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Checklist of the Monogenea (Platyhelminthes) parasitic in Tunisian aquatic vertebrates

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Summary

153 species of monogeneans have been recorded in Tunisian aquatic vertebrates (89 hosts). A list of these species with hosts is presented. A comparison of the Monogenea diversity off the coast of Tunisia with other regions of the Mediterranean Sea and the world is provided. The number of parasites depends on the number of hosts examined and their diversity in the region. This list shows that Monopisthocotylea is the richest group. In addition, new records have been reported during a survey of the diversity of monogeneans fish in the southern coast of Tunisia (Gulf of Gabes) including: *Benedenia monticellii* (Parona and Perugia, 1895) Johnston, 1929*, Lamellodiscus bidens* Euzet, 1984*, Lamellodiscus confusus* Amine, Euzet & Kechemir-Issad, 2007*, Lamellodiscus ergensi* Euzet & Oliver, 1966*, Lamellodiscus hilii* Euzet, 1984*, Lamellodiscus impervius* Euzet, 1984*, Lamellodiscus knoepffleri* Oliver, 1969*, Lamellodiscus theroni* Amine, Euzet & Kechemir-Issad, 2007*, Ligophorus acuminatus* Euzet & Suriano, 1977*, Ligophorus angustus* Euzet & Suriano, 1977*, Ligophorus heteronchus* Euzet & Suriano, 1977*, Ligophorus macrocolpos* Euzet & Suriano, 1977*, Ligophorus minimus* Euzet & Suriano, 1977*, Capsala maccallumi* Price, 1939 and *Pseudanthocotyloides heterocotyle* (Van Beneden, 1871) Euzet & Prost, 1969.
Keywords: Monogenea; Checklist; aquatic vertebrates; new records; Mediterranean; Tunisia

Introduction

Tunisian coastal waters are located in the south-central Mediterranean Sea. Tunisia has a 1670- km coastline including 7 coastal lagoons, covering a total surface of 105200 ha and an exceptional continental shelf of 88 000 km^2 (Cherif *et al.*, 2011). It also has a large hydrographic network in the north. The surface water accommodates a relatively high faunal diversity, especially in terms of aquatic vertebrates that can host a high species richness of parasites. Among them, monogeneans (Plathyhelmintes) which are commonly found on fishes can also parasitise freshwater turtles and amphibians. These parasites are ideal for diversity investigations because they are diverse both in terms of morphology and numbers. Their members are generally host specific, and their phylogeny is well resolved (Poulin, 2002). In addition, the study of monogeneans is also fundamental to aquaculture because they are known as agents responsible for many epidemics (Lia *et al.*, 2007). In Tunisia, these flatworms were first studied by Ktari (1969) who described the species of *Atrispinum salpae* (Parona & Perugia, 1890) Maillard & Noisy, 1979 from *Sarpa salpa* (Linnaeus, 1758). After that, more than 50 studies have been published about monogenenans including description of new species and new hosts as well as locality records. Despite these parasitological surveys, there were no attempts to quantify the species richness of

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Table 1. List of Monogenea parasites of Tunisian aquatic organisms. Records are listed by monogenoidean families and ordered per: parasite species (alphabetically), host species (alphabetically), reference (chronologically). NR, New record. Areas: 1, North; 2, East ; 3, South; 4. hydrographic network in the north.

Monogenoides species	Host species	Microhabitat	Reference
Family Amphibdellatidae Carus, 1885			
Amphibdella paronaperugiae Llewellyn, 1960	*Torpedo torpedo* (Linnaeus, 1758) (1, 3)	gills	Neifar, 1995, 2001
Amphibdelloides benhassinae Tazerouti, Euzet and Neifar, 2006	*Torpedo torpedo* (Linnaeus, 1758) (1, 3)	gills	Neifar, 1995, 2001; Tazerouti *et al.*, 2006
Amphibdelloides kechemirae Tazerouti, Euzet and Neifar, 2006	*Torpedo marmorata* Risso, 1810 (1, 3)	gills	Neifar, 1995, 2001; Tazerouti *et al.*, 2006
Amphibdelloides vallei Llewellyn, 1960	*Torpedo marmorata* Risso, 1810 (1, 3)	gills	Neifar, 2001
Family Ancyrocephalidae Bychowsky, 1937			
Glyphidohaptor plectocirra (Paperna, 1972) Kritsky, Galli and Yang, 2007	*Siganus luridus* (Rüppell, 1829), *S. rivulatus* Forsskål and Niebuhr, 1775 (3)	gills	Boussellaa, 2020
Haliotrema balisticus (Hargis, 1955) Yamaguti, 1963	*Balistes capriscus* Gmelin, 1789 (3)	gills	Kacem and Neifar, 2015; present work
Ligophorus acuminatus Euzet and Suriano, 1977	*Chelon saliens* (Risso, 1810) (3)	gills	present work (NR)
Ligophorus angustus Euzet and Suriano, 1977	*Chelon labrosus* (Risso, 1827) (3)	gills	present work (NR)
Ligophorus chabaudi Euzet and Suriano, 1977	*Mugil cephalus* Linnaeus, 1758 (1)	gills	Neifar, 1995
Ligophorus heteronchus Euzet and Suriano, 1977	*Chelon saliens* (Risso, 1810) (3)	gills	present work (NR)
Ligophorus macrocolpos Euzet and Suriano, 1977	*Chelon saliens* (Risso, 1810) (3)	gills	present work (NR)
Ligophorus minimus Euzet and Suriano, 1977	*Chelon saliens* (Risso, 1810) (3)	gills	present work (NR)
Ligophorus szidati Euzet and Suriano, 1977	*Chelon auratus* (Risso, 1810) (1) (3)	gills	Neifar, 1995 present work
Ligophorus vanbenedenii (Parona and Perugia, 1890) Euzet and Suriano, 1977	*Chelon auratus* (Risso, 1810) (1) (3)	gills	Neifar, 1995 present work
Pseudempleurosoma sp.	*Sphyraena chrysotaenia* Klunzinger, 1884 (2, 3)	pharynx and oesophagus	Boussellaa, 2018, 2020
Family Axinidae Monticelli, 1903			
Axine belones Abildgaard, 1794	*Belone belone* (Linnaeus, 1760) (1) (1, 2)	gills	Ktari, 1971; Neifar, 1995 Châari, 2013; Châari *et al.*, 2016
Axine sp.	*Belone svetovidovi* Collette and Parin, 1970 (1, 2)	gills	Châari, 2013; Châari *et al.*, 2016
Axinoides sp.	*Tylosurus acus imperialis* (Rafinesque, 1810) (1, 2)	gills	Châari, 2013; Châari *et al.*, 2016
Nudaciraxine imperium Châari, Derbel and Neifar, 2010	*Tylosurus acus imperialis* (Rafinesque, 1810) (1, 2)	gills	Châari, 2013; Châari *et al.*, 2010, 2016
Family Calceostomatidae Parona and Perugia, 1890			
Dicrumenia bychowskyi Mamaev, 1969	*Pomadasys incisus* (Bowdich, 1825) (1)	gills	Euzet and Ktari, 1973
Family Capsalidae Baird, 1853			
Benedenia monticellii (Parona and Perugia, 1895) Johnston, 1929	*Mugil cephalus* Linnaeus, 1758 (3)	skin	present work (NR)
Capsala maccallumi Price, 1939	*Euthynnus alletteratus* (Rafinesque, 1810) (3)	gills	present work (NR)
Neoentobdella apiocolpos (Euzet and Maillard, 1967) Kearn and Whittington, 2005	*Taeniura grabata* Geoffroy Saint-Hilaire, 1817 (1, 3)	skin (ventral surface)	Neifar, 2001

Neoentobdella diadema (Monticelli, 1902) Kearn and Whittington, 2005	*Dasyatis marmorata* (Steindachner, 1892), *D. pastinaca* (Linnaeus, 1758), *D. tortonesei* Capapé, 1975 (1, 3)	skin (ventral surface)	Neifar, 2001
Trimusculotrema micracantha (Euzet and Maillard, 1967) Whittington and Barton, 1990	*Dasyatis marmorata* (Steindachner, 1892), *D. pastinaca* (Linnaeus, 1758), *D. tortonesei* Capapé, 1975 (1, 3)	skin (ventral surface)	Neifar, 2001
Trochopus heteracanthus Massa, 1903	*Chelidonichthys lucerna* (Linnaeus, 1758) (1)	gills	Neifar, 1995
Trochopus pini (Van Beneden and Hesse, 1863) Massa, 1903	*Chelidonichthys lucerna* (Linnaeus, 1758) (1)	gills	Ktari, 1971; Neifar, 1995
Family Chauhaneidae Euzet and Trilles, 1960			
Cotyloatlantica mediterranea (Euzet and Trilles, 1960) Bravo-Hollis, 1984	*Sphyraena sphyraena* (Linnaeus, 1758) (1) (2, 3)	gills	Ktari, 1971; Neifar, 1995 Boussellaa, 2020; Boussellaa *et al.* 2018
Family Chimaericolidae Brinkmann, 1942			
Chimaericola leptogaster (Leuckart, 1830) Brinkmann, 1942	host unknown (not cited) (1)	gills	Ktari, 1971
Family Dactylogyridae Bychowsky, 1933			
Dactylogyrus heteromorphus El Garbi, Birgi and Lambert, 1994	*Luciobarbus callensis* (Valenciennes, 1842) (4)	gills	El Garbi *et al.*, 1994; Khalil and Polling, 1997; Řehulková *et al.*, 2018
Dactylogyrus tunisiensis El Garbi, Birgi and Lambert, 1994	*Luciobarbus callensis* (Valenciennes, 1842) (4)	gills	El Garbi *et al.*, 1994; Khalil and Polling, 1997; Řehulková *et al.*, 2018
Family Diclidophoridae Cerfontaine, 1895			
Choricotyle chrysophryi Van Beneden and Hesse, 1863	*Boops boops* (Linnaeus, 1758) (1)	gills	Ktari, 1977; Neifar, 1995
Diclidophora sp.	*Trisopterus capelanus* (Lacepède, 1800) (1)	gills	Ktari, 1971
Family Dionchidae Bychowsky, 1959			
Dionchus agassizi Goto, 1899	*Echeneis naucrates* Linnaeus, 1758 (1)	gills	Ktari, 1971, 1975, 1977
Dionchus remorae (MacCallum, 1916) Price, 1938	*Echeneis naucrates* Linnaeus, 1758 (1)	gills	Ktari, 1975, 1977
Family Diplectanidae Monticelli, 1903			
Diplectanum aequans (Wagener, 1857)	*Dicentrarchus labrax* (Linnaeus, 1758) (3) (1)	gills	Euzet, 1984, present work Neifar, 1995
Diplectanum grassei Oliver, 1974	*Umbrina cirrosa* Linnaeus, 1758 (1)	gills	Neifar, 1995
Diplectanum laubieri Lambert and Maillard, 1974	*Dicentrarchus puctatus* (Bloch, 1792) (1)	gills	Neifar, 1995
Diplectanum melvillei Oliver and Paperna, 1984	*Umbrina cirrosa* Linnaeus, 1758 (1)	gills	Neifar, 1995
Diplectanum simile Bychowsky, 1957	*Sciaena umbra* Linnaeus, 1758 (1)	gills	Neifar, 1995
Echinoplectanum echinophallus (Euzet and Oliver, 1965) Justine and Euzet, 2006	*Mycteroperca marginata* (Lowe, 1834) (3)	gills	Chaabane *et al.*, 2017
Lamellodiscus abbreviatus Sanfilippo, 1978	*Diplodus sargus* (Linnaeus, 1758) (1)	gills	Neifar, 1995
Lamellodiscus bidens Euzet, 1984	*Diplodus puntazzo* (walbaum, 1792) (3)	gills	present work (NR)
Lamellodiscus confusus Amine, Euzet and Kechemir-Issad, 2007	*Sarpa salpa* (Linnaeus, 1758) (3)	gills	Present work (NR)
Lamellodiscus crampus Neifar, 2008	*Dentex maroccanus* Valenciennes, 1830 (3)	gills	Neifar, 2008
Lamellodiscus echeneis (Wagener, 1857) Diesing, 1858	*Sparus aurata* Linnaeus, 1758 (3) (1)	gills	Euzet, 1984, present work Neifar, 1995
Lamellodiscus elegans Bychowsky, 1957	*Diplodus annularis* (Linnaeus, 1758), *D. sargus* (Linnaeus, 1758), *Oblada melanura* (Linnaeus, 1758) (1)	gills	Neifar, 1995
Lamellodiscus ergensi Euzet and Oliver, 1966	*Diplodus vulgaris* (Geoffroy Saint-Hilaire) (3)	gills	present work (NR)
Lamellodiscus erythrini Euzet and Oliver, 1966	*Pagellus erythrinus* (Linnaeus, 1758) (3) (1)	gills	Euzet, 1984; present work Neifar, 1995

Lamellodiscus euzeti Diamanka, Boudaya, Toguebaye and Pariselle, 2011	*Dentex gibbosus* (Rafinesque, 1810) (3)	gills	Diamanka *et al.*, 2011
Lamellodiscus flagellatus Boudaya, Neifar and Euzet, 2009	*Lithognathus mormyrus* (Linnaeus, 1758) (3)	gills	Boudaya *et al.*, 2009
Lamellodiscus fraternus Bychowsky, 1957	*Diplodus annularis* (Linnaeus, 1758) (3) (1)	gills	Euzet, 1984; present work Neifar, 1995
Lamellodiscus furcosus Euzet and Oliver, 1966	*Diplodus sargus* (Linnaeus, 1758), *D. vulgaris* (Geoffroy Saint-Hilaire, 1817) (1)	gills	Neifar, 1995
Lamellodiscus gracilis Euzet and Oliver, 1966	*Oblada melanura* (Linnaeus, 1758) (1)	gills	Neifar, 1995
Lamellodiscus gussevi Sanfilippo, 1978	*Diplodus sargus* (Linnaeus, 1758) (1)	gills	Neifar, 1995
Lamellodiscus hilii Euzet, 1984	*Diplodus puntazzo* (walbaum) (3)	gills	present work (NR)
Lamellodiscus ignoratus Palombi, 1943	*Diplodus sargus* (Linnaeus), *Sarpa salpa* (Linnaeus) (1) *Diplodus puntazzo* (walbaum, 1792), *D. vulgaris* (Geoffroy Saint-Hilaire, 1817), (3)	gills	Neifar, 1995 present work
Lamellodiscus impervius Euzet, 1984	*Diplodus puntazzo* (walbaum, 1792) (3)	gills	present work (NR)
Lamellodiscus knoepffleri Oliver, 1969	*Spicara smaris* (Linnaeus, 1758) (3)	gills	present work (NR)
Lamellodiscus mirandus Euzet and Oliver, 1966	*Diplodus sargus* (Linnaeus, 1758) (1)	gills	Neifar, 1995
Lamellodiscus mormyri Euzet and Oliver, 1967	*Lithognathus mormyrus* (Linnaeus, 1758) (3) (1)	gills	Euzet, 1984; Boudaya *et al*., 2009 Neifar, 1995
Lamellodiscus parisi Oliver, 1969	*Sarpa salpa* (Linnaeus, 1758) (3) (1)	gills	Euzet, 1984; present work Neifar, 1995
Lamellodiscus rastellus Neifar, Euzet and Oliver, 2004	*Pagrus auriga* Valenciennes, 1843 (3)	gills	Neifar *et al.*, 2004
Lamellodiscus sarculus Neifar, Euzet and Oliver, 2004	*Pagrus coeruleostictus* (Valenciennes, 1830) (3)	gills	Neifar *et al.*, 2004
Lamellodiscus sigilatus Neifar, Euzet and Oliver, 2004	*Pagrus coeruleostictus* (Valenciennes, 1830) (3)	gills	Neifar *et al.*, 2004
Lamellodiscus theroni Amine, Euzet and Kechemir-Issad, 2007	*Diplodus puntazzo* (walbaum, 1792) (3)	gills	present work (NR)
Lamellodiscus verberis Euzet and Oliver, 1967	*Lithognathus mormyrus* (Linnaeus, 1758) (3) (1)	gills	Euzet, 1984; present work Neifar, 1995
Protolamellodiscus serranelli (Euzet and Oliver, 1965) Oliver, 1969	*Serranus cabrilla* (Linnaeus, 1758), *S. scriba* (Linnaeus, 1758) (3) (1)	gills	Euzet, 1984 Neifar, 1995
Pseudodiplectanum syrticum Derbel, Boudaya and Neifar, 2007	*Synaptura chthys kleinii* (Risso, 1827) (3)	gills	Derbel *et al*., 2007; present work
Pseudorhabdosynochus beverleyburtonae (Oliver, 1984) Kritsky and Beverley-Burton, 1986	*Mycteroperca marginata* (Lowe, 1834) (3)	gills	Chaabane *et al*., 2016 b
Pseudorhabdosynochus bouaini Neifar and Euzet, 2007	*Mycteroperca costae* (Steindachner, 1878) (3)	gills	Neifar and Euzet, 2007; Chaabane *et al.*, 2017
Pseudorhabdosynochus dolicocolpos Neifar and Euzet, 2007	*Mycteroperca costae* (Steindachner, 1878) (3)	gills	Neifar and Euzet, 2007; Chaabane *et al.*, 2017
Pseudorhabdosynochus enitsuji Neifar and Euzet, 2007	*Mycteroperca costae* (Steindachner, 1878) (3)	gills	Neifar and Euzet, 2007; Chaabane *et al.*, 2017
Pseudorhabdosynochus hayet Chaabane, Neifar, Gey and Justine, 2016	*Mycteroperca rubra* (Bloch, 1793) (3)	gills	Chaabane *et al*., 2016 b
Pseudorhabdosynochus regius Chaabane, Neifar and Justine, 2015	*Mycteroperca rubra* (Bloch, 1793) (3)	gills	Chaabane *et al*., 2015

Pseudorhabdosynochus riouxi (Oliver, 1986) Santos, Buchmann and Gibson, 2000	*Mycteroperca marginata* (Lowe, 1834) (3)	gills	Chaabane *et al.*, 2017
Pseudorhabdosynochus sinediscus Neifar and Euzet, 2007	*Mycteroperca costae* (Steindachner, 1878) (3)	gills	Neifar and Euzet, 2007; Chaabane *et al.*, 2017
Pseudorhabdosynochus sosia Neifar and Euzet, 2007	*Mycteroperca costae* (Steindachner, 1878) (3)	gills	Neifar and Euzet, 2007; Chaabane *et al.*, 2017
Pseudorhabdosynochus sulamericanus Santos, Buchmann and Gibson, 2000	*Hyporthodus haifensis* (Ben-Tuvia, 1953) (3)	gills	Chaabane *et al.*, 2016 a
Family Discocotylidae Price, 1936			
Anthocotyle merlucii Van Beneden and Hesse, 1863	*Merluccius merluccius* (Linnaeus, 1758) (1)	gills	Neifar, 1995
Family Fridericianellidae Gupta and Sachdeva, 1990			
Calceostomella inermis (Parona and Perugia, 1889) Palombi, 1943	*Sciaena umbra* Linnaeus, 1758 (1) *Umbrina cirrosa* Linnaeus, 1758 (1)	gills	Neifar, 1995 Euzet and Ktari, 1970 a, 1973; Neifar, 1995
Family Gastrocotylidae Price, 1943			
Gastrocotyle trachuri Van Beneden and Hesse, 1863	*Trachurus mediterraneus* (Steindachner, 1868), *T. trachurus* (Linnaeus, 1758), (1, 2, 3)	gills	Feki, 2017
Pseudaxine trachuri Parona and Perugia, 1890	*Trachurus mediterraneus* (Steindachner, 1868) (1, 2, 3) *Trachurus trachurus* (Linnaeus, 1758) (1) (1, 2, 3)	gills	Feki, 2017 Ktari, 1971; Neifar, 1995 Feki, 2017
Pseudaxine sp.	*Euthynnus alletteratus* (Rafinesque, 1810) (1)	gills	Ktari, 1971
Family Gotocotylidae Yamaguti, 1963			
Gotocotyla acanthura (Parona and Perugia, 1896) Meserve, 1938	*Brama brama* (Bonnaterre, 1788), *Dentex dentex* (Linnaeus, 1758), *Oblada melanura* (Linnaeus, 1758), *Pomatomus saltatrix* (Linnaeus, 1758), *Trachinotus ovatus* (Linnaeus, 1758) (1)	gills	Ktari, 1971
Gotocotyla sp1. of Neifar, 1995	*Trachinotus ovatus* (Linnaeus, 1758) (1)	gills	Neifar, 1995
Gotocotyla sp 2. of Neifar, 1995	*Pomatomus saltatrix* (Linnaeus, 1758) (1)	gills	Neifar, 1995
Family Heteraxinidae Unnithan, 1957			
Cemocotyle trachuri Dillon and Hargis, 1965	*Trachurus mediterraneus* (Steindachner, 1868), *T. trachurus* (Linnaeus, 1758) (1, 2, 3)	gills	Feki, 2017
Heteraxine seriola (Ishii, 1936) Sproston, 1946	*Seriola dumerili* (Risso, 1810) (1)	gills	Ktari, 1971
Intracotyle hannibali (Euzet and Ktari, 1970) Mamaev, 1977	*Pomadasys incisus* (Bowdich, 1825) (1)	gills	Euzet and Ktari, 1970 b
Family Hexabothriidae Price, 1942			
Dasyonchocotyle spiniphallus Hargis, 1955	*Bathytoshia centroura* (Mitchill, 1815) (1, 3)	gills	Neifar, 2001
Epicotyle torpedinis (Price, 1942) Euzet and Maillard, 1974	*Torpedo marmorata* Risso, 1810, *T. torpedo* (Linnaeus, 1758) (1, 3)	skin	Neifar, 2001
Erpocotyle catenulata (Guberlet, 1933) Yamaguti, 1963	*Mustelus mustelus* (Linnaeus, 1758) (1, 3)	gills	Neifar, 2001
Erpocotyle sp.	*Mustelus punctulatus* Risso, 1827 (1)	gills	Neifar, 1995
Heteronchocotyle gymnurae Neifar, Euzet and Ben Hassine, 2001	*Gymnura altavela* (Linnaeus, 1758) (1, 3)	gills	Neifar, 2001; Neifar *et al.*, 2001 b
Hexabothrium appendiculatum (Kuhn, 1829) von Nordmann, 1840	*Scyliorhinus stellaris* (Linnaeus, 1758) (1)	gills	Neifar, 2001
Hexabothrium canicula (Cerfontaine, 1899) Price, 1942	host unknown (not cited) (1)	gills	Ktari, 1971

Neonchocotyle pastinacae Ktari and Maillard, 1972	*Dasyatis pastinaca* (Linnaeus, 1758) (1)	gills	Ktari and Maillard, 1972
Rajonchocotyle sp.	*Raja clavata* Linnaeus, 1758, *R. miraletus* Linnaeus, 1758, *R. radula* Delaroche, 1809, *Rostroraja alba* (Lacepède, 1803) (1, 2, 3)	gills	Neifar, 2001
Family Hexostomatidae			
Hexostoma thynni (Delaroche, 1811) Rafinesque, 1815	*Thunnus thynnus* (Linnaeus, 1758) (1)	gills	Ktari, 1971
Neohexostoma euthynni (Meserve, 1938) Price, 1961	*Euthynnus alletteratus* (Rafinesque, 1810) (1) (3)	gills	Ktari, 1971 present work
Family Mazocraeidae			
Grubea cochlear Diesing, 1858	*Scomber japonicus* Houttuyn, 1782 (3)	gills	present work
	Scomber scombrus Linnaeus, 1758 (1) (1, 2, 3)		Ktari, 1971 Feki, 2017
Kuhnia scombri (Kuhn, 1829) Sproston, 1945	*Scomber scombrus* Linnaeus, 1758 (1) (1, 2, 3)	gills	Ktari, 1971 Feki, 2017
	Scomber colias Gmelin, 1789 (1, 2, 3)		Feki, 2017
	Scomber japonicus Houttuyn, 1782 (3)		Present work
Mazocraes pilchardi (Van Beneden and Hesse, 1863) Sproston, 1946	*Sardina pilchardus* (Walbaum, 1792) (1) (3)	gills	Feki, 2017 present work
Mazocraes sp.	*Sardinella aurita* Valenciennes, 1847 (3) (2)	gills	Derbel, 2004; present work Feki, 2017
Mazocraeoides sardinellae Ktari, 1982	*Sardinella maderensis* (Lowe, 1838) (1)	gills	Ktari, 1982; Neifar, 1995
Pseudanthocotyloides heterocotyle (Van Beneden, 1871) Euzet and Prost, 1969	*Engraulis encrasicolus* (Linnaeus, 1758) (3)	gills	present work (NR)
Pseudokuhnia minor (Goto, 1984) Rohde and Watson, 1985	*Scomber colias* Gmelin, 1789 (1, 2, 3)	gills	Feki, 2017
	Scomber japonicus Houttuyn, 1782 (3)		present work
Family Microcotylidae Taschenberg, 1879			
Atrispinum salpae (Parona and Perugia, 1890) Maillard and Noisy, 1979	*Sarpa salpa* (Linnaeus, 1758) (1)	gills	Ktari, 1969, 1971; Neifar, 1995
Bychowskicotyla mormyri (Lorenz, 1878) Unnithan, 1971	*Lithognathus mormyrus* (Linnaeus, 1758) (1)	gills	Ktari, 1971; Neifar, 1995
Bivagina alcedinis (Parona and Perugia, 1889) Yamaguti, 1963	*Spicara maena* (Linnaeus, 1758) (1)	gills	Neifar, 1995
Bradyhaptorus trachini (Parona and Perugia, 1890) Unnithan, 1971	*Trachinus araneus* Cuvier, 1829 *T. draco* Linnaeus, 1758, *T. radiatus* Cuvier, 1829 (1)	gills	Azizi, 2020; Azizi *et al*., 2017
Metamicrocotyla cephalus (Azim, 1939) Hargis, 1954	*Mugil cephalus* Linnaeus, 1758 (1) (3)	gills	Ktari, 1971 present work
Microcotyle erythrini Van Beneden and Hesse, 1863	*Pagellus erythrinus* (Linnaeus, 1758) (1) (3)	gills	Ktari, 1971; Neifar, 1995 present work
Microcotyle pomatomi Goto, 1899	*Pomatomus saltatrix* (Linnaeus, 1758) (1)	gills	Neifar, 1995
Pauciconfibula trachini (Parona and Perugia, 1889) Dilllon and Hargis, 1965	*Trachinus araneus* Cuvier, 1829 (1)	gills	Ktari, 1971; Neifar, 1995
	Trachinus radiatus Cuvier, 1829 (1)		Azizi, 2020; Azizi *et al*., 2021
Polylabris tubicirrus (Paperna and Kohn, 1964) Mamaev and Parukhin, 1976	*Diplodus annularis* (Linnaeus, 1758) (1) (3)	gills	Ktari, 1971 present work

Polylabris mamaevi Ogawa and Egusa, 1980	*Siganus luridus* Rüppell, 1829, *S. rivulatus* Forsskål and Niebuhr, 1775 (3)	gills	Boussellaa, 2020
Pseudoaspinatrium euzeti (Ktari, 1971) Mamaev, 1986	*Dentex gibbosus* (Rafinesque, 1810) (1)	gills	Ktari, 1971
Pseudoaspinatrium gallieni (Euzet and Ktari, 1971) Mamaev, 1986	*Tylosurus acus imperialis* (Rafinesque, 1810) (1) (2, 3)	Inner gill cover, gills	Ktari, 1971; Euzet and Ktari, 1971 Châari, 2013; Châari *et al.*, 2016
Sparicotyle chrysophrii (Van Beneden and Hesse, 1863) Mamaev, 1984	host unknown (not cited) (1)	gills	Ktari, 1971
Sciaenacotyle pancerii (Sonsino, 1891) Mamaev, 1989	*Umbrina cirrosa* Linnaeus, 1785 (1)	gills	Ktari, 1970, 1971
Serranicotyle labracis (Van Beneden and Hesse, 1863) Maillard, Euzet and Silan, 1988	host unknown (not cited) (1)	gills	Ktari, 1971
Solostamenides mugilis (Vogt, 1879) Unnithan, 1971	*Chelon auratus* (Risso, 1810), *C. labrosus* (Risso, 1827), *C. ramada* (Risso, 1827), *Ch saliens* (Risso, 1810), *Mugil cephalus* Linnaeus, 1758 (1)	gills	Ktari, 1971; Neifar, 1995
Family Monocotylidae Taschenberg, 1879			
Calicotyle kroyeri Diesing, 1850	*Raja miraletus* Linnaeus, 1758, *R. radula* Delaroche, 1809, *Rostroraja alba* (Lacepède, 1803) (2, 3)	cloaca	Neifar, 2001
Calicotyle palombi Euzet and Williams, 1960	*Mustelus punctulatus* Risso, 1827 (1, 2, 3)	cloaca	Neifar, 2001
Calicotyle stossichi Braun, 1899	*Mustelus mustelus* (Linnaeus, 1758), *M. punctulatus* Risso, 1827 (1, 2, 3)	rectal gland	Neifar, 2001
Calicotyle vicina Neifar, Euzet and Ben Hassine, 2001	*Rhinobatos rhinobatos* (Linnaeus, 1758) (3)	cloaca	Neifar, 2001; Neifar *et al.*, 2001a
Cathariotrema sp.	*Galeorhinus galeus* (Linnaeus, 1758) (1)	nasal capsule	Neifar, 2001
Empruthotrema raiae (MacCallum, 1916) Johnston and Tiegs, 1922	*Raja clavata* Linnaeus, 1758, *R. miraletus* Linnaeus, 1758, *R. radula* Delaroche, 1809, *Rostroraja alba* (Lacepède, 1803) (1, 2,3)	nasal tissues	Neifar, 2001
Heliocotyle kartasi Neifar, Euzet and Ben Hassine, 1999	*Aetomylaeus bovinus* (Geoffroy Saint-Hilaire, 1817) (1, 3)	gills	Neifar, 2001, Neifar *et al.*, 1999a
Heterocotyle capapei Neifar, Euzet and Ben Hassine, 2000	*Dasyatis tortonesei* Capapé, 1975 (1, 3)	gills	Neifar, 2001; Neifar *et al.*, 2000
Heterocotyle forcifera Neifar, Euzet and Ben Hassine, 1999	*Taeniura grabata* Geoffroy Saint-Hilaire, 1817 (1, 3)	gills	Neifar, 2001; Neifar *et al.*, 1999 b
Heterocotyle minima (MacCallum, 1916) Price, 1938	*Bathytoshia centroura* (Mitchill, 1815) (1, 3)	gills	Neifar, 2001
Heterocotyle mokhtarae Neifar, Euzet and Ben Hassine, 1999	*Taeniura grabata* Geoffroy Saint-Hilaire, 1817 (1, 3)	gills	Neifar, 2001; Neifar *et al.*, 1999 b
Heterocotyle pastinacae Scott, 1904	*Dasyatis pastinaca* (Linnaeus, 1758) (1, 3)	gills	Neifar, 1995, 2001; Neifar *et al.*, 1998
	Dasyatis marmorata (Steindachner, 1892) (1, 3)		Neifar, 2001; Neifar *et al.*, 1998
Heterocotyle scotti Neifar, Euzet and Ben Hassine, 1998	*Dasyatis marmorata* (Steindachne, 1892) (3) *Dasyatis pastinaca* (Linnaeus, 1758) (1) (1, 3)	gills	Neifar, 2001; Neifar *et al.*, 1998 Neifar, 1995 Neifar, 2001; Neifar *et al.,* 1998
Heterocotyle similis Neifar, Euzet and Ben Hassine, 1998	*Dasyatis pastinaca* (Linnaeus, 1758) (1, 3)	gills	Neifar *et al.*, 1998
Heterocotyle striata Neifar, Euzet and Ben Hassine, 1999	*Taeniura grabata* Geoffroy Saint-Hilaire, 1817 (1, 3)	skin ventral surface	Neifar, 2001; Neifar *et al.*, 1999 b
Mehracotyle insolita Neifar, Euzet and Ben Hassine, 2002	*Rhinobatos cemiculus* Geoffroy Saint-Hilaire, 1817 (1, 3)	interbranchial septa	Neifar, 2001; Neifar *et al.*, 2002
Merizocotyle concinna (Scott, 1904) Chisholm, Wheeler and Beverley-Burton, 1995	*Dasyatis marmorata* (Steindachner, 1892) (1) *Dasyatis pastinaca* (Linnaeus, 1758) (1, 3)	nasal tissues	Neifar, 2001
Monocotyle sp.	*Aetomylaeus bovinus* (Geoffroy Saint-Hilaire, 1817) (1, 3)	gills	Neifar, 2001

Myliocotyle pteromylaei Neifer, Euzet and Ben Hassine, 1999	*Aetomylaeus bovinus* (Geoffroy Saint-Hilaire, 1817) (1, 3)	gills	Neifar, 2001; Neifar *et al.*, 1999 c
Neoheterocotyle ktarii Neifar, Euzet and Ben Hassine, 2001	*Rhinobatos rhinobatos* (Linnaeus, 1758) (3)	gills	Neifar, 2001; Neifar *et al.*, 2001 a
Thaumatocotyle tunisiensis Neifar, Euzet and Ben Hassine, 2000	*Dasyatis tortonesei* Capapé, 1975 (1, 3)	nasal tissues	Neifar, 2001; Neifar *et al.*, 2000
Triloculotrema euzeti Boudaya and Neifar, 2016	*Mustelus punctulatus* Risso, 1827 (1, 2, 3)	nasal tissues	Boudaya and Neifar, 2016
Family Plectanocotylidae Monticelli, 1903			
Plectanocotyle major Boudaya, Neifar and Euzet, 2006	*Chelidonichthys obscurus* (Walbaum, 1792) (3)	gills	Boudaya *et al.*, 2006
Plectanocotyle gurnardi (Van Beneden and Hesse, 1863) Llewellyn, 1941	*Chelidonichthys cuculus* (Linnaeus, 1758), *C. lastoviza* (Bonnaterre, 1788), *C. obscurus* (Walbaum, 1792) (1)	gills	Ktari, 1971
Family Polystomatidae Gamble, 1896			
Neopolystoma euzeti Combes and Ktari, 1976	*Mauremys caspica* var. *leprosa* (Gmelin, 1774) (4)	urinary bladder and rectum	Combes and Ktari, 1976
Polystomoides ocellatus (Rudolphi, 1819) Ozaki, 1935	*Mauremys caspica* var. *leprosa* (Gmelin, 1774) (4)	esophagus	Lambert *et al.*, 1978
Family Pseudodactylogyridae Gusev, 1965			
Pseudodactylogyrus anguillae (Yin and Sproston, 1948) Gusev, 1965	*Anguilla anguilla* (Linnaeus, 1758) (1)	gills	Neifar, 1995
Family Pyragraphoridae Yamaguti, 1963			
Pyragraphorus hollisae Euzet and Ktari, 1970	*Trachinotus ovatus* (Linnaeus, 1758) (1)	gills	Euzet and Ktari, 1970 c; Neifar, 1995
Family Tetraonchoididae Bychowsky, 1951			
Tetraonchoides paradoxus Bychowsky, 1951	*Uranoscopus scaber* Linnaeus, 1758 (1)	gills	Neifar, 1995

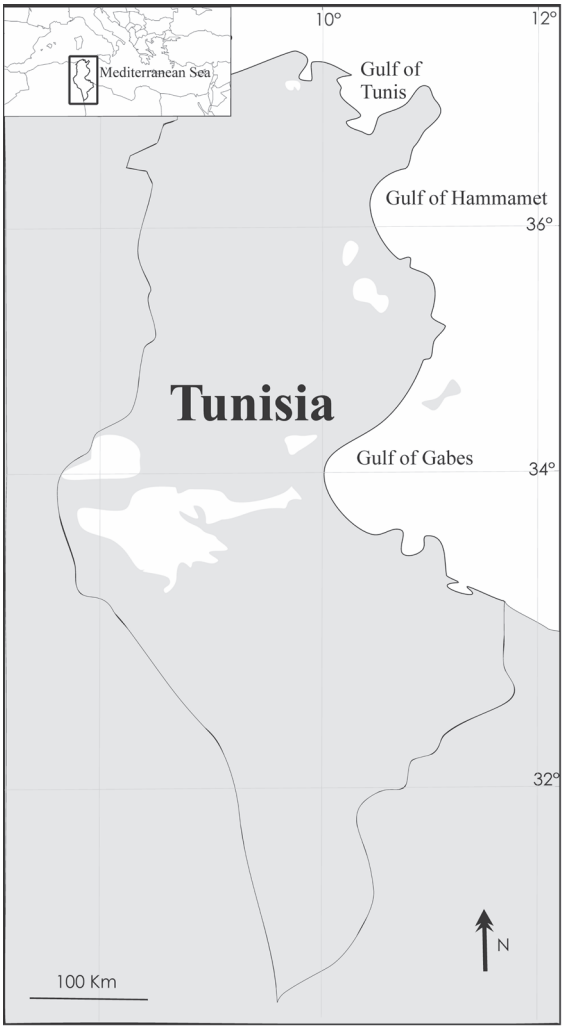

Fig. 1. Map of Tunisia showing sites of monogenean records.

Monogenea of Tunisian aquatic vertebrates.

In this paper we present all the available species records of monogeneans in Tunisian waters and we incorporate new data derived from our own work on species recorded from marine fish of the Gulf of Gabes (southern coast of Tunisia) in order to make the first checklist of monogeneans as parasites of Tunisian aquatic vertebrates.

Materials and Methods

The list of Monogenea from Tunisian aquatic vertebrates was prepared based on published data and doctoral and masters theses. It is organized in both a parasite–host table (Table 1) and a host–parasite one (Table 2).The families and species of monogeneans are presented in alphabetical order followed by microhabitat, localities and references (Table 1). The nomenclatures of all taxa are presented according to WoRMS (2021). However, authors of new combinations for some very old taxa of Monogenea are lacking.

Monogenea were reported from hosts of different localities in the coast of Tunisia, at the northern area (Gulf of Tunis 37°N, 10°30'E), at the eastern area (Gulf of Hammamet 36°5'N, 10°45'E) and at the southern area (Gulf of Gabes 34°05'N, 10°26'E) (Fig. 1). In addition, fish were sampled from the Gulf of Gabes at Skhira (34°05'N; 10°01'E), Kerkennah (34°45'N; 11°17'E) and Sidi Mansour (34°46'N; 10°48'E). This fish has been caught by locals fishermen. The specimens, coming from the coastal fishing, were identified using Fisher *et al.* (1987) and Whitehead *et al.* (1984). These fish were dissected as soon as they died and examined for Monogenea. Living parasites were detached then partially compressed between slide and coverslip. They were examined using an optical microscope. Some parasites were fixed with 70 % alcohol and stained with Semichon's acetic carmine. After dehydration using a graded ethanol series, the parasites were cleared in clove oil and mounted in Canada balsam for identification. Several specimens were fixed, stained and mounted directly in ammonium picrate glycerine after Malmberg (1957). The slides were sealed with Canada balsam. The host-parasite list of our work is arranged in alphabetical order of Monogenea-family (Table 3). Prevalence (P), mean abundance (MA) and mean intensity (MI) are determined according to Bush *et al.* (1997).

Ethical Approval and/or Informed Consent

All applicable institutional, national and international guidelines for the care and use of animals were followed.

Results and Discussion

The checklist of Monogenea species recorded from Tunisian waters includes 153 species from 89 host species. Among them, 37 species are reported from elasmobranchs and two species, *Neopolystoma euzeti* Combes & Ktari, 1976 and *Polystomoides ocellatus* (Rudolphi, 1819) Ozaki, 1935 from the freshwater tortoise *Mauremys caspica* var. *leprosa* (Gmelin, 1774).

The diversity of Monogenea in the coast of Tunisia is similar to that of other regions of the Mediterranean. For example, in the coast of Italy, there are 141 species of Monogenea reported from 93 host species (Strona *et al.*, 2010). However, this diversity is lower than the other regions of the World. In fact, 367 Monogenea are reported from 363 Mexican aquatic vertebrates (Mendoza-Garfias *et al.*, 2017) and 581 species from 263 inland aquatic vertebrates in China (Xia *et al.*, 2000). In general, the number of parasites reported must be dependent on the number of host examined as well as the number of host in the regions. Thus, areas with the highest host diversity have the highest diversity of parasites reported if the research efforts into fish parasites discovery are important. Jorge and Poulin (2018) note that there is a poor match between the host species richness and the parasite species discovery. Some areas with hotspots of host diversity, such as the tropical regions, suffer from a research deficit in parasite discovery.

Table 2. List of Tunisian aquatic host species and their monogenean parasites.

Host species	Monogenean species
Aetomylaeus bovinus (Geoffroy Saint-Hilaire, 1817)	*Heliocotyle kartasi* Neifar, Euzet and Ben Hassine, 1999; *Monocotyle* sp.; *Myliocotyle pteromylaei* Neifer, Euzet and Ben Hassine, 1999
Anguilla anguilla (Linnaeus, 1758)	*Pseudodactylogyrus anguillae* (Yin and Sproston, 1948) Gusev, 1965
Balistes capriscus Gmelin, 1789	*Haliotrema balisticus* (Hargis, 1955) Yamaguti, 1963
Bathytoshia centroura (Mitchill, 1815)	*Dasyonchocotyle spiniphallus* Hargis, 1955; *Heterocotyle minima* (MacCallum, 1916) Price, 1938
Belone belone (Linnaeus, 1758)	*Axine belones* Abildgaard, 1794
Belone svetovidovi Collette and Parin, 1970	*Axine* sp.
Boops boops (Linnaeus, 1758)	*Choricotyle chrysophryi* Van Beneden and Hesse, 1863
Brama brama (Bonnaterre, 1788)	*Gotocotyla acanthura* (Parona and Perugia, 1896) Meserve, 1938
Chelidonichthys cuculus (Linnaeus, 1758)	*Plectanocotyle gurnardi* (Van Beneden and Hesse, 1863) Llewellyn, 1941
Chelidonichthys lastoviza (Bonnaterre, 1788)	*Plectanocotyle gurnardi* (Van Beneden and Hesse, 1863) Llewellyn, 1941
Chelidonichthys lucerna (Linnaeus, 1758)	*Trochopus heteracanthus* Massa, 1903; *Trochopus pini* (Van Beneden and Hesse, 1863) Massa, 1903
Chelidonichthys obscurus (Walbaum, 1792)	*Plectanocotyle gurnardi* (Van Beneden and Hesse, 1863) Llewellyn, 1941; *Plectanocotyle major* Boudaya, Neifar and Euzet, 2006
Chelon auratus (Risso, 1810)	*Ligophorus szidati* Euzet and Suriano, 1977; *Ligophorus vanbenedenii* (Parona and Perugia, 1890) Euzet and Suriano, 1977; *Solostamenides mugilis* (Vogt, 1879) Unnithan, 1971
Chelon labrosus (Risso, 1827)	*Ligophorus angustus* Euzet and Suriano, 1977; *Solostamenides mugilis* (Vogt, 1879) Unnithan, 1971
Chelon ramada (Risso, 1827)	*Solostamenides mugilis* (Vogt, 1879) Unnithan, 1971
Chelon saliens (Risso, 1810)	*Ligophorus acuminatus* Euzet and Suriano, 1977; *Ligophorus heteronchus* Euzet and Suriano, 1977; *Ligophorus macrocolpos* Euzet and Suriano, 1977; *Ligophorus minimus* Euzet and Suriano, 1977; *Solostamenides mugilis* (Vogt, 1879) Unnithan, 1971
Dasyatis marmorata (Steindachner, 1892)	*Heterocotyle pastinacae* Scott, 1904; *Heterocotyle scotti* Neifar, Euzet and Ben Hassine, 1998; *Merizocotyle concinna* (Scott, 1904) Chisholm, Wheeler and Beverley-Burton, 1995; *Neoentobdella diadema* (Monticelli, 1902) Kearn and Whittington, 2005; *Trimusculotrema micracantha* (Euzet and Maillard, 1967) Whittington and Barton, 1990

Dasyatis pastinaca (Linnaeus, 1758)	*Heterocotyle pastinacae* Scott, 1904; *Heterocotyle scotti* Neifar, Euzet and Ben Hassine, 1998; *Heterocotyle similis* Neifar, Euzet and Ben Hassine, 1998; *Merizocotyle concinna* (Scott, 1904) Chisholm, Wheeler and Beverley-Burton, 1995; *Neonchocotyle pastinacae* Ktari and Maillard, 1972; *Neoentobdella diadema* (Monticelli, 1902) Kearn and Whittington, 2005; *Trimusculotrema micracantha* (Euzet and Maillard, 1967) Whittington and Barton, 1990
Dasyatis tortonesei Capapé, 1975	*Heterocotyle capapei* Neifar, Euzet and Ben Hassine, 2000; *Neoentobdella diadema* (Monticelli, 1902) Kearn and Whittington, 2005; *Thaumatocotyle tunisiensis* Neifar, Euzet and Ben Hassine, 2000; *Trimusculotrema micracantha* (Euzet and Maillard, 1967) Whittington and Barton, 1990
Dentex dentex (Linnaeus, 1758)	*Gotocotyla acanthura* (Parona and Perugia, 1896) Meserve, 1938
Dentex gibbosus (Rafinesque, 1810)	*Pseudoaspinatrium euzeti* (Ktari, 1971) Mamaev, 1986; *Lamellodiscus euzeti* Diamanka, Boudaya, Toguebaye and Pariselle, 2011
Dentex maroccanus Valenciennes, 1830	*Lamellodiscus crampus* Neifar, 2008
Dicentrarchus labrax (Linnaeus, 1758)	*Diplectanum aequans* (Wagener, 1857)
Dicentrarchus puctatus (Bloch, 1792)	*Diplectanum laubieri* Lambert and Maillard, 1974
Diplodus annularis (Linnaeus, 1758)	*Lamellodiscus elegans* Bychowsky, 1957; *Lamellodiscus fraternus* Bychowsky, 1957; *Polylabris tubicirrus* (Paperna and Kohn, 1964) Mamaev and Parukhin, 1976
Diplodus puntazzo (walbaum, 1792)	*Lamellodiscus bidens* Euzet, 1984; *Lamellodiscus hilii* Euzet, 1984; *Lamellodiscus ignoratus* Palombi, 1943; *Lamellodiscus impervius* Euzet, 1984; *Lamellodiscus theroni* Amine, Euzet and Kechemir-Issad, 2007
Diplodus sargus (Linnaeus, 1758)	*Lamellodiscus abbreviatus* Sanfilippo, 1978; *Lamellodiscus elegans* Bychowsky, 1957; *Lamellodiscus furcosus* Euzet and Oliver, 1966; *Lamellodiscus gussevi* Sanfilippo, 1978; *Lamellodiscus ignoratus* Palombi, 1943; *Lamellodiscus mirandus* Euzet and Oliver, 1966
Diplodus vulgaris (Geoffroy Saint-Hilaire, 1817)	*Lamellodiscus ergensi* Euzet and Oliver, 1966; *Lamellodiscus furcosus* Euzet and Oliver, 1966; *Lamellodiscus ignoratus* Palombi, 1943
Echeneis naucrates Linnaeus, 1758	*Dionchus agassizi* Goto, 1899; *Dionchus remorae* (MacCallum, 1916) Price, 1938
Engraulis encrasicolus (Linnaeus, 1758)	*Pseudanthocotyloides heterocotyle* (Van Beneden, 1871) Euzet and Prost, 1969
Euthynnus alletteratus (Rafinesque, 1810)	*Capsala maccallumi* Price, 1939; *Neohexostoma euthynni* (Meserve, 1938) Price, 1961
Galeorhinus galeus (Linnaeus, 1758)	*Cathariotrema* sp.
Gymnura altavela (Linnaeus, 1758)	*Heteronchocotyle gymnurae* Neifar, Euzet and Ben Hassine, 2001
Hyporthodus haifensis (Ben-Tuvia, 1953)	*Pseudorhabdosynochus sulamericanus* Santos, Buchmann and Gibson, 2000

Lithognathus mormyrus (Linnaeus, 1758)	*Bychowskicotyla mormyri* (Lorenz, 1878) Unnithan, 1971; *Lamellodiscus flagellatus* Boudaya, Neifar and Euzet, 2009; *Lamellodiscus verberis* Euzet and Oliver, 1967
Luciobarbus callensis (Valenciennes, 1842)	*Dactylogyrus heteromorphus* El Garbi, Birgi and Lambert, 1994; *Dactylogyrus tunisiensis* El Garbi, Birgi and Lambert, 1994
Mauremys caspica var. *leprosa* (Gmelin, 1774)	*Neopolystoma euzeti* Combes and Ktari, 1976
Merluccius merluccius (Linnaeus, 1758)	*Anthocotyle merlucii* Van Beneden and Hesse, 1863
Mugil cephalus Linnaeus, 1758	*Benedenia monticellii* (Parona and Perugia, 1895) Johnston, 1929; *Ligophorus chabaudi* Euzet and Suriano, 1977; *Metamicrocotyla cephalus* (Azim, 1939) Hargis, 1954; *Solostamenides mugilis* (Vogt, 1879) Unnithan, 1971
Mustelus mustelus (Linnaeus, 1758)	*Calicotyle stossichi* Braun, 1899; *Erpocotyle catenulata* (Guberlet, 1933) Yamaguti, 1963
Mustelus punctulatus Risso, 1827	*Calicotyle palombi* Euzet and Williams, 1960; *Calicotyle stossichi* Braun, 1899; *Erpocotyle* sp.; *Triloculotrema euzeti* Boudaya and Neifar, 2016
Mycteroperca costae (Steindachner, 1878)	*Pseudorhabdosynochus bouaini* Neifar and Euzet, 2007; *Pseudorhabdosynochus dolicocolpos* Neifar and Euzet, 2007; *Pseudorhabdosynochus enitsuji* Neifar and Euzet, 2007; *Pseudorhabdosynochus sinediscus* Neifar and Euzet, 2007; *Pseudorhabdosynochus sosia* Neifar and Euzet, 2007
Mycteroperca marginata (Lowe, 1834)	*Echinoplectanum echinophallus* (Euzet and Oliver, 1965) Justine and Euzet, 2006; *Pseudorhabdosynochus beverleyburtonae* (Oliver, 1984) Kritsky and Beverley-Burton, 1986; *Pseudorhabdosynochus riouxi* (Oliver, 1986) Santos, Buchmann and Gibson, 2000
Mycteroperca rubra (Bloch, 1793)	*Pseudorhabdosynochus hayet* Chaabane, Neifar, Gey and Justine, 2016; *Pseudorhabdosynochus regius* Chaabane, Neifar and Justine, 2015
Oblada melanura (Linnaeus, 1758)	*Gotocotyla acanthura* (Parona and Perugia, 1896) Meserve, 1938; *Lamellodiscus elegans* Bychowsky, 1957; *Lamellodiscus gracilis* Euzet and Oliver, 1966
Pagellus erythrinus (Linnaeus, 1758)	*Lamellodiscus erythrini* Euzet and Oliver, 1966; *Microcotyle erythrini* Van Beneden and Hesse, 1863
Pagrus auriga Valenciennes, 1843	*Lamellodiscus rastellus* Neifar, Euzet and Oliver, 2004
Pagrus coeruleostictus (Valenciennes, 1830)	*Lamellodiscus sarculus* Neifar, Euzet and Oliver, 2004; *Lamellodiscus sigilatus* Neifar, Euzet and Oliver, 2004
Pomadasys incisus (Bowdich, 1825)	*Dicrumenia bychowskyi* Mamaev, 1969; *Intracotyle hannibali* (Euzet and Ktari, 1970) Mamaev, 1977
Pomatomus saltatrix (Linnaeus, 1758)	*Microcotyle pomatomi* Goto, 1899; *Gotocotyla acanthura* (Parona and Perugia, 1896) Meserve, 1938; *Gotocotyla* sp 2. of Neifar, 1995
Raja clavata Linnaeus, 1758	*Empruthotrema raiae* (MacCallum, 1916) Johnston and Tiegs, 1922; *Rajonchocotyle* sp.
Raja miraletus Linnaeus, 1758	*Calicotyle kroyeri* Diesing, 1850;

Raja radula Delaroche, 1809	*Empruthotrema raiae* (MacCallum, 1916) Johnston and Tiegs, 1922; *Rajonchocotyle* sp.
Rhinobatos cemiculus Geoffroy Saint-Hilaire, 1817	*Mehracotyle insolita* Neifar, Euzet and Ben Hassine, 2002
Rhinobatos rhinobatos (Linnaeus, 1758)	*Calicotyle vicina* Neifar, Euzet and Ben Hassine, 2001; *Neoheterocotyle ktarii* Neifar, Euzet and Ben Hassine, 2001
Rostroraja alba (Lacepède, 1803)	*Calicotyle kroyeri* Diesing, 1850; *Empruthotrema raiae* (MacCallum, 1916) Johnston and Tiegs, 1922; *Rajonchocotyle* sp.
Sardina pilchardus (Walbaum, 1792)	*Mazocraes pilchardi* (Van Beneden and Hesse, 1863) Sproston, 1946
Sardinella aurita Valenciennes, 1847	*Mazocraes* sp.
Sardinella maderensis (Lowe, 1838)	*Mazocraeoides sardinellae* Ktari, 1982
Sarpa salpa (Linnaeus, 1758)	*Atrispinum salpae* (Parona and Perugia, 1890) Maillard and Noisy, 1979; *Lamellodiscus confusus* Amine, Euzet and Kechemir-Issad, 2007; *Lamellodiscus ignoratus* Palombi, 1943; *Lamellodiscus parisi* Oliver, 1969
Sciaena umbra Linnaeus, 1857	*Calceostomella inermis* (Parona and Perugia, 1889) Palombi, 1943; *Diplectanum simile* Bychowsky, 1957
Scomber colias Gmelin, 1789	*Kuhnia scombri* (Kuhn, 1829) Sproston, 1945; *Pseudokuhnia minor* (Goto, 1984) Rohde and Watson, 1985
Scomber japonicus Houttuyn, 1782	*Grubea cochlear* Diesing, 1858; *Kuhnia scombri* (Kuhn, 1829) Sproston, 1945; *Pseudokuhnia minor* (Goto, 1984) Rohde and Watson, 1985
Scomber scombrus Linnaeus, 1758	*Grubea cochlear* Diesing, 1858; *Kuhnia scombri* (Kuhn, 1829) Sproston, 1945
Scyliorhinus stellaris (Linnaeus, 1758)	*Hexabothrium appendiculatum* (Kuhn, 1829) Von Nordmann, 1840
Seriola dumerili (Risso, 1810)	*Heteraxine seriola* (Ishii, 1936) Sproston, 1946
Serranus cabrilla (Linnaeus, 1758)	*Protolamellodiscus serranelli* (Euzet and Oliver, 1965) Oliver, 1969
Serranus scriba (Linnaeus, 1758)	*Protolamellodiscus serranelli* (Euzet and Oliver, 1965) Oliver, 1969
Siganus luridus (Rüppell, 1829)	*Glyphidohaptor plectocirra* (Paperna, 1972) Kritsky, Galli and Yang, 2007; *Polylabris mamaevi* Ogawa and Egusa, 1980
Siganus rivulatus Forsskål and Niebuhr, 1775	*Glyphidohaptor plectocirra* (Paperna, 1972) Kritsky, Galli and Yang, 2007; *Polylabris mamaevi* Ogawa and Egusa, 1980
Sparus aurata Linnaeus, 1758	*Lamellodiscus echeneis* (Wagener, 1857) Diesing, 1858;
Sphyraena sphyraena (Linnaeus, 1758)	*Cotyloatlantica mediterranea* (Euzet and Trilles, 1960) Bravo-Hollis, 1984
Spicara maena (Linnaeus, 1758)	*Bivagina alcedinis* (Parona and Perugia, 1889) Yamaguti, 1963
Spicara smaris (Linnaeus, 1758)	*Lamellodiscus knoepffleri* Oliver, 1969
Synapturichthys kleinii (Risso, 1827)	*Pseudodiplectanum syrticum* Derbel, Boudaya and Neifar, 2007

Taeniura grabata Geoffroy Saint-Hilaire, 1817	*Heterocotyle forcifera* Neifar, Euzet and Ben Hassine, 1999; *Heterocotyle mokhtarae* Neifar, Euzet and Ben Hassine, 1999; *Heterocotyle striata* Neifar, Euzet and Ben Hassine, 1999; *Neoentobdella apiocolpos* (Euzet and Maillard, 1967) Kearn and Whittington, 2005
Thunnus thynnus (Linnaeus, 1758)	*Hexostoma thynni* (Delaroche, 1811) Rafinesque, 1815
Torpedo marmorata Risso, 1810	*Amphibdelloides kechemirae* Tazerouti, Euzet and Neifar, 2006; *Amphibdelloides vallei* Llewellyn, 1960; *Epicotyle torpedinis* (Price, 1942) Euzet and Maillard, 1974
Torpedo torpedo (Linnaeus, 1758)	*Amphibdella paronaperugiae* Llewellyn, 1960; *Amphibdelloides benhassinae* Tazerouti, Euzet and Neifar, 2006
Trachinotus ovatus (Linnaeus, 1758)	*Gotocotyla acanthura* (Parona and Perugia, 1896) Meserve, 1938; *Gotocotyla* sp1. of Neifar, 1995; *Pyragraphorus hollisae* Euzet and Ktari, 1970
Trachinus araneus Cuvier, 1829	*Pauciconfibula trachini* (Parona and Perugia, 1889) Dilllon and Hargis, 1965; *Bradyhaptorus trachini* (Parona and Perugia, 1890) Unnithan, 1971
Trachinus draco Linnaeus, 1758	*Bradyhaptorus trachini* (Parona and Perugia, 1890) Unnithan, 1971
Trachinus radiatus Cuvier, 1829	*Bradyhaptorus trachini* (Parona and Perugia, 1890) Unnithan, 1971; *Pauciconfibula trachini* (Parona and Perugia, 1889) Dilllon and Hargis, 1965
Trachurus mediterraneus (Steindachner, 1868)	*Cemocotyle trachuri* Dillon and Hargis, 1965; *Gastrocotyle trachuri* Van Beneden and Hesse, 1863; *Pseudaxine trachuri* Parona and Perugia, 1890
Trachurus trachurus (Linnaeus, 1758)	*Cemocotyle trachuri* Dillon and Hargis, 1965; *Gastrocotyle trachuri* Van Beneden and Hesse, 1863; *Pseudaxine trachuri* Parona and Perugia, 1890
Trisopterus capelanus (Lacepède, 1800)	*Diclidophora* sp.
Tylosurus acus imperialis (Rafinesque, 1810)	*Nudaciraxine imperium* Châari, Derbel and Neifar, 2010; *Pseudoaspinatrium gallieni* (Euzet and Ktari, 1971) Mamaev, 1986
Umbrina cirrosa Linnaeus, 1758	*Calceostomella inermis* (Parona and Perugia, 1889) Palombi, 1943; *Diplectanum grassei* Oliver, 1974; *Diplectanum melvillei* Oliver and Paperna, 1984; *Sciaenacotyle pancerii* (Sonsino, 1891) Mamaev, 1989
Uranoscopus scaber Linnaeus, 1758	*Tetraonchoides paradoxus* Bychowsky, 1951

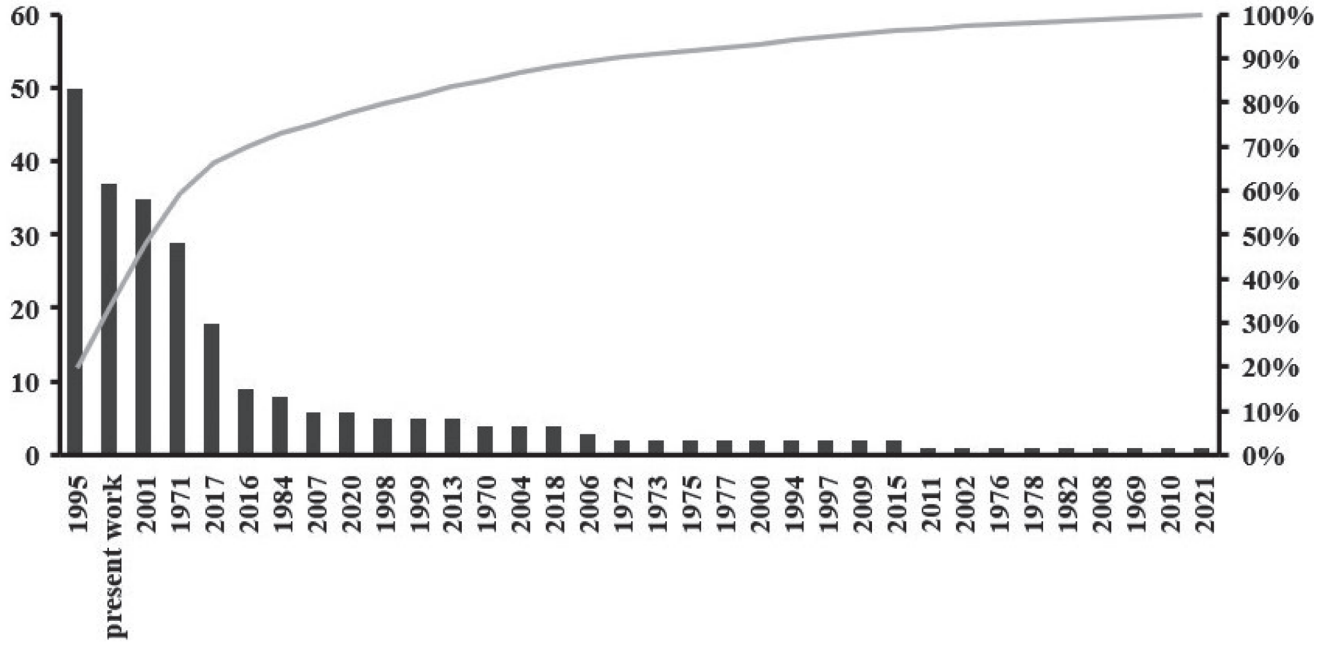

Fig. 2. Cumulative curve of monogeneans species recorded from Tunisia.

In this list, twenty six families are recorded; among them the Diplectanidae Monticelli, 1903 which represents the major monogenean family. Most species belong to the genus *Lamellodiscus* Johnston & Tiegs, 1922. Many phylogenetic analyses suggest that this group seem to be able to speciate rapidly, even in sympatric condition (Desdevises *et al*., 2002) leading to a high diversity.

This list shows that there are more species of Monopisthocotylea (93 species) than Polyopisthocotylea (60 species). Several studies of Monogenea diversity of fish from many localities show that the Monopisthocotylea is the richest group (Justine *et al*., 2010, 2012; Mendoza-Garfias *et al*., 2017). This difference is probably due to the differences in speciation rates between the two groups. In fact, sympatric speciation is important factor in parasite diversity, thus multiple congeners species in hosts are the product of speciation and diversification within the host (Poulin, 1999). Therefore, it appears that polyopisthocotyleans exhbit a lower level of speciation than monopisthocotyleans.

This difference can be also explained by the sampling effort. Indeed, examining additional hosts can probably change the number of monogeneans records and may also change the Monopisthocotylea/ Polyopisthocotylea balance of recorded species. Moreover, Mendoza-Garfias *et al.* (2017) mentioned that the inventory of the monogeneans fauna in Mexico is not completed because a small number of aquatic vertebrates have been studied for monogeneans in this area.

We noted that the number of Monogenea recorded in the coast of Tunisia has increased in the past 2 decades and led to the description of many new species. The first species were reported by Ktari and Euzet & Ktari in the 1970s. After that, the number has increased with the studies of Neifar (1995, 2001). Since 2001, only 61 species have been reported. This diversity is related to the research effort in terms of the number of studies and the number of fish species examined each year.

The species accumulation curve of this group off the Tunisian waters shows a rising curve that is not reaching the asymptote (Fig. 2). This means that new species (or new records) of monogeneans will continue to be found when other hosts and other areas are examined. This number does not represent the real monogenean fauna of Tunisia but only the number of species reported by the few researchers who have worked in this region. Those described so far represent only a very small proportion of the real richness considering the potential host fauna. It is difficult to have an estimate of relative parasites biodiversity.

The discovery of cryptic species affects estimates of parasites diversity. Several cases show that what was once thought to be a single parasite species infecting a few host species turns out to represent on complex of cryptic species, each specific to a single host species (Poulin & Keeney, 2008). Their discovery depends mostly on the application of molecular methods.

Most Monogenea included in the checklist are restricted to fishes with high commercial value. The parasitological study of fishes with minor commercial interest allows us to complete the list of Monogenea from the coast of Tunisia. Moreover, the parasiofauna of some area such as the eastern coast is not well studied.

This list includes results from our study of Monogenea parasite of fish in the Gulf of Gabes. During this study, we have examined 22 teleost fish species belonging to nine families. A total of 37 species of Monogenea belonging to 16 genera and six families were found

Table 3. Monogenean species diversity in the Gulf of Gabes.

Monogenean family	Monogenean species	Fish species	Number of fishes examined	P (%)	MA	MI
Ancyrocephalidae	*Haliotrema balisticus*	*Balistes capriscus*	2	100	6	6
	Ligophorus vanbenedenii	*Chelon auratus*	21	80	6.4	8
	Ligophorus szidati			80	4.8	6
	Ligophorus angustus	*Chelon labrosus*	4	100	3	3
	Ligophorus macrocolpos	*Chelon saliens*	12	50	0.75	1
	Ligophorus minimus			75	2	2
	Ligophorus heteronchus			100	8.33	8
	Ligophorus acuminatus			100	10.3	10
Capsalidae	*Benedenia monticellii*	*Mugil cephalus*	22	13.6	0.22	1
	Capsala maccallumi	*Euthynnus alletteratus*	4	50	3	6
Diplectanidae	*Diplectanum aequans*	*Dicentrarchus labrax*	2	100	10	10
	Pseudodiplectanum syrticum	*Synapturichthys kleinii*	30	90	15 .3	17
	Lamellodiscus knoepffleri	*Spicara smaris*	9	88	4.4	5
	Lamellodiscus elegans	*Diplodus annularis*	82	22	0.5	2
	Lamellodiscus fraternus			71.4	4.7	6
	Lamellodiscus ignoratus	*Diplodus puntazzo*	6	83.3	18	21
		Diplodus vulgaris	5	100	28	28
	Lamellodiscus theroni	*Diplodus puntazzo*	6	66	13	20.5
	Lamellodiscus hilii			50	1	2
	Lamellodisscus bidens			66	2.2	4
	Lamellodiscus impervius			33	1.6	4
	Lamellodiscus ergensi	*Diplodus vulgaris*	5	100	3.6	3
	Lamellodiscus verberis	*Lithognatus mormyrus*	4	100	38	38
	Lamellodiscus erythrini	*Pagellus erythrinus*	7	85.7	15.28	20
	Lamellodiscus rastellus	*Pagrus auriga*	2	100	24	24
	Lamellodiscus confusus	*Sarpa salpa*	14	100	12	12
	Lamellodiscus parisi			28	0.5	2
	Lamellodiscus echeneis	*Sparus aurata*	4	75	1.5	2

Hexostomatidae	*Neohexostoma euthynni*	*Euthynnus alletteratus*	4	75	6	8
Microcotylidae	*Metamicrocotyla cephalus*	*Mugil cephalus*	22	13	0.6	7
	Polylabris tubicirrus	*Diplodus annularis*	82	2.5	1	1
	Microcotyle erythrini	*Pagellus erythrinus*	7	42	0.85	2
Mazocraeidae	*Grubea cochlear*	*Scomber japonicus*	21	19	0.1	1
	Pseudokuhnia minor			55	2.35	4
	Kuhnia scombri			18	0.36	2
	Pseudanthocotyloides heterocotyle	*Engraulis encrasicolus*	31	54	2.4	4
	Mazocraes sp.	*Sardinella aurita*	46	8.6	0.08	1
	Mazocraes pilchardi	*Sardina pilchardus*	63	15	0.19	1

(Table 3). Among them 15 species are recorded for the first time off the coast of Tunisia (Table 1). The number of helminth species per host species was variable. *Diplodus puntazzo* (Walbaum) has the richest Monogenea fauna (5 species).

Conflict of Interest

The authors declare that they have no conflict of interest.

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References

Azizi, R. (2020): *Métazoaires parasites des poissons du genre Trachinus (Teleostei: Trachinidés) des côtes tunisiennes: Taxinomie, bioécologie et pathogénicité* [*Metazoan parasites of fishes from the genus Trachinus (Teleostei:Trachinidae) from Tunisian coasts: Taxinomy, bioecology and pathogenicity*]. PhD thesis, Tunis, Tunisia: University of Tunis, 217 pp. (In French)

Azizi, R., Yemmen, C., Bahri, S. (2017): Metazoan parasites of trachinid fishes (Teleostei: Trachinidae) from Tunisian coasts (Mediterranean Sea). *Acta Adriat*, 58(2): 209 – 224. DOI: 10.32582/aa.58.2.2

Azizi, R., Bouguerche, C., Santoro, M., Gey, D., Tazerouti, F., Justine, J-L., Bahri, S. (2021): Redescription and molecular characterization of two species of *Pauciconfibula* (Monogenea, Microcotylidae) from trachinid fishes in the Mediterranean Sea. *Parasitol Res*, 120 (7): 2363 – 2377. DOI: 10.1007/s00436-021-07097-9

Boudaya, L., Neifar, L., Euzet, L. (2006): *Plectanocotyle major* sp. n. (Monogenea: Plectanocotylidae), a gill parasite of *Chelidonichthys obscurus* (Teleostei: Triglidae) from the Mediterranean Sea. *Folia Parasitol*, 53: 53 – 56. DOI: 10.14411/fp.2006.004

Boudaya, L., Neifar, L., Euzet, L. (2009): Diplectanid parasites of *Lithognathus mormyrus* (L.) (Teleostei: Sparidae) from the Mediterranean Sea, with the description of *Lamellodiscus flagellatus* n. sp. (Monogenea: Diplectanidae). *Syst Parasitol*, 74: 149 – 159. DOI: 10.1007/s11230-009-9213-7

Boudaya, L., Neifar, L. (2016): *Triloculotrema euzeti* n. sp. (Monogenea, Monocotylidae) from the nasal tissues of the blackspotted smooth-hound *Mustelus punctulatus* (Carcharhiniformes, Triakidae) from off Tunisia. *Parasite,* 23: 62. DOI: 10.1051/parasite/2016072

Boussellaa, W. (2020): *La parasitofaune des poissons exotiques des côtes tunisiennes*. [*Parasitofauna of exotic fishes from Tunisian coasts*]. PhD thesis. Sfax, Tunisia: University of Sfax, 358 pp. (In French)

Boussellaa, W., Neifar, L., Goedknegt, A., Thieltges, D.W. (2018): Lessepsian migration and parasitism: richness, prevalence and intensity of parasites in the invasive fish *Sphyraena chrysotaenia* compared to its native congener *Sphyraena sphyraena* in Tunisian coastal waters. *PeerJ*, 6: e5558. DOI: 10.7717/peerj.5558

Bush, A.O., Lafferty, K.D., Lotz, J.M., Shostaka, M. (1997): Parasitology meets ecology on its own terms : Margolis *et al.* Revisited. *J. Prasitol.*, 83(4): 575 – 583. DOI: 10.2307/3284227

Châari, M. (2013): *Systématique, parasites et contribution à l'étude de la biologie des Belonidae des côtes Est de la Tunisie* [*Systematic, parasites and contribution to the study of the biology of Belonidae from the eastern coasts of Tunisia*]. PhD thesis. Sfax, Tunisia: University of Sfax, 294 pp. (In French)

Châari, M., Derbel, H., Neifar, L. (2010): *Nudaciraxine imperium* sp. n. (Monogenea: Axinidae) from the gills of Mediterranean needlefish *Tylosurus acus imperialis* (Teleostei: Belonidae). *Folia Parasitol*, 57(1): 31 – 36. DOI: 10.14411/fp.2010.005

Châari, M., Derbel, H., Neifar, L. (2016): *Sclerodistomoides pacificus* Kamegai, 1971 (Sclerodistomoididae Gibson & Bray, 1979) and *Tetrochetus coryphaenae* Yamaguti, 1934 (Accacoeliidae Odhner, 1911), two rarely reported digeneans from *Tylosurus acus imperialis* (Rafinesque) (Belonidae), and a list of helminth parasites of *Tylosurus acus* (Lacépède). *Syst Parasitol*, 93(4): 375 – 86. DOI: 10.1007/s11230-016-9622-3

Chaabane, A., Neifar, L., Justine, J-L. (2015): *Pseudorhabdosynochus regius* n. sp. (Monogenea, Diplectanidae) from the mottled grouper *Mycteroperca rubra* (Teleostei) in the Mediterranean Sea and Eastern Atlantic. *Parasite*, 22: 9. DOI: 10.1051/parasite/2015005

Chaabane, A., Justine, J-L., Gey, D., Bakenhaster, MD., Neifar, L. (2016 a): *Pseudorhabdosynochus sulamericanus* (Monogenea, Diplectanidae), a parasite of deep-sea groupers (Serranidae) occurs transatlantically on three congeneric hosts (*Hyporthodus* spp.), one from the Mediterranean Sea and two from the western Atlantic. *PeerJ*, 4(8): e2233. DOI: 10.7717/peerj.2233

Chaabane, A., Neifar, L., Gey, D., Justine, J-L. (2016 b): Species of *Pseudorhabdosynochus* (Monogenea, Diplectanidae) from groupers (*Mycteroperca* spp., Epinephelidae) in the Mediterranean and Eastern Atlantic Ocean, with special reference to the "beverleyburtonae group" and description of two new species. *PLOS One*, 11(8): e0159886. DOI: 10.1371/journal.pone.0159886

Chaabane, A., Neifar, L., Justine, J-L. (2017): Diplectanids from *Mycteroperca* spp. (Epinephelidae) in the Mediterranean Sea: Redescriptions of six species from material collected off Tunisia and Libya, proposal for the '*Pseudorhabdosynochus riouxi* group', and a taxonomic key. *PLOS One*, 12(2): e0171392. DOI: 10.1371/journal.pone.0171392

Cherif, N., Attia El Hili, H., Mzoughi, N., Chouba, L., El Bour, M., El-Amri, D., Hamza, A., Maatoug, K., Zaafrane, S., Hammami, S. (2011): *Tunisian aquaculture : present situation and potentialities. Fish Farms: Management, Disease Control and the Environment.* Nova Science Publishers N.Y., USA. Editors: Gavin L. Andrews and Lauren A. Vexton, 180 pp.

Combes, C., Ktari, M.H. (1976): *Neopolystoma euzeti* n. sp. (Monogenea, Polystomatidae) Premier représentant du genre *Neopolystoma* Price, 1939 en Afrique [*Neopolystoma euzeti* n. sp. (Mono-

genea, Polystomatidae) first representative of the genus *Neopolystoma* Price, 1939 in Africa]. *Ann Parasitol Hum Comp,* 51(2): 221 – 225 (In French)

Derbel, H. (2004): *Biodiversité des Monogènes parasites des poissons téléostéens du golfe de Gabès*. [*Biodiversity of Monogenea parasites of teleost fish from the gulf of Gabes*]. Master. Sfax, Tunisia: University of Sfax, 165pp. (In French)

Derbel, H., Boudaya, L., Neifar, L. (2007): *Pseudodiplectanum syrticum* n. sp. (Monogenea: Diplectanidae), a parasite of *Synaptur*ichthys *kleinii* (Teleostei: Soleidae) from off Tunisia. *Syst Parasitol,* 68: 225 – 231. DOI: 10.1007/s11230-007-9108-4

Desdevises, Y., Morand, S., Jousson, O., Legendre, P. (2002) : Coevolution between *Lamellodiscus* (Monogenea: Diplectanidae) and Sparidae (Teleostei): the study of a complex host-parasite system. *Evolution,* 56(12): 2459 – 2471. DOI: 10.1111/j.0014-3820.2002.tb00171.x

Diamanka, A., Boudaya, L., Toguebaye, B.S., Pariselle, A. (2011): *Lamellodiscus euzeti* n. sp. (Monogenea: Diplectanidae), a parasite from *Dentex canariensis* and *D. gibbosus* (Teleostei: Sparidae) in the Atlantic Ocean and Mediterranean Sea. *Parasite*, 18(2): 145 – 150. DOI: 10.1051/parasite/2011182145

El Gharbi, S., Birgi, E., Lambert, A. (1994): Monogènes Dactylogyridae parasites de Cyprinidae du genre *Barbus* d'Afrique du Nord [Monogenea Dactylogyridae parasites of Cyprinidae of *Barbus* genus from the North of Africa]. *Syst Parasitol*, 27(1): 45 – 70. DOI: 10.1007/BF02185667 (In French)

Euzet, L. (1984): Diplectanidae (Monogenea) parasites de poissons des îles Kerkennah (Tunisie) [Diplectanidae (Monogenea) parasites of fish fom Kerkennah islands]. *Arch. Inst. Pasteur Tunis*, 61(4): 463 – 474 (In French)

Euzet, L., Ktari, M.H. (1970 a): Le développement larvaire et la position systématique des Calceostomatidae (Monogenea) [Larval development and systematic position of Calceostomatidae (Monogenea)]. *C. R. Acad. Sci. Paris*, 271: 2332 – 2335 (In French)

Euzet, L., Ktari, M.H. (1970 b): *Heteraxinoides hannibali* n. sp. (Monogenea, Polyopisthocotylea), parasite branchial de *Pomadasys incisus* (Bowdich, 1825) (Teleostei) dans le golfe de Tunis [*Heteraxinoides hannibali* n. sp. (Monogenea, Polyopisthocotylea), gill parasite of *Pomadasys incisus* (Bowdich, 1825) (Teleostei) from the gulf of Tunis]. *Bull. Mus. Natl. Hist. Nat. Paris*, 41 (1): 269 – 279 (In French)

Euzet, L., Ktari, M.H. (1970 c): *Pyragraphorus hollisae* sp. nov (Monogenea) parasite de *Lichia Glauca* (L., 1758) (Carangidae) en Méditerranée [*Pyragraphorus hollisae* sp. nov (Monogenea) parasite of *Lichia Glauca* (L., 1758) (Carangidae) from Mediterranean]. *An. Inst. Biol. Univ. Nal. Auton. Mexico*, 41(1): 61 – 71 (In French)

Euzet, L., Ktari, M.H. (1971): *Aspinatrium gallieni* n. sp. (Monogenea, Polyopisthocotylea) parasite de *Strongylura acus* (Lacépède, 1803) en Méditerranée [*Aspinatrium gallieni* n. sp. (Monogenea, Polyopisthocotylea) parasite of *Strongylura acus* (Lacépède, 1803) from Mediterranean]. *Bull. Soc. Zool. Fr.*, 96: 509 – 517 (In French)

Euzet, L., Ktari, M.H. (1973): Les Calceostomatidae (Monogenea) parasites de Téléostéens du golfe de Tunis, développement larvaire et position systématique [Calceostomatidae (Monogenea) parasite of Teleostei from the gulf of Tunis, larval development and systematic position]. *Bull. Inst. Océanogr. Pêche, Salammbô*, 2(4): 605 – 622 (In French)

Feki, M. (2017): *Les Métazoaires parasites des petits pélagiques des côtes tunisiennes: biodiversité et implications pratiques pour la discrimination et l'identification des stocks* [*Metazoa parasites of small pelagics off the Tunisian coasts: biodiversity and practical implications for discrimination and stock identification*]. PhD thesis. Sfax, Tunisia: University of Sfax, 359 pp. (In French)

Fischer, W., Bauchot, M.L., Schneider, M. (1987): *Fiches FAO d'identification des espèces pour les besoins de la pêche. Méditerranée et Mer Noire. Zone de pêche 37. Vertébrés* [*FAO species identifi cation sheets for fishery purposes. Mediterranean and Black Sea. Fishing area 37. Volume 2 Vertebrates*]. FAO, Rome, 1529 pp. (In French)

Jorge, F., Poulin, R. (2018): Poor geographical match between the distributions of host diversity and parasite discovery effort. *Proc Biol Sci*, 285(1879): 20180072. DOI: 10.1098/rspb.2018.0072

Justine, J-L., Beveridge, I., Boxshall, GA., Bray, RA., Moravec, F., Whittington, ID. (2010): An annotated list of fish parasites (Copepoda, Monogenea, Digenea, Cestoda and Nematoda) collected from Emperors and Emperor Bream (Lethrinidae) in New Caledonia further highlights parasite biodiversity estimates on coral reef fish. *Zootaxa*, 2691: 1 – 40. DOI: 10.11646/zootaxa.2691.1.1

Justine, J-L., Beveridge, I., Boxshall, GA., Bray, RA., Miller, TL., Moravec, F., Trilles, J-P., Whittington, ID. (2012) : An annotated list of fish parasites (Isopoda, Copepoda, Monogenea, Digenea, Cestoda, Nematoda) collected from Snappers and Bream (Lutjanidae, Nemipteridae, Caesionidae) in New Caledonia confirms high parasite biodiversity on coral reef fish. *Aquat Biosyst*, 8 (1): 1 – 29. DOI: 10.1186/2046-9063-8-22

Kacem, H., Neifar, L. (2015): Parasitic inventory of *Balistes capriscus* (Teleostei: Balistidae) from the Gulf of Gabès (Southern Tunisia, Central Mediterranean Sea). *J. Coast. Life Med.*, 3(2): 106 – 108. DOI: 10.12980/JCLM.3.201514J69

Khalil, L.F., Polling, L. (1997): *Check list of the helminth parasites of African freshwater fishes.* University of the North, Republic of South Africa, Pietersburg, Republic of South Africa, 185 pp.

Ktari, M.H. (1969): Recherche sur l'anatomie et la biologie de *Microcotyle salpae* Parona et Perugia, 1890 parasite de *Box salpa* L. (Téléostéen). [Research of the anatomy and biology of *Microcotyle salpae* Parona and Perugia, 1890 parasite of *Box salpa* L. (Teleostei)]. *Ann. Parasit. Hum. Comp.*, 44(4): 425 – 440 (In French)

Ktari, M.H. (1970): *Microcotyle panceri* Sonsino, 1891 (Monogenea - Microcotylidae) parasite d'*Umbrina cirrhosa* L. dans le golfe de Tunis [*Microcotyle panceri* Sonsino, 1891 (Monogenea - Microcotylidae) parasite of *Umbrina cirrhosa* L. from the gulf of Tunis]. *Bull. Inst. Océanogr. Pêche, Salammbô*, 1(4): 169 – 180

(In French)
Ktari, M.H. (1971): *Recherches sur la reproduction et le développement de quelques monogènes (polyopisthocotylea) parasites de poissons marin*s [*Research of the reproduction and development of some Monogenea (polyopisthocotylea) parasites of marine fish*]. PhD thesis, Montpellier, France: Academy University of Sciences and Technics of Languedoc, 327 pp. (In French)
Ktari, M.H. (1975): The occurence of two congeneric species of Monogenea on the gills of *Echeneis naucrates* L. (Pisces-Teleostei) collected in Tunisia. *Second European Multicolloquy Parasitol.*: 93 – 94
Ktari, M.H. (1977): Le parasitisme d'*Echeneis naucrates* L. (Poisson Téléostéen) par deux Monogènes (Monopisthocotylea) du genre *Dionchus*: *D. agassizi* Goto 1899 et *D. remorae* MacCallum 1916 [Parasitism of *Echeneis naucrates* L. (Teleost fish) by two Monogenea (Monopisthocotylea) of the genus *Dionchus*: *D. agassizi* Goto 1899 and *D. remorae* MacCallum 1916]. *Excerta Parasit. en memoria del Dr. E. Caballero y Caballero, Inst. Biol*.: 61 – 67 (In French)
Ktari, M.H. (1982): Présence de *Mazocraeoides sardinellae* (Monogene-Plathelminthe) parasite branchial de *Sardinella maderensis* (Poisson-Teleosteen) du golfe de Tunis [Presence of *Mazocraeoides sardinellae* (Monogenea-Platyhelminthe) a gill parasite of *Sardinella maderensis* (Teleost fish) from the gulf of Tunis]. *Rev Fac Sc Tunis*, 2: 95 – 99 (In French)
Ktari, M.H., Maillard, C. (1972): *Neonchocotyle pastinacae* n.g. n.sp. (Monogenea Hexabothriidae) parasite de *Dasyatis pastinaca* dans le golfe de Tunis: description de l'adulte et de la larve [*Neonchocotyle pastinacae* n.g. n.sp. (Monogenea Hexabothriidae) parasite of *Dasyatis pastinaca* from the gulf of Tunis: description of adult and larva]. *Ann Parasitol Hum Comp*, 47(2): 181 – 191 (In French)
Lambert, A., Combes, C., Ktari, M.H. (1978): Morphologie de l'oncomiracidium de *Polystomoides* Ward, 1917 (Monogenea) et situation du genre parmi les Polystomatidae [Morphology of the oncomiracidium of *Polystomoides* Ward, 1917 (Monogenea) and situation of the genus among Polystomatidae]. *Z Parasitenkd*, 56: 175 – 181 (In French)
Lia, R., Zizzo, N., Tinelli, A., Lionetti, A., Cantacessi, C., Otranto, D. (2007): Mass mortality in wild greater amberjack (*Seriola dumerili*) infected by *Zeuxapta seriolae* (Monogenea: Heteraxinidae) in the Ionian Sea. *Bull Eur Assoc Fish Pathol,* 27(3): 108 – 111
Malmberg, G. (1957) : On the occurrence of *Gyrodactylus* on Swedish fishes. *Skrifter utgivna av Sodra Sveriges Fiskeriforening*: 19 – 76
Mendoza-Garfias, B., García-Prieto, L., Pérez-Ponce De León, G. (2017) : Checklist of the Monogenea (Platyhelminthes) parasitic in Mexican aquatic vertebrates. *Zoosystema*, 39(4): 501 – 598. DOI: 10.5252/z2017n4a5
Neifar, L. (1995): *Contribution à l'étude de la Biodiversité des Monogènes parasites de poissons du secteur Nord-Est de la Tunisie* [*Contribution to the study of the biodiversity of Monogenea parasites of fish from the North-East sector of Tunisia*]. Post graduate Diploma, Tunis, Tunisia: University of Tunis, 209 pp. (In French)
Neifar, L. (2001): *Biodiversité et évolution des Plathelminthes parasites des Elasmobranches* [*Biodiversity and evolution of parasite Plathelminthes of Elasmobranchs*]. PhD thesis, Tunis, Tunisia: University of Tunis, 371 pp. (In French)
Neifar, L. (2008): *Lamellodiscus crampus* sp. nov. (Monogenea, Diplectanidae), a parasite of *Dentex maroccanus* (Teleostei, Sparidae) from off Tunisia. *Acta Parasitol*, 53(3): 258 – 262. DOI: 10.2478/s11686-008-0048-1
Neifar, L., Euzet L., Ben Hassine, O.K. (1998): Nouveaux Monocotylidae (Monogenea), parasites branchiaux de *Dasyatis pastinaca* (Linné) (Euselachii, Dasyatidae). Compléments à la description d'*Heterocotyle pastinacae* Scott, 1904 [New Monocotylidae (Monogenea), gill parasites of *Dasyatis pastinaca* (Linné) (Euselachii, Dasyatidae). Complements to the description of *Heterocotyle pastinacae* Scott, 1904]. *Syst Parasitol*, 41(3): 197 – 208. DOI: 10.1023/A:1006069712779
Neifar, L., Euzet, L., Ben Hassine, O.K. (1999a): *Heliocotyle kartasi* n. g., n. sp. (Monogenea: Monocotylidae) parasitic on *Pteromylaeus bovinus* (Euselachii: Myliobatinae) from Tunisia. *Folia Parasitol*, 46(1): 29 – 32
Neifar, L., Euzet, L., Ben Hassine, O.K. (1999b): Trois nouveaux *Heterocotyle* (Monogenea, Monocotylidae) parasites branchiaux de *Taeniura grabata* (Euselachii, Dasyatidae) en Tunisie [Three new *Heterocotyle* (Monogenea, Monocotylidae) gill parasites of *Taeniura grabata* (Euselachii, Dasyatidae) from Tunisia]. *Zoosystema*, 21(2): 157 – 170 (In French)
Neifar, L., Euzet, L., Ben Hassine, O.K. (1999c): *Myliocotyle pteromylaei* gn. et sp. n. (Monogenea: Monocotylidae) parasite branchial de *Pteromylaeus bovinus* (Euselachii: Myliobatinae) en Tunisie [*Myliocotyle pteromylaei* gn. and sp. n. (Monogenea: Monocotylidae) gill parasite of *Pteromylaeus bovinus* (Euselachii: Myliobatinae) from Tunisia]. *Parasite*, 6(4): 323 – 327. DOI: 10.1051/parasite/1999064323 (In French)
Neifar, L., Euzet, L., Ben Hassine, O.K. (2000): New species of the Monocotylidae (Monogenea) from the stingray *Dasyatis tortonesei* Capape´ (Euselachii, Dasyatidae) off the Tunisian coast, with comments on host specificity and the specific identities of Mediterranean stingrays. *Syst Parasitol*, 47: 43 – 50. DOI: 10.1023/A:1006354423136
Neifar, L., Euzet, L., Ben Hassine, O.K. (2001a): Monocotylidae (Monogenea) nouveaux parasites de *Rhinobatos rhinobatos* (Euselachii, Rhinobatidae) [Monocotylidae (Monogenea) new parasites of *Rhinobatos rhinobatos* (Euselachii, Rhinobatidae)]. *Zoosystema*, 23: 659 – 667 (In French)
Neifar, L., Euzet, L., Ben Hassine, O.K. (2001b): *Heteronchocotyle gymnurae* sp.n. (Monogenea: Hexbothriidae) a gill parasite of *Gymnura altavela* (Elasmobranchii: Gymnuridae) from the Mediterranean Sea. *Comp Parasitol*, 68(1): 91 – 96
Neifar, L., Euzet, L., Ben Hassine, O.K. (2002): Une nouvelle espèce de Monocotylidae (Monogenea) parasite branchial de *Rhino-*

batos cemiculus (Euselachii, Rhinobatidae), avec proposition d'un nouveau genre et d'un amendement à la diagnose des Monocotylidae [A new species of Monocotylidae (Monogenea) a gill parasite of *Rhinobatos cemiculus* (Euselachii, Rhinobatidae), with proposal of a new genus and amendment to the diagnosis of Monocotylidae]. *Zoosystema*, 24(4): 699 – 706 (In French)

Neifar, L., Euzet, L., Oliver, G. (2004): *Lamellodiscus* (Plathelminthes, Monogenea, Diplectanidae) nouveaux parasites branchiaux des poissons marins du genre *Pagrus* (Teleostei, Sparidae) [*Lamellodiscus* (Plathelminthes, Monogenea, Diplectanidae) new gill parasites of marine fish of genus *Pagrus* (Teleostei, Sparidae)]. *Zoosystema*, 26(3): 365 – 376 (In French)

Neifar, L., Euzet, L. (2007): Five new species of *Pseudorhabdosynochus* (Monogenea: Diplectanidae) from the gills of *Epinephelus costae* (Teleostei: Serranidae). *Folia Parasitol*, 54(2): 117 – 128. DOI: 10.14411/fp.2007.017

Poulin, R. (1999): Speciation and diversification of parasite lineages: an analysis of congeneric parasite species in vertebrates. *Evol. Ecol.*, 13: 455 – 467

Poulin, R. (2002): The evolution of monogenean diversity. *Int J Parasitol*, 32(3): 245 – 254. DOI: 10.1016/S0020-7519(01)00329-0

Poulin, R., Keeney, DB. (2008) : Host specificity under molecular and experimental scrutiny. *Trends Parasitol*, 24(1): 8 – 24. DOI: 10.1016/j.pt.2007.10.002

Tazerouti, F., Neifar, L., Euzet, L. (2006): Nouveaux Amphibdellatidae (Platyhelminthes, Monogenea, Monopisthocotylea) parasites des Torpedinidae (Pisces, Elasmobranchii) de Méditerranée [new Amphibdellatidae (Platyhelminthes, Monogenea, Monopisthocotylea) parasites of Torpedinidae (Pisces, Elasmobranchii) from Mediterranean]. *Zoosystema*, 28(3): 607 – 616. (In French)

Řehulková, E., Seifertová, M., Přikrylová, I., Francová, K. (2018): Monogenea. In: Scholz,T., Vanhove, M. P. M., Smit, N., Jayasundera, Z., Gelnar, M. A *Guide to the Parasites of African Freshwater Fishes*. CEBioS, Royal Belgian Instiute of Natural Sciences, Brussels, pp. 185 – 243

Strona, G., Stefani, F., Galli, P. (2010): Monogenoidean parasites of Italian marine fish: An updated checklist. *Ital J Zool*, 77(4) : 419 – 437. DOI: 10.1080/11250001003614841

Xia, X.Q., Wang, W. J., Lu, C.P. (2000): The distribution of monogenean parasites on aquatic vertebrates inhabiting Chinese inland waters. *Syst Parasitol*, 46: 151 – 155. DOI: 10.1023/A:1006377618593

Whitehead, P.J.P., Bauchot, M.L., Hureau, J.C., Nielson, J., Tortonese, E. (1984): *Fishes of the north-eastern Atlantic and Mediterranean (Vol. 1).* Paris: UNESCO, 510 pp.

WoRMS Editorial Board (2021): World Register of Marine Species. Available from https://www.marinespecies.org at VLIZ. Accessed 2021-07-12.