saad-Fares and Maillard, 1986	M	Bartoli et al. (1989d)
<i>Pycnadenoides senegalensis</i> Fischthal and Thomas, 1972	NEA+M	Bartoli et al. (1989d)
PLEORCHIIDAE (Poche 1926)		
<i>Pleorchis polyorchis</i> (Stossich 1889)	NEA+M	Bartoli et al. (2004)
ROBPHILDOLLFUSIDAE Paggi and Orecchia, 1963		
<i>Robphildollfusium fractum</i> (Rudolphi 1819)	M	Bartoli (1987)
ZOOGONIDAE Odhner, 1911		
<i>Deretrema scorpaenicola</i> Bartoli and Bray, 1990	M	Bartoli and Bray (1990)
<i>Diphtherostomum brusinae</i> (Stossich 1889)	W	Bray and Gibson (1986)
<i>Lecithostaphyllus retroflexus</i> (Molin 1859)	NEA+M	Bartoli et al. (2003a)
<i>Zoogonus rubellus</i> (Olsson 1868)	NEA+M	Bray and Gibson (1986)

M, Mediterranean; NEA, north-eastern Atlantic; W, wider.

were new records for the Mediterranean. As can be seen in Table I, a large proportion (45.5%) of the digenean species found in the Scandola Nature Reserve are restricted to the Mediterranean.

In the teleosts from the Scandola Nature Reserve, opecoelids represent the most important digenean family (27 species=26.5%) (Table I).

Of the 63 teleost species studied, only *Gobius geniporus* and *Trachinus draco* were entirely devoid of adult digeneans, and of the 2238 fish autopsied, 1097 (49.02%) were parasitized (Table II). The unparasitized fishes tended to be young individuals. One digenean species was found in 608 (55.4%) of the infected fishes, two digenean species in 298 (27.2%), three in 128 (11.7%), four in 45 (4.1%), five in 14 (1.3%) and six in four (0.4%). Specimens of a given digenean species in numbers of 1–10 have been found in 695 fishes (63.3%), 11–100 in 342 fishes (31.1%), 101–1000 in 44 fishes (4%) and >1000 in 16 fishes (1.5%).

For each host species and for each of their digenean species, various parasitological indices and information on the site of the parasites are presented in Table II. This table shows that some digeneans were very prevalent and abundant, while others were very rare. With regard to the sites used by the parasites, all available niches were used by digeneans in *Gaidropsarus mediterraneus*, *Mullus surmuletus*, *Scorpaena porcus* and *Serranus scriba*. For all other hosts, some sites were never used, these usually being the stomach and gall-bladder. Nevertheless, the stomach only was occupied in *Gobius cobitis*, *G. cruentatus*, *Salaria pavo* and *Spicara maena*.

Some digenean species were very restricted in their distribution and were limited, for example, to: (1) the stomach for *Arnola microcirrus*, *Hemiurus luehei*, *Lecithochirium fusiforme*, *L. grandiporum*, *L. rufoviride* and *L. musculus* (nevertheless, single individuals of *L. musculus* were found in the pyloric caeca of *Serranus scriba*, the middle intestine of *Mullus surmuletus* and in the posterior intestine of *Symphodus tinca*—according to Gibson and Bray (1986), *L. musculus* can occur in a range of teleosts which feed on gobies that harbour gravid worms in their body cavity; these accidental hosts may have these worms, at least temporarily, in the intestine); (2) the pyloric caeca for *Bucephalus marinus*, *Monorchis monorchis*, *Podocotyle*

Table II. Parasitological indices for digeneans from teleost fishes off the Scandola Nature Reserve, Corsica (Western Mediterranean).

	Site(s)	Prevalence (%)	Abundance	Mean	Range
APOGONIDAE					
<i>Apogon imberbis</i> n=9					
<i>Genitocotyle mediterranea</i>	B (CD)	100	18.2	18.2	2–52
ATHERINIDAE					
<i>Atherina boyeri</i> n=26					
<i>Bacciger bacciger</i>	C (D)	30.7	0.4	1.3	1–2
<i>Genitocotyle mediterranea</i>	C (DE)	73.1	2.5	3.5	1–6
<i>Lecithaster stellatus</i>	F	3.8	0.04	1	1
BELONIDAE					
<i>Belone belone gracilis</i> n=30					
<i>Lecithaster stellatus</i>	F	3.3	0.03	1	1
<i>Lecithostaphylus retroflexus</i>	CDE (F)	80	8.9	11.3	1–37
<i>Tergestia acanthocephala</i>	F	36.7	0.8	2.1	1–5
BLENNIIDAE					
<i>Parablennius gattorugine</i> n=6					
<i>Monorchis blennii</i>	C	66.6	19.3	29	14–52
<i>Diptherostomum brusinae</i>	F	16.6	3	18	18
<i>Zoogonus rubellus</i>	F	16.6	4.2	25	25
<i>Salaria pavo</i> n=2					
<i>Magnibursatus skrjabini</i>	A	50	1.5	3	3
BOTHIDAE					
<i>Bothus podas</i> n=6					
<i>Helicometra</i> form 3	CF	33.3	0.5	1.5	1–2
CARANGIDAE					
<i>Trachurus mediterraneus</i> n=27					
<i>Lasiotocus typicus</i>	F (E)	7.4	1.7	23	1–45
<i>Aphanurus stossichi</i>	A	3.7	0.07	2	2
<i>Hemiurus communis</i>	A	3.7	0.15	4	4
<i>Prodistomum polonii</i>	B (CDE)	92.6	13.9	15	3–32
<i>Pseudopecoeloides chloroscombri</i>	DE (C)	29.7	0.8	2.6	1–6
<i>Tergestia laticollis</i>	EF (D)	44.4	3.5	7.9	2–20
<i>Trachurus picturatus</i> n=17					
<i>Ectenurus lepidus</i>	AB	8.3	0.8	1	1
<i>Monascus filiformis</i>	D (E)	41.7	0.5	1.2	1–2
<i>Prodistomum polonii</i>	B (CDE)	100	22.6	22.6	2–70
<i>Pseudopecoeloides chloroscombri</i>	D (E)	35.3	0.7	2	1–3
<i>Tergestia laticollis</i>	E (DF)	47	2.4	5.1	1–14
<i>Trachurus trachurus</i> n=25					
<i>Lasiotocus typicus</i>	F	8	0.1	1.5	1–2
<i>Ectenurus lepidus</i>	A	8	0.2	2	1–3
<i>Monascus filiformis</i>	D	4	0.04	1	1
<i>Prodistomum polonii</i>	B (AC)	72	8.1	11.2	1–38
<i>Pseudopecoeloides chloroscombri</i>	DE (BC)	45.8	1	2.3	1–5
<i>Tergestia laticollis</i>	F (DE)	56	1.9	3.4	1–12
CENTRACANTHIDAE					
<i>Spicara maena</i> n=5					
<i>Hemiurus communis</i>	A	33.3	2.7	8	8
<i>Spicara smaris</i> n=10					
<i>Lepocreadium album</i>	CD (E)	90	2.3	2.6	1–6
<i>Hemiurus communis</i>	D	50	1.5	3	3

Table II. (Continued).

	Site(s)	Prevalence (%)	Abundance	Mean	Range
CONGRIDAE					
<i>Conger conger</i> n=3					
<i>Helicometra</i> form 3	C	33.3	1.3	4	4
<i>Lecithochirium fusiforme</i>	A	100	39	39	4–95
<i>Lecithochirium musculus</i>	A	33.3	1	3	3
<i>Lecithochirium rufoviride</i>	A	33.3	1.7	5	5
<i>Podocotyle novella</i>	D (EF)	33.3	6	18	18
<i>Prosorhynchus aculeatus</i>	F	66.7	20	30	30
<i>Prosorhynchus crucibulum</i>	CD (E)	100	49.3	49.3	1–145
GOBIIDAE					
<i>Gobius cobitis</i> n=6					
<i>Lecithochirium musculus</i>	A	33.4	0.7	2	1–3
<i>Gobius cruentatus</i> n=1					
<i>Lecithochirium musculus</i>	A	100	8	8	8
<i>Gobius geniporus</i> n=17					
<i>Gobius paganellus</i> n=11					
<i>Deretrema scorpaenicola</i>	G	18.2	0.4	2	1–3
<i>Lecithochirium musculus</i>	A	36.4	0.4	1	1
<i>Pomatoschistus marmoratus</i> n=35					
<i>Genitocotyle mediterranea</i>	E (CD)	34.3	0.5	1.5	1–3
LABRIDAE					
<i>Coris julis</i> n=58					
<i>Diptherostomum brusinae</i>	F (E)	3.5	0.1	2	1–3
<i>Labrus merula</i> n=54					
<i>Deretrema scorpaenicola</i>	G	1.9	0.02	1	1
<i>Diptherostomum brusinae</i>	F	1.9	0.1	5	5
<i>Helicometra</i> form 2	E (CF)	9.3	0.3	3.4	1–6
<i>Helicometra</i> form 3	EF (CD)	9.6	1.2	4.2	1–13
<i>Lepidauchen stenostoma</i>	C (D)	5.6	0.1	2.3	1–3
<i>Peracreadium genu</i>	CDE (BF)	35.2	3.7	10.4	1–46
<i>Proctoeces maculatus</i>	F	3.7	0.04	1	1
<i>Zoogonus rubellus</i>	F	5.6	1.2	21	2–50
<i>Labrus viridis</i> n=19					
<i>Deretrema scorpaenicola</i>	D	5.3	0.05	1	1
<i>Helicometra</i> form 3	E (CF)	26.3	2.6	9.8	2–40
<i>Peracreadium genu</i>	CDE (F)	15.8	2.7	17.3	1–46
<i>Symphodus cinereus</i> n=82					
<i>Gaeuskajatrema perezii</i>	D	1.2	0.01	1	1
<i>Macvicaria alacris</i>	C (D)	6.1	0.1	1.4	1–3
<i>Symphodus mediterraneus</i> n=17					
<i>Helicometra</i> form 4	D	5.9	0.1	1	1
<i>Symphodus ocellatus</i> n=302					
<i>Deretrema scorpaenicola</i>	G	0.7	0.01	1	1
<i>Genitocotyle mediterranea</i>	CD (E)	10	0.7	6.6	1–31
<i>Helicometra</i> form 3	C	2	0.04	2	1–4
<i>Helicometra</i> form 4	F	0.3	0.01	3	3
<i>Lecithaster stellatus</i>	F (E)	8.9	0.14	1.5	1–4
<i>Macvicaria alacris</i>	CDE	8.6	0.14	1.7	1–6
<i>Symphodus roissali</i> n=230					
<i>Gaeuskajatrema perezii</i>	CDE (F)	21.7	2.8	12.7	1–97
<i>Helicometra</i> form 3	DE (F)	3	0.03	1	1
<i>Holorchis pycnopus</i>	CDEF	4.3	0.07	1.5	1–4
<i>Symphodus rostratus</i> n=41					
<i>Deretrema scorpaenicola</i>	G	2.4	0.1	5	5

Table II. (Continued).

	Site(s)	Prevalence (%)	Abundance	Mean	Range
<i>Helicometra</i> form 4	CDEF	31.7	1.1	3.4	1–13
<i>Macvicaria alacris</i>	CDE	14.6	1.1	7.7	1–41
<i>Symphodus tinca</i> n=114					
<i>Helicometra</i> form 2	CDEF	7	0.18	2.6	1–4
<i>Helicometra</i> form 3	CDEF	6.1	0.24	3.9	1–13
<i>Lecithochirium musculus</i>	E	0.8	0.01	1	1
<i>Macvicaria alacris</i>	CD (EF)	8.8	0.6	6.6	1–14
<i>Proctoeces maculatus</i>	F	3.5	0.04	1	1
<i>Zoogonus rubellus</i>	F	7.9	0.2	3	1–5
<i>Thalassoma pavo</i> n=2					
<i>Helicometra</i> form 3	C	50	1	2	2
<i>Xyrichthys novacula</i> n=4					
<i>Helicometra</i> form 3	C	25	10.8	43	43
LOPHIIDAE					
<i>Lophius piscatorius</i> n=16					
<i>Aphallus tubarium</i>	CDF	18.8	0.3	1.7	1–3
<i>Derogenes latus</i>	B	6.3	0.1	1	1
<i>Dinosoma</i> sp.	A	6.3	0.5	8	8
<i>Lecithochirium fusiforme</i>	A	6.3	0.1	1	1
<i>Lecithochirium musculus</i>	A	6.3	0.1	1	1
<i>Prosorhynchoides gracilescens</i>	CD (BEF)	25	5.2	20.8	3–52
<i>Prosorhynchus aculeatus</i>	C	6.3	0.2	3	3
<i>Stephanostomum cesticillum</i>	CDE (BF)	50	4.1	8.1	1–54
<i>Synaptobothrium caudiporum</i>	A	6.3	0.1	1	1
LOTIDAE					
<i>Gaidropsarus mediterraneus</i> n=17					
<i>Bathycreadium elongata</i>	B to F	23.5	2.1	9	6–13
<i>Bucephalus marinus</i>	B	5.9	0.2	3	3
<i>Derogenes varicus</i>	A	11.8	0.2	2	1–3
<i>Deretrema scorpaenicola</i>	G	5.9	0.1	1	1
<i>Helicometra</i> form 3	CDE (F)	35.3	2.8	7.8	1–22
<i>Metadena phoceae</i>	F	23.5	7.9	33.8	5–110
<i>Opecoeloides columbellae</i>	BC	58.8	46	78	5–177
<i>Stephanostomum gaidropsari</i>	CDE (F)	41.2	6.8	16.4	1–77
MORONIDAE					
<i>Dicentrarchus labrax</i> n=11					
<i>Bucephalus baeri</i>	F	9.1	1.4	15	15
<i>Bucephalus labracis</i>	BC	9.1	15.9	175	175
<i>Bucephalus minimus</i>	DE	36.4	2.2	6	2–9
<i>Cainocreadium labracis</i>	CD	100	20.2	20.2	3–115
<i>Timoniella praeteritum</i>	C	9.1	0.2	2	2
MULLIDAE					
<i>Mullus surmuletus</i> n=129					
<i>Aponurus laguncula</i>	A	1.5	0.04	2.5	2–5
<i>Derogenes latus</i>	G	6.2	0.1	2	1–6
<i>Holorchis legendrei</i>	F (CDE)	13.8	0.4	2.8	1–22
<i>Lasiotocus mulli</i>	F	27.7	5.4	19.6	1–118
<i>Lecithochirium musculus</i>	D	0.7	0.01	1	1
<i>Opecoeloides furcatus</i>	BC (DEF)	44.6	6	13.4	2–92
<i>Poracanthium furcatum</i>	CDE (BF)	50	14	28	1–202
<i>Proctotrema bacilliovatum</i>	F (B)	33.1	4.1	12.3	1–170
<i>Timonia mediterranea</i>	B	10.8	1	9.2	1–30

Table II. (Continued).

	Site(s)	Prevalence (%)	Abundance	Mean	Range
MURAENIDAE					
<i>Muraena helena</i> n=10					
<i>Lecithochirium grandiporum</i>	A	100	9	9	3–23
<i>Lecithochirium musculus</i>	A	10	0.1	2	2
<i>Lecithochirium rufoviride</i>	A	20	0.2	1	1
<i>Folliculovarium mediterraneum</i>	DE	20	0.8	4	2–6
PHYCIDAE					
<i>Phycis phycis</i> n=10					
<i>Bathycreadium elongata</i>	D (CE)	50	2	4	1–9
<i>Derogenes varicus</i>	A	10	0.2	2	2
<i>Lecithochirium musculus</i>	A	40	2.8	7	3–14
<i>Stephanostomum pristi</i>	B (C)	80	9.3	11.6	1–25
SCIAENIDAE					
<i>Sciaena umbra</i> n=41					
<i>Anoikostoma coronatum</i>	F	85.4	476	558	18–2920
<i>Metadena pauli</i>	BCDE	68.3	1176	1722	2–6270
<i>Paracryptogonimus aloysiae</i>	BCD	14.6	1	7.2	2–22
<i>Pleorchis polyorchis</i>	C (D)	19.5	0.5	2.6	1–4
<i>Stephanostomum bicoronatum</i>	F	24.4	4.6	19	1–111
<i>Umbrina cirrosa</i> n=1					
<i>Lepocreadium pegorchis</i>	CDE	100	284	284	284
<i>Pycnadenoides umbrinae</i>	CD	100	4	4	4
SCORPAENIDAE					
<i>Scorpaena notata</i> n=5					
<i>Lecithochirium musculus</i>	A	40	1.4	3.5	1–6
<i>Podocotyle scorpaenae</i>	D	20	0.6	3	3
<i>Scorpaena porcus</i> n=70					
<i>Deretrema scorpaenicola</i>	G	21.4	0.3	1.4	1–4
<i>Helicometra</i> form 2	BCD (AEF)	55.7	5.3	9.5	1–46
<i>Lecithochirium musculus</i>	A	20	0.6	3.2	1–15
<i>Podocotyle scorpaenae</i>	CD	21.4	0.6	2.7	1–6
<i>Scorpaena scrofa</i> n=11					
<i>Helicometra</i> form 2	BC (DE)	36.4	1.5	4.3	1–14
<i>Lecithochirium musculus</i>	A	36.4	1.5	4	1–10
<i>Podocotyle scorpaenae</i>	BC (AD)	33.3	3.1	11.3	3–26
SERRANIDAE					
<i>Epinephelus marginatus</i> n=1					
<i>Podocotyle temensis</i>	B	100	23	23	23
<i>Serranus cabrilla</i> n=15					
<i>Deretrema scorpaenicola</i>	G	20	0.3	1.7	1–2
<i>Helicometra</i> form 1	BDF	26.7	0.5	1.8	1–3
<i>Serranus scriba</i> n=46					
<i>Deretrema scorpaenicola</i>	G	4.3	0.04	1	1
<i>Helicometra</i> form 1	BCD (EF)	80.4	5.6	6.9	1–36
<i>Lecithochirium musculus</i>	A (B)	28.3	1.5	5.3	1–16
SOLEIDAE					
<i>Monochirus hispidus</i> n=3					
<i>Homalometron galaicus</i>	C	100	6.7	6.7	2–15
<i>Synaptura kleinii</i> n=8					
<i>Homalometron senegalense</i>	C (DE)	100	24.4	24.4	2–41
SPARIDAE					
<i>Boops boops</i> n=13					
<i>Aphanurus stossichi</i>	A (B)	84.6	12.6	14.9	4–32
<i>Arnola microcirrus</i>	A	30.8	0.9	3	1–7

Table II. (Continued).

	Site(s)	Prevalence (%)	Abundance	Mean	Range
<i>Bacciger israelensis</i>	B (C)	61.5	2.5	4.1	1–9
<i>Hemiurus communis</i>	A	76.9	7.5	9.8	4–32
<i>Robphildollfusium fractum</i>	D (C)	69.2	9	13	2–38
<i>Dentex dentex</i> n=13					
<i>Allopodocotyle jaffensis</i>	E	7.7	0.15	2	2
<i>Aphallus rubalo</i>	CF	15.4	0.5	3.5	2–5
<i>Aphallus tubarium</i>	EF	84.6	18.8	22.2	1–71
<i>Cainocreadium dentecis</i>	BCD	76.9	8.2	10.6	1–34
<i>Hemiurus communis</i>	A	7.7	0.4	5	5
<i>Metadena depressa</i>	BCD (E)	30.8	2.4	7.8	2–14
<i>Pachycreadium carnosum</i>	CDE	23.1	0.7	3	1–3
<i>Diplodus annularis</i> n=54					
<i>Diptherostomum brusinae</i>	F	53.7	2	3.7	1–14
<i>Lecithochirium musculus</i>	A	1.8	0.04	2	2
<i>Lepocreadium pegorchis</i>	B	1.8	0.2	1	1
<i>Macvicaria crassigula</i>	CDE (F)	29.6	1	3.7	1–6
<i>Monorchis parvus</i>	BC	72.2	11.7	16.2	1–122
<i>Pseudopycnadena fischthali</i>	DE	3.7	0.1	2.5	1–4
<i>Diplodus puntazzo</i> n=31					
<i>Monorchis monorchis</i>	B	12.9	0.1	1	1
<i>Peracreadium characis</i>	BC (D)	71	4.3	6	1–32
<i>Pseudopycnadena fischthali</i>	CDE	9.6	0.1	1	1
<i>Diplodus sargus</i> n=69					
<i>Diptherostomum brusinae</i>	F	31.9	7.2	22.5	1–92
<i>Holorchis pycnopus</i>	CDEF	20.3	1.1	5.4	1–26
<i>Lepidauchen stenostoma</i>	C	1.5	0.01	1	1
<i>Lepocreadium album</i>	CD	2.9	0.06	2	1–2
<i>Macvicaria crassigula</i>	CD (BE)	24.6	0.7	2.8	1–11
<i>Monorchis parvus</i>	B	20.2	3.7	15.2	1–17
<i>Proctoeces maculatus</i>	DEF	7.2	0.2	2.6	1–9
<i>Pseudopycnadena fischthali</i>	DE	4.3	0.1	1.3	1–2
<i>Wardula sarguicola</i>	F	6	0.1	1.5	1–2
<i>Zoogonus rubellus</i>	F	13	2.6	20.2	1–120
<i>Diplodus vulgaris</i> n=43					
<i>Diptherostomum brusinae</i>	F	34.9	9.2	26.3	1–93
<i>Holorchis pycnopus</i>	CDE (F)	16.3	1.3	8	1–24
<i>Lepocreadium album</i>	B	2.3	0.07	3	3
<i>Macvicaria crassigula</i>	CDE (B)	27.9	1.16	4.2	1–11
<i>Monorchis parvus</i>	B (C)	11.6	1.6	13.8	1–42
<i>Proctoeces maculatus</i>	F	2.3	0.02	1	1
<i>Pseudopycnadena fischthali</i>	DE	13.9	0.1	0.8	1
<i>Pycnadenoides senegalensis</i>	E	2.3	0.02	1	1
<i>Wardula sarguicola</i>	F	2.3	0.02	1	1
<i>Zoogonus rubellus</i>	F	7	0.8	11.7	4–25
<i>Lithognathus mormyrus</i> n=52					
<i>Derogenes latus</i>	G	1.9	0.02	1	1
<i>Diptherostomum brusinae</i>	F	3.8	0.06	1.5	1–2
<i>Holorchis pycnopus</i>	CDEF	50	2.1	4.2	1–17
<i>Lepocreadium pegorchis</i>	B (C)	5.8	0.7	12.7	1–21
<i>Macvicaria mormyri</i>	CD	25	0.4	1.5	1–2
<i>Pycnadenoides senegalense</i>	CD	3.8	0.15	4	1–4
<i>Oblada melanura</i> n=22					
<i>Hemiurus communis</i>	B	4.5	0.05	1	1
<i>Lepocreadium album</i>	BC	31.8	6	19	2–42

Table II. (Continued).

	Site(s)	Prevalence (%)	Abundance	Mean	Range
<i>Macvicaria dubia</i>	CDE	31.8	0.7	2.1	1–4
<i>Pagellus erythrinus</i> n=92					
<i>Allopodocotyle jaffensis</i>	E	2.2	0.02	1	1
<i>Hemiurus communis</i>	ACD	3.3	0.15	4.7	2–8
<i>Hemiurus luehei</i>	A	2.2	0.1	3	2–4
<i>Holorchis micracanthum</i>	CDE	10.9	0.3	2.3	1–4
<i>Holorchis pycnopus</i>	CD (E)	19.6	0.8	4	1–25
<i>Lepidauchen stenostoma</i>	D	1.1	0.01	1	1
<i>Lepocreadium album</i>	C	4.3	0.04	2.8	1–5
<i>Macvicaria crassigula</i>	CD	9.8	0.2	1.7	1–7
<i>Pachycreadium carnosum</i>	CD (E)	28.3	0.5	1.7	1–4
<i>Pagrus pagrus</i> n=59					
<i>Allopodocotyle jaffensis</i>	DEF	16.9	0.3	1.6	1–3
<i>Aphallus rubalo</i>	E	1.7	0.05	3	3
<i>Hemiurus communis</i>	AC (D)	5.1	0.1	2.3	2–4
<i>Hemiurus luehei</i>	A	1.7	0.07	4	4
<i>Holorchis micracanthum</i>	D	1.7	0.02	1	1
<i>Holorchis pycnopus</i>	DEF	15.3	0.4	2.7	1–12
<i>Lecithochirium musculus</i>	A	3.4	0.03	1	1
<i>Macvicaria crassigula</i>	CD (E)	27.1	1	3.6	1–18
<i>Pachycreadium carnosum</i>	CD (E)	25.4	0.5	2.1	1–9
<i>Zoogonus rubellus</i>	F	3.4	0.05	1.5	1–2
<i>Sarpa salpa</i> n=9					
<i>Centroderma spinosissima</i>	CDE	44.4	13.6	30.5	1–60
<i>Elstia stossichium</i>	DE	11.1	3.6	32	32
<i>Lepocreadium pegorchis</i>	B	22.2	0.4	2	1–3
<i>Mesometra brachycoelia</i>	BCDE	55.6	17.7	31.8	1–60
<i>Mesometra orbicularis</i>	BCDE	77.8	11.2	14.4	1–53
<i>Robphildollfusium fractum</i>	DE (CF)	77.8	34.3	44.1	2–112
<i>Wardula capitellata</i>	E	44.4	1.2	2.8	2–5
<i>Sparus auratus</i> n=19					
<i>Allopodocotyle pedicellata</i>	EF	57.9	3.3	5.7	2–12
<i>Diptherostomum brusinae</i>	F (E)	26.3	6.7	25.6	6–78
<i>Macvicaria maillardi</i>	CDE	52.7	1.5	2.9	1–12
<i>Macvicaria obovata</i>	CDE (F)	52.7	3	5.8	1–10
<i>Pycnadenoides senegalense</i>	CD (E)	26.3	2.3	8.8	1–14
<i>Zoogonus rubellus</i>	F	10.5	1	9.5	1–18
<i>Spondyllosoma cantharus</i> n=108					
<i>Arnola microcirrus</i>	A	0.9	0.01	1	1
<i>Hemiurus communis</i>	A	2.8	0.1	3.3	1–8
<i>Lepocreadium album</i>	BC	2.8	0.1	3	1–5
<i>Macvicaria crassigula</i>	DE	2.8	0.03	1	1
<i>Monorchis monorchis</i>	B	7.4	0.4	4.8	1–18
SYNODONTIDAE					
<i>Synodus saurus</i> n=29					
<i>Aphanurus stossichi</i>	A	3.5	0.03	1	1
<i>Derogenes varicus</i>	A	3.5	0.03	1	1
<i>Helicometra</i> form 3	D	3.5	0.07	2	2
<i>Hemiurus communis</i>	A	17.2	0.2	1	1
<i>Lecithaster</i> sp.	D	3.5	0.03	1	1
<i>Lecithochirium musculus</i>	A	31	0.8	2.5	1–8

Table II. (Continued).

	Site(s)	Prevalence (%)	Abundance	Mean	Range
TRACHINIDAE					
<i>Trachinus araneus</i> n=4					
<i>Hemiurus luehei</i>	A	25	1.5	6	6
<i>Trachinus draco</i> n=2					
TRIGLIDAE					
<i>Chelidonichthys lucerna</i> n=5					
<i>Helicometra</i> form 3	B	20	0.2	1	1
<i>Lecithochirium musculus</i>	A	20	2.2	11	11
<i>Prosorhynchoides gracilescens</i>	CE	20	0.8	4	4
<i>Synaptobothrium caudiporum</i>	A	20	0.2	1	1
URANOSCOPIDAE					
<i>Uranoscopus scaber</i> n=49					
<i>Anisocladium fallax</i>	BCD (E)	32.7	6.6	20.1	2–45
<i>Anisocladium gracile</i>	DE (CF)	30.6	6.4	20.9	2–49
<i>Anisocoelium capitellatum</i>	G	30.6	4.4	14	2–35
<i>Stephanostomum minutum</i>	F	18.4	0.4	2.3	1–5
ZEIDAE					
<i>Zeus faber</i> n=12					
<i>Stephanostomum cesticillum</i>	E (CDF)	25	1.6	6.3	6–7
<i>Helicometra</i> form 3	B	8.3	0.1	1	1

Sites: A, stomach; B, pyloric caeca; C, duodenum; D, mid-intestine; E, posterior intestine; F, rectum; G, gall-bladder. Secondary sites are given in parentheses. Note that records from *Trachurus mediterraneus* and *T. picturatus* have often been reported as *T. trachurus*.

temensis and *Timonia mediterranea*; (3) the duodenum for *Homalometron galaicus*, *Monorchis blennii*, *Prosorhynchus crucibulum* and *Timoniella praeteritum*; (4) the rectum for *Diptherostomum brusinae*, *Lasiotocus mulli*, *Lecithaster stellatus*, *Metadena phoceae*, *Prosorhynchus aculeatus*, *Stephanostomum minutum*, *Tergestia acanthocephala*, *Wardula sarguicola* and *Zoogonus rubellus*; and (5) the gall-bladder for *Derogenes latus* (but a single individual was recovered from the pyloric caeca of *Lophius piscatorius*), *Deretrema scorpaenicola* (but a single individual was found in the middle intestine of *Labrus viridis*) and *Anisocoelium capitellatum*. Some other digenean species were much less restricted in their distribution and were found all along the digestive tract of their host apart from the stomach and gall-bladder: *Bathycreadium elongata*, *Helicometra* form 1, *Helicometra* form 2, *Holorchis pycnopus*, *Opecoeloides furcatus*, *Peracreadium genu*, *Poracanthium furcatum* and *Stephanostomum cesticillum*.

In Table III, we present a parasite–host list. Of the 102 digenean species found in the teleosts from Scandola, 55 were oioxenic (53.9%), 13 stenoxenic (12.7%) and 34 (33.3%) euryxenic (terminology of Euzet and Combes 1980). Of the 34 euryxenic species, nine were restricted to sparids (five digenean species found in two hosts, three in three hosts, one in six hosts), 17 were parasites of two to five unrelated fish host species, six of six to 10 unrelated hosts and two of >11 unrelated hosts. These latter two cases refer to *Lecithochirium musculus* and forms of *Helicometra* (which will probably prove to be a species complex).

With the exception of the nine euryxenic species found in sparids, all of the other 25 euryxenic species are found in unrelated fish families. Among these 25 euryxenic digeneans: 14 parasitize fish hosts belonging to two different families, six parasitize fish hosts belonging to three different families, two parasitize fish hosts belonging to four

Table III. Parasite–host list.

Parasite	Hosts
<i>Allopodocotyle jaffensis</i>	<i>Dentex dentex</i> , <i>Pagellus erythrinus</i> , <i>Pagrus pagrus</i>
<i>Allopodocotyle pedicellata</i>	<i>Sparus auratus</i>
<i>Anisocladium fallax</i>	<i>Uranoscopus scaber</i>
<i>Anisocladium gracile</i>	<i>Uranoscopus scaber</i>
<i>Anisocoelium capitellatum</i>	<i>Uranoscopus scaber</i>
<i>Anoikostoma coronatum</i>	<i>Sciaena umbra</i>
<i>Aphallus rubalo</i>	<i>Dentex dentex</i> , <i>Pagrus pagrus</i>
<i>Aphallus tubarium</i>	<i>Dentex dentex</i> , <i>Lophius piscatorius</i>
<i>Aphanurus stossichi</i>	<i>Boops boops</i> , <i>Synodus saurus</i> , <i>Trachurus mediterraneus</i>
<i>Aponurus laguncula</i>	<i>Mullus surmuletus</i>
<i>Arnola microcirrus</i>	<i>Boops boops</i> , <i>Spondyllosoma cantharus</i>
<i>Bacciger bacciger</i>	<i>Atherina boyeri</i>
<i>Bacciger israelensis</i>	<i>Boops boops</i>
<i>Bathycreadium elongata</i>	<i>Gaidropsarus mediterraneus</i> , <i>Phycis phycis</i>
<i>Bucephalus baeri</i>	<i>Dicentrarchus labrax</i>
<i>Bucephalus labracis</i>	<i>Dicentrarchus labrax</i>
<i>Bucephalus marinus</i>	<i>Gaidropsarus mediterraneus</i>
<i>Bucephalus minimus</i>	<i>Dicentrarchus labrax</i>
<i>Cainocreadium dentecis</i>	<i>Dentex dentex</i>
<i>Cainocreadium labracis</i>	<i>Dicentrarchus labrax</i>
<i>Centroderma spinosissima</i>	<i>Sarpa salpa</i>
<i>Deretrema scorpaenicola</i>	<i>Gaidropsarus mediterraneus</i> , <i>Gobius paganellus</i> , <i>Labrus merula</i> , <i>L. viridis</i> , <i>Serranus cabrilla</i> , <i>S. scribea</i> , <i>Scorpaena porcus</i> , <i>Symphodus ocellatus</i> , <i>S. rostratus</i>
<i>Derogenes latus</i>	<i>Lithognathus mormyrus</i> , <i>Lophius piscatorius</i> , <i>Mullus surmuletus</i>
<i>Derogenes varicus</i>	<i>Gaidropsarus mediterraneus</i> , <i>Phycis phycis</i> , <i>Synodus saurus</i>
<i>Dinosoma</i> sp.	<i>Lophius piscatorius</i>
<i>Diphterostomum brusinae</i>	<i>Coris julis</i> , <i>Diplodus annularis</i> , <i>D. sargus</i> , <i>D. vulgaris</i> , <i>Labrus merula</i> , <i>Lithognathus mormyrus</i> , <i>Parablennius gattorugine</i> , <i>Sparus auratus</i>
<i>Ectenurus lepidus</i>	<i>Trachurus picturatus</i> , <i>T. trachurus</i>
<i>Elstia stossichianum</i>	<i>Sarpa salpa</i>
<i>Folliculovarium mediterraneum</i>	<i>Muraena helena</i>
<i>Gaeuskajatrema perezi</i>	<i>Symphodus cinereus</i> , <i>S. roissali</i>
<i>Genitocotyle mediterranea</i>	<i>Apogon imberbis</i> , <i>Atherina boyeri</i> , <i>Pomatoschistus marmoratus</i> , <i>Symphodus ocellatus</i>
<i>Helicometra</i> form 1	<i>Serranus cabrilla</i> , <i>S. scribea</i>
<i>Helicometra</i> form 2	<i>Labrus merula</i> , <i>Scorpaena porcus</i> , <i>S. scrofa</i> , <i>Symphodus tinca</i>
<i>Helicometra</i> form 3	<i>Bothus podas</i> , <i>Chelidonichthys lucerna</i> , <i>Conger conger</i> , <i>Gaidropsarus mediterraneus</i> , <i>Labrus merula</i> , <i>L. viridis</i> , <i>Symphodus ocellatus</i> , <i>S. roissali</i> , <i>S. tinca</i> , <i>Synodus saurus</i> , <i>Thalassoma pavo</i> , <i>Xyrichthys novacula</i> , <i>Zeus faber</i>
<i>Helicometra</i> form 4	<i>Symphodus mediterraneus</i> , <i>S. ocellatus</i> , <i>S. rostratus</i>
<i>Hemiurus communis</i>	<i>Boops boops</i> , <i>Dentex dentex</i> , <i>Oblada melanura</i> , <i>Pagellus erythrinus</i> , <i>Pagrus pagrus</i> , <i>Spicara maena</i> , <i>S. smarisi</i> , <i>Spondyllosoma cantharus</i> , <i>Synodus saurus</i> , <i>Trachurus mediterraneus</i>
<i>Hemiurus luehei</i>	<i>Pagellus erythrinus</i> , <i>Pagrus pagrus</i> , <i>Trachinus araneus</i>
<i>Holorchis legendrei</i>	<i>Mullus surmuletus</i>
<i>Holorchis micracanthum</i>	<i>Pagellus erythrinus</i> , <i>Pagrus pagrus</i>
<i>Holorchis pycnoporus</i>	<i>Diplodus sargus</i> , <i>D. vulgaris</i> , <i>Lithognathus mormyrus</i> , <i>Pagellus erythrinus</i> , <i>Pagrus pagrus</i> , <i>Symphodus roissali</i>
<i>Homalometron galaicis</i>	<i>Monochirus hispidus</i>
<i>Homalometron senegalense</i>	<i>Synaptura kleinii</i>
<i>Lasiotocus mulli</i>	<i>Mullus surmuletus</i>
<i>Lasiotocus typicus</i>	<i>Trachurus mediterraneus</i> , <i>T. trachurus</i>

Table III. (Continued).

Parasite	Hosts
<i>Lecithaster stellatus</i>	<i>Atherina boyeri</i> , <i>Belone belone</i> , <i>Symphodus ocellatus</i>
<i>Lecithaster</i> sp.	<i>Synodus saurus</i>
<i>Lecithochirium fusiforme</i>	<i>Conger conger</i> , <i>Lophius piscatorius</i>
<i>Lecithochirium grandiporum</i>	<i>Muraena helena</i>
<i>Lecithochirium musculus</i>	<i>Chelidonichthys lucerna</i> , <i>Conger conger</i> , <i>Diplodus annularis</i> , <i>Gobius cobitis</i> , <i>G. cruentatus</i> , <i>G. paganellus</i> , <i>Lophius piscatorius</i> , <i>Mullus surmuletus</i> , <i>Muraena helena</i> , <i>Pagrus pagrus</i> , <i>Phycis phycis</i> , <i>Scorpaena notata</i> , <i>S. porcus</i> , <i>S. scrofa</i> , <i>Serranus scriba</i> , <i>Symphodus tinca</i> , <i>Synodus saurus</i>
<i>Lecithochirium rufoviride</i>	<i>Conger conger</i> , <i>Muraena helena</i>
<i>Lecithostaphylus retroflexus</i>	<i>Belone belone</i>
<i>Lepidauchen stenostoma</i>	<i>Diplodus sargus</i> , <i>Labrus merula</i> , <i>Pagellus erythrinus</i>
<i>Lepocreadium album</i>	<i>Diplodus sargus</i> , <i>D. vulgaris</i> , <i>Oblada melanura</i> , <i>Pagellus erythrinus</i> , <i>Spicara smaris</i> , <i>Spondylisoma cantharus</i>
<i>Lepocreadium pegorchis</i>	<i>Diplodus annularis</i> , <i>Lithognathus mormyrus</i> , <i>Umbrina cirrosa</i> , <i>Sarpa salpa</i>
<i>Macvicaria alacris</i>	<i>Symphodus cinereus</i> , <i>S. ocellatus</i> , <i>S. rostratus</i> , <i>S. tinca</i>
<i>Macvicaria crassigula</i>	<i>Diplodus annularis</i> , <i>D. sargus</i> , <i>D. vulgaris</i> , <i>Pagellus erythrinus</i> , <i>Pagrus pagrus</i> , <i>Spondylisoma cantharus</i>
<i>Macvicaria dubia</i>	<i>Oblada melanura</i>
<i>Macvicaria maillardi</i>	<i>Sparus auratus</i>
<i>Macvicaria mormyri</i>	<i>Lithognathus mormyrus</i>
<i>Macvicaria obovata</i>	<i>Sparus auratus</i>
<i>Magnibursatus skrjabini</i>	<i>Salaria pavo</i>
<i>Mesometra brachycoelia</i>	<i>Sarpa salpa</i>
<i>Mesometra orbicularis</i>	<i>Sarpa salpa</i>
<i>Metadena depressa</i>	<i>Dentex dentex</i>
<i>Metadena pauli</i>	<i>Sciaena umbra</i>
<i>Metadena phoceae</i>	<i>Gaidropsarus mediterraneus</i>
<i>Monascus filiformis</i>	<i>Trachurus picturatus</i>
<i>Monorchis blennii</i>	<i>Parablennius gattorugine</i>
<i>Monorchis monorchis</i>	<i>Diplodus puntazzo</i> , <i>Spondylisoma cantharus</i>
<i>Monorchis parvus</i>	<i>Diplodus annularis</i> , <i>D. sargus</i> , <i>D. vulgaris</i>
<i>Opecoeloides columbellae</i>	<i>Gaidropsarus mediterraneus</i>
<i>Opecoeloides furcatus</i>	<i>Mullus surmuletus</i>
<i>Pachycreadium carnosum</i>	<i>Dentex dentex</i> , <i>Pagellus erythrinus</i> , <i>Pagrus pagrus</i>
<i>Paracryptogonimus aloysiae</i>	<i>Sciaena umbra</i>
<i>Peracreadium characis</i>	<i>Diplodus puntazzo</i>
<i>Peracreadium genu</i>	<i>Labrus merula</i> , <i>L. viridis</i>
<i>Pleorchis polyorchis</i>	<i>Sciaena umbra</i>
<i>Podocotyle novella</i>	<i>Conger conger</i>
<i>Podocotyle scorpaenae</i>	<i>Scorpaena notata</i> , <i>S. porcus</i> , <i>S. scrofa</i>
<i>Podocotyle temensis</i>	<i>Epinephelus marginatus</i>
<i>Poracanthium furcatum</i>	<i>Mullus surmuletus</i>
<i>Proctoeces maculatus</i>	<i>Diplodus sargus</i> , <i>D. vulgaris</i> , <i>Labrus merula</i> , <i>Symphodus tinca</i>
<i>Proctotrema bacilliovatum</i>	<i>Mullus surmuletus</i>
<i>Prodistomum polonii</i>	<i>Trachurus mediterraneus</i> , <i>T. picturatus</i> , <i>T. trachurus</i>
<i>Prosorhynchoides gracilescens</i>	<i>Lophius piscatorius</i>
<i>Prosorhynchus aculeatus</i>	<i>Conger conger</i> , <i>Lophius piscatorius</i>
<i>Prosorhynchus crucibulum</i>	<i>Conger conger</i>
<i>Pseudopecoeloides chloroscombri</i>	<i>Trachurus mediterraneus</i> , <i>T. picturatus</i> , <i>T. trachurus</i>
<i>Pseudopycnadena fischthali</i>	<i>Diplodus annularis</i> , <i>D. sargus</i> , <i>D. vulgaris</i> , <i>D. puntazzo</i>
<i>Pycnadenoides senegalensis</i>	<i>Diplodus vulgaris</i> , <i>Lithognathus mormyrus</i> , <i>Sparus auratus</i>
<i>Pycnadenoides umbrinae</i>	<i>Umbrina cirrosa</i>
<i>Robphildollfusium fractum</i>	<i>Boops boops</i> , <i>Sarpa salpa</i>
<i>Stephanostomum bicoronatum</i>	<i>Sciaena umbra</i>

Table III. (Continued).

Parasite	Hosts
<i>Stephanostomum cesticillum</i>	<i>Lophius piscatorius</i> , <i>Zeus faber</i>
<i>Stephanostomum gaidropsari</i>	<i>Gaidropsarus mediterraneus</i>
<i>Stephanostomum minutum</i>	<i>Uranoscopus scaber</i>
<i>Stephanostomum pristis</i>	<i>Phycis phycis</i>
<i>Synaptobothrium caudiporum</i>	<i>Chelidonichthys lucerna</i> , <i>Lophius piscatorius</i>
<i>Tergestia acanthocephala</i>	<i>Belone belone</i>
<i>Tergestia laticollis</i>	<i>Trachurus mediterraneus</i> , <i>T. picturatus</i> , <i>T. trachurus</i>
<i>Timonia mediterranea</i>	<i>Mullus surmuletus</i>
<i>Timoniella praeteritum</i>	<i>Dicentrarchus labrax</i>
<i>Wardula capitellata</i>	<i>Sarpa salpa</i>
<i>Wardula sarguicola</i>	<i>Diplodus sargus</i> , <i>D. vulgaris</i>
<i>Zoogonus rubellus</i>	<i>Diplodus sargus</i> , <i>D. vulgaris</i> , <i>Labrus merula</i> , <i>Pagrus pagrus</i> , <i>Parablennius gattorugine</i> , <i>Sparus auratus</i> , <i>Symphodus tinca</i>

different families, one parasitizes fish hosts belonging to five different families, one parasitizes fish hosts belonging to nine different families and one parasitizes fish hosts belonging to 12 different families. Nevertheless, two digenean species are found in the family pair Congridae–Lophiidae, two others are in the pair Triglidae–Lophiidae and two others in the Labridae–Sparidae–Blenniidae. For these euryxenic species, the relationships between the parasites and their hosts probably have an ecological basis (e.g. foodwebs).

In Table IV, we compare the data collected from each teleost species studied in the Scandola Nature Reserve with those reported from the same teleost species in other areas of the Mediterranean and the Black Seas. Such a comparison is not easy because: (1) the sample size varies; and (2) the digenean species reported are sometimes different. In this study, the validity and synonymy of the different digenean species reported by the various authors are not discussed.

In a specific geographical area, the ratio of the total number of the digenean species found in all fish species studied (N) to the number of fish species examined (N'), which corresponds to the mean number of digenean species per host species, i.e. $M=N/N'$, is a reflection of digenean species diversity. Table IV shows that the highest ratio (3.8) is observed off the Scandola Nature Reserve. By contrast, the lowest ratio is reported for the Adriatic (1.9; 2.0; 0.6: the last value could be wrong due to the nature of the data provided by Radujkovic and Raibaut 1989), while an intermediate situation is observed for the Eastern Mediterranean (2.6; 2.9; 2.1).

If we compare the data reported for the Sparidae, a family which has been well studied throughout the Mediterranean (Table V), we obtain similar results: a high mean number of digenean species per host species occurs off the Scandola Nature Reserve, a much lower level in the Adriatic and an intermediate situation for the Eastern Mediterranean. Fredj et al. (1992) have shown that biodiversity in general is high in the Western Mediterranean, lower in the Adriatic and even lower in the Eastern Mediterranean. The high digenean diversity observed for the Scandola region is in accordance with Fredj et al. (1992), but the lower diversity for the Adriatic as compared with the Eastern Mediterranean differs somewhat from the findings of these authors. The higher digenean diversity observed in the Eastern Mediterranean *vis-à-vis* the Adriatic could be related to the encroachment of the Red Sea digenean fauna carried by Red Sea immigrant teleost hosts. In the Western Mediterranean, the high value of the ratio N/N' found off the Scandola Nature Reserve (3.8) strongly contrasts with a lower one (2.0) indicated by Orecchia and Paggi (1978) for

Table IV. Number of digenean species from teleost fishes off the Scandola Nature Reserve (Corsica) compared, where available, with data from the same host species from other areas of the Mediterranean and Black Seas (bold type indicates the highest number of digenean species reported in the host fish; the sample size is given in parentheses).

	Western Mediterranean		Adriatic			Eastern Mediterranean				
	Scandola	North- western Italian coast	Split	Montenegro		Greece	Lebanon	Israel	Black Sea	
	Present work	1 [†]	2	3	4	5	6	7	8	9
APOGONIDAE										
<i>Apogon imberbis</i>	1 (9)	–	–	–	–	0	–	–	–	–
ATHERINIDAE										
<i>Atherina boyeri</i>	3 (26)	–	–	2 (78)	2	2	–	–	–	–
BELONIDAE										
<i>Belone belone</i>	3 (30)	–	1 (2)	–	0	1	–	–	–	0 (13)
BLENNIIDAE										
<i>Parablennius gattorugine</i>	3 (6)	4 (34)	2 (7)	–	0	1	–	–	–	–
<i>Salaria pavo</i>	1 (2)	1 (112)	–	–	0	–	–	0 (12)	–	–
BOTHIDES										
<i>Bothus podas</i>	1 (6)	0 (17)	1 (2)	–	–	2	–	–	–	–
CARANGIDAE										
<i>Trachurus</i> spp.	8 (69)	2 (66)	2 (21)	2 (15)	2	6	3 (24)	–	6 (18)	6 (68)
CENTRACANTHIDES										
<i>Spicara maena</i>	1 (5)	–	2 (20)	–	–	2	–	–	1 (80)	1 (38)
<i>Spicara smaris</i>	2 (10)	–	3 (16)	–	0	3	1 (50)	–	–	–
CONGRIDAE										
<i>Conger conger</i>	7 (3)	1 (106)	–	1 (6)	1	5	–	–	–	–
GOBIIDAE										
<i>Gobius cobitis</i>	1 (6)	3 (107)	–	–	–	–	–	1 (23)	–	–
<i>Gobius cruentatus</i>	1 (1)	–	1 (2)	–	0	1	–	–	–	–
<i>Gobius geniporus</i>	0 (17)	–	1 (3)	–	–	–	–	–	–	–
<i>Gobius paganellus</i>	2 (11)	1 (4)	–	–	–	–	–	–	–	–
<i>Pomatoschistus marmoratus</i>	1 (35)	–	–	–	–	–	–	–	–	–

Table IV. (Continued).

	Western Mediterranean		Adriatic			Eastern Mediterranean				
	Scandola	North-western Italian coast	Split	Montenegro		Greece	Lebanon	Israel	Black Sea	
		Present work								
		1 [†]	2	3	4	5	6	7	8	9
LABRIDAE										
<i>Coris julis</i>	1 (58)	–	1 (6)	–	–	0	–	–	–	–
<i>Labrus merula</i>	7 (54)	–	1 (1)	–	0	4	–	–	–	–
<i>Labrus viridis</i>	3 (19)	–	–	–	–	–	–	–	–	–
<i>Symphodus cinereus</i>	2 (82)	–	5 (74)	–	0	0	–	–	2 (13)	–
<i>Symphodus mediterraneus</i>	1 (17)	–	–	–	–	5	–	–	–	–
<i>Symphodus ocellatus</i>	5 (302)	–	–	–	0	–	–	–	2 (4)	–
<i>Symphodus roissali</i>	3 (230)	0 (105)	1 (4)	–	–	2	–	–	2 (9)	1 (21)
<i>Symphodus rostratus</i>	3 (41)	–	–	–	0	–	–	–	–	–
<i>Symphodus tinca</i>	5 (114)	–	3 (11)	3 (63)	3	2	–	–	3 (16)	3 (22)
<i>Thalassoma pavo</i>	1 (2)	–	–	–	0	0	–	1 (3)	–	–
<i>Xyrichtys novacula</i>	1 (4)	–	–	–	–	0	–	–	–	–
LOPHIIDAE										
<i>Lophius piscatorius</i>	9 (16)	1 (10)	1 (4)	–	–	5	–	–	–	–
LOTIDAE										
<i>Gaidropsarus mediterraneus</i>	8 (17)	–	1 (2)	–	–	5	–	–	4 (12)	–
MORONIDAE										
<i>Dicentrarchus labrax</i>	5 (11)	4 (200)	–	–	0	2	1 (1)	0 (2)	–	–
MULLIDAE										
<i>Mullus surmuletus</i>	9 (129)	1 (110)	1 (1)	2 (2)	2	3	2 (26)	6 (14)	–	4 (65)
MURAENIDAE										
<i>Muraena helena</i>	4 (10)	–	1 (1)	–	0	1	–	–	–	–
PHYCIDAE										
<i>Phycis phycis</i>	4 (10)	–	–	–	0	3	–	–	–	–

Table IV. (Continued).

	Western Mediterranean		Adriatic			Eastern Mediterranean				
	Scandola	North-western Italian coast	Split	Montenegro		Greece	Lebanon	Israel	Black Sea	
	Present work	1 [†]	2	3	4	5	6	7	8	9
SCIAENIDAE										
<i>Sciaena umbra</i>	5 (41)	–	1 (1)	–	0	–	–	0 (3)	3 (26)	1 (7)
<i>Umbrina cirrosa</i>	2 (1)	2 (114)	–	–	0	2	–	5 (17)	1 (1)	2 (3)
SCORPAENIDAE										
<i>Scorpaena notata</i>	2 (5)	–	–	–	0	–	–	0 (1)	–	–
<i>Scorpaena porcus</i>	4 (70)	–	–	–	0	1	–	0 (14)	2 (75)	3 (35)
<i>Scorpaena scrofa</i>	3 (11)	–	–	–	0	1	–	0 (2)	–	–
SERRANIDAE										
<i>Epinephelus marginatus</i>	1 (1)	–	–	–	0	–	1 (17)	1 (15)	–	–
<i>Serranus cabrilla</i>	2 (15)	–	1 (3)	1 (23)	1	3	–	–	–	–
<i>Serranus scriba</i>	3 (46)	–	2 (11)	–	0	3	–	–	–	0 (5)
SOLEIDAE										
<i>Monochirus hispidus</i>	1 (3)	–	1 (3)	–	–	0	–	–	–	–
<i>Synaptura kleinii</i>	1 (8)	–	–	–	–	–	–	–	–	–
SPARIDAE										
<i>Boops boops</i>	5 (13)	3 (142)	5 (32)	–	0	4	3 (266)	5 (32)	–	–
<i>Dentex dentex</i>	7 (13)	2 (111)	–	–	0	1	–	–	–	–
<i>Diplodus annularis</i>	6 (54)	–	6 (46)	4 (85)	4	8	0 (27)	–	3 (42)	2 (28)
<i>Diplodus puntazzo</i>	3 (31)	–	–	–	0	5	–	0 (1)	–	–
<i>Diplodus sargus</i>	10 (69)	–	1 (4)	–	0	1	4 (252)	5 (44)	–	–
<i>Diplodus vulgaris</i>	10 (43)	2 (41)	2 (10)	1 (2)	1	5	4 (202)	4 (15)	–	–
<i>Lithognathus mormyrus</i>	6 (52)	–	–	3 (15)	3	2	5 (420)	3 (40)	–	–
<i>Oblada melanura</i>	3 (22)	–	1 (11)	–	0	3	2 (92)	3 (16)	–	–
<i>Pagellus erythrinus</i>	9 (92)	3 (260)	1 (18)	2 (40)	2	5	8 (306)	–	–	–
<i>Pagrus pagrus</i>	10 (59)	–	–	–	–	–	2 (40)	2 (10)	–	–
<i>Sarpa salpa</i>	7 (9)	6 (250)	4 (12)	–	–	4	–	5 (24)	–	–
<i>Sparus auratus</i>	6 (19)	3 (100)	–	1 (2)	1	3	–	3 (8)	–	–

Table IV. (Continued).

	Western Mediterranean		Adriatic			Eastern Mediterranean				
	Scandola	North-western Italian coast	Split	Montenegro		Greece	Lebanon	Israel	Black Sea	
	Present work	1 [†]	2	3	4	5	6	7	8	9
<i>Spondyllosoma cantharus</i>	5 (108)	–	1 (2)	–	0	4	4 (44)	–	–	–
SYNODIDAE										
<i>Synodus saurus</i>	6 (29)	–	–	–	–	1	–	–	–	–
TRACHINIDAE										
<i>Trachinus araneus</i>	1 (4)	–	–	–	–	–	–	3 (7)	–	–
<i>Trachinus draco</i>	0 (2)	1 (21)	1 (6)	–	0	4	–	–	–	1 (15)
TRIGLIDAE										
<i>Chelidonichthys lucerna</i>	4 (5)	–	–	–	0	1	–	–	–	–
URANOSCOPIDAE										
<i>Uranoscopus scaber</i>	4 (49)	2 (100)	3 (43)	2 (7)	2	3	–	0 (1)	3 (14)	4 (26)
ZEIDAE										
<i>Zeus faber</i>	2 (12)	0 (100)	2 (11)	–	0	3	–	–	–	–
No. of fish examined	2238	2110	390	338	?	?	1767	304	310	346
No. of digenean species reported (N)	234	42	60	24	24	122	40	47	32	28
No. of fish host species studied (N')	61	21	32	12	41	47	14	22	12	13
N/N'	3.8	2	1.9	2	0.6	2.6	2.9	2.1	2.7	2.2

[†]References: 1, Orecchia and Paggi 1978; 2, Sey 1968, 1970; 3, Radujkovic et al. 1989; 4, Radujkovic and Raibaut 1989 (sample value not given); 5, Papoutsoglou 1976 (sample value not given); 6, Saad-Fares 1985; 7, Fischthal 1980, 1982; 8, Vlassenko 1931; 9, Pogorel'tseva 1952.

Table V. Digenean species diversity in the well-studied sparid fishes (data from table IV).

	<i>N</i>	<i>N'</i>	<i>N/N'</i>
Western Mediterranean			
Scandola Nature Reserve (present study)	87	13	6.7
North-western Italian coast (Orecchia and Paggi 1978)	19	6	3.2
Adriatic			
Split (Sey 1968, 1970)	21	8	2.6
Montenegro (Radujkovic et al. 1989)	11	5	2.2
Montenegro (Radujkovic and Raibaut 1989)	11	11	1
Eastern Mediterranean			
Saronicos, Greece (Papoutsoglou 1976)	45	12	3.8
Lebanon (Saad-Fares 1985)	32	9	3.6
Israel (Fischthal 1980, 1982)	30	9	3.3

N, Total number of all digenean species reported from all sparid species; *N'*, total number of sparid species.

the north-western coast of Italy (Table IV). These two places are not widely distant and the striking contrast appears not to be related to sampling effort, since the sample numbers are similar in these two areas (2238 fish for Scandola 2110 for the north-western coast of Italy). As an example, eight digenean species were found in 69 specimens of three *Trachurus* spp. from Scandola (i.e. 27 *T. mediterraneus*+17 *T. picturatus*+25 *T. trachurus*=69; often these three species are reported as '*T. trachurus*'), but only two from 66 along the western coast of Italy. For a particular host fish, the number of digenean species recovered tends to increase in step with the sample size. Nevertheless, we have found seven digenean species in three *Conger conger* from off Scandola, while only one has been reported in 106 *C. conger* from western Italy. Similarly, seven digenean species were found in 13 *Dentex dentex* from off Scandola, while only two were reported from 111 of these fishes from the western Italian coast.

Table VI shows a comparison of the digenean fauna for the same 21 teleost species (i.e. restricted to those hosts recorded by the Italians) studied both off Scandola and the north-western coast of Italy (see list in Table IV). The ratio value (*N/N'*) for off the Scandola Nature Reserve (4.8) is much higher than that for the north-western coast of Italy (2.0), even though the sampling numbers in the first area (742) are significantly lower than that of the second (2110).

The very high digenean species diversity observed off the Scandola Nature Reserve is probably related to the high general level of biodiversity reported in the region (Miniconi et al. 1990; Verlaque 1990; Merella 1991; Verlaque et al.1999). This high level of biodiversity is related to the stability of the equilibrium of the ecosystem in this well-preserved area (protected for 25 years), which is devoid of major pollutants and opens

Table VI. Comparison of the digenean diversity from the same 21 teleost species (see Table IV) studied off the Scandola Nature Reserve (SNR) and off the north-western Italian coast (data from Orecchia and Paggi 1978).

	<i>n</i>	<i>N</i>	<i>N'</i>	<i>N/N'</i>
SNR (Corsica)	742	101	21	4.8
NW Italian coast	2110	42	21	2

n, Total number of fishes examined; *N*, total number of digenean species reported; *N'*, total number of fish species.

directly to the Western Mediterranean basin. A high level of biodiversity and favourable environmental factors will promote the successful completion of the digenean life-cycle.

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References

- Bartoli P. 1983. Populations ou espèces? Recherches sur la signification de la transmission de Trématodes Lepocreadiinae (T. Odhner 1905) dans deux écosystèmes marins. *Annales de Parasitologie Humaine et Comparée* 58:117–139.
- Bartoli P. 1987. Caractères adaptatifs originaux des Digènes intestinaux de *Sarpa salpa* (Teleostei, Sparidae) et leur interprétation en termes d'évolution. *Annales de Parasitologie Humaine et Comparée* 62:542–576.
- Bartoli P, Bray RA. 1987. Redescription of two cryptogonimid digeneans from the fish *Dentex dentex* (L. 1758) (Sparidae) in the Mediterranean Sea. *Systematic Parasitology* 10:117–127.
- Bartoli P, Bray RA. 1990. *Deretrema* (*Spinoderetrema*) *scorpaenicola* n. sp. (Digenea: Zoogonidae) from the gall-bladder of western Mediterranean teleosts. *Bulletin du Museum National d'Histoire Naturelle, Paris, sér. 4* 12A(1):43–50.
- Bartoli P, Bray RA. 1996. Description of three species of *Holorchis* Stossich, 1901 (Digenea: Lepocreadiidae) from marine fishes off Corsica. *Systematic Parasitology* 35:133–143.
- Bartoli P, Bray RA. 2001. Contribution to the knowledge of species of the genus *Stephanostomum* Looss, 1899 (Digenea: Acanthocolpidae) from teleosts of the Western Mediterranean, with the description of *S. gaidropsari* n. sp. *Systematic Parasitology* 49:159–188.
- Bartoli P, Bray RA. 2004. *Ancylocoelium typicum* Nicoll, 1913 (Digenea, Monorchhiidae), a poorly known parasite of *Trachurus* spp. (Teleostei, Carangidae) from the Western Mediterranean and north-eastern Atlantic, and observations on its taxonomic position. *Systematic Parasitology* 58:23–39.
- Bartoli P, Gibson DI. 1989. *Wardula sarguicola* n. sp. (Digenea, Mesometridae), a rectal parasite of *Diplodus sargus* (Teleostei, Sparidae) in the western Mediterranean. *Annales de Parasitologie Humaine et Comparée* 64:20–29.
- Bartoli P, Gibson DI. 1991. On *Podocotyle scorpaenae*, *Poracanthium furcatum* and *Derogenes latus*, three poorly known digenean parasites of western Mediterranean teleosts. *Systematic Parasitology* 20:29–46.
- Bartoli P, Gibson DI. 1995. Three rare and little known cryptogonimid digeneans from the sciaenid fish *Sciaena umbra* (L.) in the western Mediterranean. *Systematic Parasitology* 30:121–139.
- Bartoli P, Gibson DI. 1998. A new acanthocolpid cercaria (Digenea) from *Cantharus dorbignyi* (Prosobranchia) in the Western Mediterranean. *Systematic Parasitology* 40:175–184.
- Bartoli P, Gibson DI. 2000. Three little known acanthostomine digeneans from *Uranoscopus scaber* L. in the Western Mediterranean. *Systematic Parasitology* 46:123–141.
- Bartoli P, Gibson DI. 2001. *Metadena phoceae* n. sp. (Digenea: Cryptogonimidae), a rectal parasite of the shore rockling *Gaidropsarus mediterraneus* (Teleostei: Lotidae) in the Western Mediterranean. *Systematic Parasitology* 50:53–62.
- Bartoli P, Prévot G. 1966. Contribution à l'étude des Monorchhiidae (T. Odhner 1911) parasites des Poissons du genre *Mullus* en Méditerranée; description de *Timonia mediterranea* n. gen., n. sp. (Trematoda, Digenea). *Annales de Parasitologie Humaine et Comparée* 41:397–412.
- Bartoli P, Gibson DI, Bray RA. 1988. The Opcoelidae (Digenea) of sparid fishes of the western Mediterranean. I. *Pachycreadium* Manter, 1954. *Systematic Parasitology* 12:231–239.
- Bartoli P, Bray RA, Gibson DI. 1989a. The Opcoelidae (Digenea) of sparid fishes of the western Mediterranean. III. *Macvicaria* Gibson & Bray, 1982. *Systematic Parasitology* 13:167–192.
- Bartoli P, Bray RA, Gibson DI. 1989b. The Opcoelidae (Digenea) of sparid fishes of the western Mediterranean. V. *Allopodocotyle* Pritchard, 1966. *Systematic Parasitology* 14:69–77.
- Bartoli P, Gibson DI, Bray RA. 1989c. The Opcoelidae (Digenea) of sparid fishes of the western Mediterranean. IV. *Peracreadium* Nicoll, 1909 and *Cainocreadium* Nicoll, 1909. *Systematic Parasitology* 14:53–67.

- Bartoli P, Gibson DI, Bray RA, Maillard C, Lambert M. 1989d. The Opecoelidae (Digenea) of sparid fishes of the western Mediterranean. II. *Pycnadenoides* Yamaguti, 1938 and *Pseudopycnadena* Saad-Fares & Maillard, 1986. *Systematic Parasitology* 13:35–51.
- Bartoli P, Gibson DI, Bray RA. 1993. The Opecoelidae (Digenea) of sparid fishes of the western Mediterranean. VI. A redescription of *Macvicaria mormyri* (Stossich 1885) n. comb. and a key to the opecoelids from the western Mediterranean sparids. *Systematic Parasitology* 26:59–67.
- Bartoli P, Gibson DI, Bray RA. 2004. Redescription of *Pleorchis polyorchis* (Stossich 1889) (Digenea: Acanthocolpidea), a rare and poorly known parasite of the intestine of *Sciaena umbra* L. (Perciformes: Sciaenidae) from the western Mediterranean Sea. *Systematic Parasitology* 58:81–90.
- Bartoli P, Gibson DI, Riutort J-J. 1994. *Genitocotyle mediterranea* n. sp. (Digenea, Opecoelidae) from *Symphodus ocellatus* (Teleostei, Labridae) in the Western Mediterranean. *Parasite* 1:365–370.
- Bartoli P, Jousson O, Russell-Pinto F. 2000a. The life cycle of *Monorchis parvus* (Digenea: Monorchidae) demonstrated by developmental and molecular data. *Journal of Parasitology* 86:479–489.
- Bartoli P, Morand S, Riutort JJ, Combes C. 2000b. Acquisition of parasites correlated with social rank and behavioural changes in a fish species. *Journal of Helminthology* 74:289–293.
- Bartoli P, Cribb TH, Bray RA. 2001. A redescription of *Homalometron senegalense* Fischthal & Thomas, 1972 (Digenea: Apocreadiidae) from *Synaptura kleinii* (Teleostei) of the Western Mediterranean. *Systematic Parasitology* 50:135–141.
- Bartoli P, Bray RA, Gibson DI. 2003a. *Lecithostaphylus retroflexus* (Molin 1859) (Zoogonidae) and *Tergestia acanthocephala* (Stossich 1887) (Fellodistomidae) (Digenea) from the epipelagic teleost *Belone belone* (L.) in the Western Mediterranean. *Systematic Parasitology* 54:131–143.
- Bartoli P, Bray RA, Gibson DI. 2003b. Opecoelidae (Digenea) from western Mediterranean fishes: three rare species. *Systematic Parasitology* 55:81–95.
- Bartoli P, Gibson DI, Overstreet RM. 2003c. First report of a species of *Folliculovarium* Gu & Shen, 1983 (Bucephalidae: Prosorhynchinae) from European marine waters, with the description of *F. mediterraneum* n. sp. *Systematic Parasitology* 56:147–154.
- Bray RA. 1973. Some digenetic trematodes in fishes from the Bay of Biscay and nearby waters. *Bulletin of the British Museum (Natural History), Zoology Series* 26:149–183.
- Bray RA. 1986. Some helminth parasites of marine fishes of South Africa: *Santeria rubalo* gen. et sp. nov. (Digenea: Cryptogonimidae). *Journal of Natural History* 20:817–823.
- Bray RA, Bartoli P. 1996. A redescription of *Lepidauchen stenostoma* Nicoll, 1913 (Digenea), and a reassessment of the status of the genus *Lepidauchen*. *Systematic Parasitology* 33:167–176.
- Bray RA, Gibson DI. 1980. The Fellodistomidae (Digenea) of fishes from the northeast Atlantic. *Bulletin of the British Museum (Natural History), Zoology Series* 37:199–293.
- Bray RA, Gibson DI. 1986. The Zoogonidae (Digenea) of fishes from the north-east Atlantic. *Bulletin of the British Museum (Natural History), Zoology Series* 51:127–206.
- Bray RA, Gibson DI. 1990. The Lepocreadiidae (Digenea) of fishes of the north-east Atlantic: review of the genera *Opechona* Looss, 1907 and *Prodistomum* Linton, 1910. *Systematic Parasitology* 15:159–202.
- Bray RA, MacKenzie K. 1990. *Aponurus laguncula* Looss, 1907 (Digenea: Lecithasteridae): a report from herring, *Clupea harengus* L., in the eastern English Channel and a review of its biology. *Systematic Parasitology* 17:115–124.
- Bray RA, Cribb TH, Barker SC. 1993. The Hemiuroidea (Digenea) of pomacentrid fishes (Perciformes) from Heron Island, Queensland, Australia. *Systematic Parasitology* 24:159–184.
- Dawes B. 1968. *The Trematoda with Special Reference to British and Other European Forms*. Cambridge: Cambridge University Press. 644 p.
- Dimitrov GI, Bray RA. 1994. A redescription and a new geographical record in the Black Sea of *Bacciger israelensis* Fischthal, 1980 (Trematoda: Fellodistomidae). *Folia Parasitologica* 41:75–79.
- Euzet L, Combes C. 1980. Les problèmes de l'espèce chez les animaux parasites. *Bulletin de la Société Zoologique de France* 40:239–285.
- Fischthal JH. 1980. Some digenetic trematodes of marine fishes from Israel's Mediterranean coast and their zoogeography, especially those from Red Sea immigrant fishes. *Zoologica Scripta* 9:11–23.
- Fischthal JH. 1982. Additional records of digenetic trematodes of marine fishes from Israel's Mediterranean coast. *Proceedings of the Helminthological Society of Washington* 49:34–44.
- Fredj G, Bellan-Santini D, Meinardi M. 1992. Etat des connaissances sur la faune marine méditerranéenne. *Bulletin de l'Institut Océanographique, Monaco* 9:133–145.
- Froese R, Pauly D. 2001. Fishbase. <http://www.fishbase.org>.
- Gibson DI. 1976. Monogenea and Digenea from fishes. *Discovery Reports* 36:182–266.

- Gibson DI, Bray RA. 1982. A study and reorganization of *Plagioporus* Stafford, 1904 (Digenea: Opecoelidae) and related genera, with special reference to forms from European Atlantic waters. *Journal of Natural History* 16:529–559.
- Gibson DI, Bray RA. 1986. The Hemiuridae (Digenea) of fishes from the north-east Atlantic. *Bulletin of the British Museum (Natural History), Zoology Series* 51:1–125.
- Gibson DI, Bray RA. 1989. The taxonomic status of *Distomum umbrinae* Stossich, 1885 (Digenea: Opecoelidae) from the sciaenid fish *Umbrina cirrosa* (L.) in the Mediterranean Sea. *Systematic Parasitology* 13:63–70.
- Holmes J, Bartoli P. 1993. Spatio-temporal structure of the communities of helminths in the digestive tract of *Sciaena umbra* L. 1758 (Teleostei). *Parasitology* 106:519–525.
- Jousson O, Bartoli P. 1999. The life-cycle of three species of the Mesometridae (Digenea) with comments on the taxonomic status of this family. *Systematic Parasitology* 44:217–228.
- Jousson O, Bartoli P. 2000. The life cycle of *Opecoeloides columbellae* comb. nov. (Digenea, Opecoelidae): evidence from molecules and morphology. *International Journal for Parasitology* 30:747–760.
- Jousson O, Bartoli P. 2001. Molecules, morphology and morphometrics of cryptic *Cainocreadium* species (Digenea: Opecoelidae) parasitic in marine fishes with a description of *Cainocreadium dentecis* n. sp. *International Journal for Parasitology* 31:706–714.
- Jousson O, Bartoli P. 2002. Species diversity among the genus *Monorchis* (Digenea: Monorchidae) parasitic in marine teleosts: molecular, morphological and morphometrical studies with a description of *Monorchis blennii* n. sp. *Parasitology Research* 88:230–241.
- Jousson O, Bartoli P, Pawlowski J. 2000. Cryptic speciation among intestinal parasites (Trematoda: Digenea) infecting sympatric host fishes (Sparidae). *Journal of Evolutionary Biology* 13:778–785.
- Kostadinova A, Power AM, Balbuena JA, Raga JA, Gibson DI. 2003. Three species of *Magnibursatus* Naidenova, 1969 (Digenea: Derogenidae) from Atlantic and Black Sea marine teleosts. *Folia Parasitologica* 50:202–210.
- Kostadinova A, Bartoli P, Gibson DI, Raga JA. 2004. Redescriptions of *Magnibursatus blennii* (Paggi & Orecchia, 1975) n. comb. and *Arnola microcirrus* (Vlasenko, 1931) (Digenea: Derogenidae) from marine teleosts off Corsica. *Systematic Parasitology* 58:125–137.
- Le Pommelet E, Bartoli P, Silan P. 1997. Biodiversité des digènes et autres helminthes intestinaux des Rougets: synthèse pour *Mullus surmuletus* (Linné 1758) et *M. barbatus* (L. 1758) dans le bassin méditerranéen. *Annales des Sciences Naturelles, Zoologie, Paris, 13e Série* 18:117–133.
- Looss A. 1907. Beiträge zur Systematik der Distomen. Zur kenntnis der Familie Hemiuridae. *Zoologischer Jahrbücher (Systematik)* 26:63–180.
- Maillard C. 1970. *Nicolla elongata* n. sp. (Digenea, Coitocaecidae) parasite d'*Onos tricirrus* (Brunnich 1768) (Teleostei) *Bulletin du Museum National d'Histoire Naturelle, 2e Série* 42:410–414.
- Maillard C. 1974. Cycle évolutif de *Timoniella praeteritum* (Looss 1901) (Trematoda, Acanthostomidae) parasite de *Morone labrax* (Teleostei, Serranidae). *Bulletin de la Société Zoologique de France* 99:245–257.
- Maillard C. 1976. Distomatoses de poissons en milieu lagunaire. Thesis, Université des Sciences et Techniques du Languedoc, Montpellier, France, 383 p.
- Margolis L, Esch GW, Holmes J, Kuris AM, Schad GA. 1982. The use of ecological terms in parasitology (report of an *ad hoc* committee of the American Society of Parasitologists). *Journal of Parasitology* 68:131–133.
- Merella P. 1991. Ricerche sulla malacofauna della Riserva naturale di Scandola (Corsica nord occidentale). Thesis, University of Sassari, Italy, 138 p.
- Miniconi R, Francour P, Bianconi CH. 1990. Inventaire de la faune ichthyologique de la Réserve Naturelle de Scandola (Corse, Méditerranée nord-occidentale). *Cybiurn* 14:77–89.
- Naidenova NN. 1969. On the foundation of a new genus of trematodes *Magnibursatus* nov. gen. (Hemiurata: Halipegidae) from Black Sea fishes. *Materialy Nauchnoi Konferentsii Vsesoyuznogo Obshchestva Gel'mintologov* 1:187–195 [in Russian].
- Orecchia P, Paggi L. 1978. Aspetti di sistematica e di ecologia degli elminti parassiti di pesci marini studiati presso l'Istituto di Parassitologia dell'Università di Roma. *Parassitologia* 20:73–89.
- Overstreet RM, Curran SS. 2002. Superfamily Bucephaloidea Poche, 1907. In: Gibson DI, Jones A, Bray RA, editors. *Keys to the Trematoda*. Vol. 1, Wallingford: CAB International and The Natural History Museum. p 67–110.
- Paggi L, Orecchia P. 1965. Su un nuovo trematode parassita dell'intestino di *Morone labrax*: *Bucephalus labracis* n. sp. *Parassitologia* 7:69–74.
- Palombi A. 1931. Il polimorfismo nei trematodi. Ricerche sperimentali su *Helicometra fasciata* (Rud.)=*H. pulchella* (Rud.)=*H. sinuata* (Rud.). *Annuario del Museo Zoologica della R. Università di Napoli, n.s.* 6:1–8.
- Papoutsoglou SE. 1976. Metazoan parasites of fishes from Saronikos Gulf Athens-Greece. *Thalassographica* 1:69–102.

- Pogorel'tseva TP. 1952. Parasites of fish of the north-eastern part of the Black Sea. Trudy Instituta Zoologii, Kiev 8:100–120 [in Russian].
- Radujkovic BM, Raibaut A. 1989. Parasites des poissons marins du Montenegro: liste des espèces de poissons avec leurs parasites. Acta Adriatica 30:307–320.
- Radujkovic BM, Orecchia P, Paggi L. 1989. Parasites des poissons marins du Montenegro; Digènes. Acta Adriatica 30:137–187.
- Reversat J, Renaud F, Maillard C. 1989. Biology of parasite populations: the differential specificity of the genus *Helicometra* Odhner, 1902 (Trematoda: Opecoelidae) in the Mediterranean Sea, demonstrated by enzyme electrophoresis. International Journal for Parasitology 19:885–890.
- Reversat J, Maillard C, Silan P. 1991. Polymorphismes phénotypique et enzymatique: intérêt et limites dans la description d'espèces d'*Helicometra* (Trematoda: Opecoelidae), mésoparasites de téléostéens marins. Systematic Parasitology 19:147–158.
- Saad-Fares A. 1985. Trématodes de poissons des côtes du Liban. Spécificité, transmission et approche populationnelle. Thesis, Université des Sciences et Techniques du Languedoc, Montpellier, France, 435 p.
- Sanmartin ML, Alvarez F, Quinteiro P, Paniagua A. 1995. *Apocreadium galaicus* sp. n. (Digenea: Apocreadiidae), a parasite of the thickback sole *Microchirus variegatus* (Soleidae, Osteichthyes) from N.W. Spain. Parasite 2(Suppl. 2):211–216.
- Sasal P, Niquil N, Bartoli P. 1999. Community structure of digenean parasites of sparid and labrid fishes of the Mediterranean sea: a new approach. Parasitology 119:635–648.
- Sey O. 1968. Parasitic helminths occurring in Adriatic fishes. Part I (flukes). Acta Adriatica 13(4):3–14.
- Sey O. 1970. Parasitic helminths occurring in Adriatic fishes. Part II (flukes and tapeworms). Acta Adriatica 13(6):3–15.
- Verlaque M. 1990. Flore marine de la région de Galeria. Travaux Scientifiques du Parc Naturel Régional et des Réserves Naturelles de Corse 29:77–88.
- Verlaque M, Francour P, Sartoretto S. 1999. Evaluation de la valeur patrimoniale des biocénoses marines de la face ouest de l'îlot de Gargalu (Réserve intégrale de Scandola). Travaux Scientifiques du Parc Naturel Régional et des Réserves Naturelles de Corse 59:121–168.
- Vlassenko PV. 1931. On the parasitic worm fauna of fishes of the Black Sea. Trudy Karadahs'koyi Nauchnoyi Stantsiyi imeni T.I. Vyazem'skoho 4:88–136 [in Russian and German].
- Whitehead PJP, Bauchot ML, Hureau JC, Nielsen J, Tortonese E. 1986. Fishes of the North-eastern Atlantic and the Mediterranean. Vols I–III, Paris: UNESCO. 1473 p.