

Experimental Results**Article In Press**

Acceptation date : February 2023

<https://doi.org/10.1017/exp.2023.4><https://archimer.ifremer.fr/doc/00823/93473/>**Archimer**<https://archimer.ifremer.fr>

First checklist triggering the inventory of marine fish ectoparasites in the Syrian coast (Eastern Mediterranean)

Hassan Mohamad ^{1,2,*}, Nisafi Ali ², Dayoub Amal ³, Guede Shade ^{2,4}, Fadel Manar ², Sasal Pierre ⁵

¹ MARBEC, Université Montpellier, Ifremer, IRD, CNRS, 34200 Sète, France.

² Department of Animal Production, Faculty of Agriculture, Tishreen University, Latakia, Syria.

³ Higher Institute for Environmental Research, Tishreen University, Latakia, Syria.

⁴ General Authority of Fisheries and Aquatic Organisms, PO Box 121, Latakia, Syria.

⁵ PSL Research University: EPHE-UPVD-CNRS, UAR CNRS 3278, Centre de Recherche Insulaire et Observatoire de l'Environnement (CRIOBE), Université de Perpignan Via Domitia, Perpignan, France.

* Corresponding author : Mohamad Hassan, email address : mohamad.hassan@ifremer.fr

Abstract :

The checklist of the ectoparasites of Syrian marine fish is provided. This fauna comprises (28) species, representing (20) genera, (15) families, (9) orders and (8) classes. The checklist is arranged alphabetically; with additional details for each species include the hosts, infected site, prevalence and intensity, and references or the source of these data. Considering these very limited data, we discussed the results found and highlighted the importance to conduct more parasitological studies in the region.

Keywords : Checklist, Fish Ectoparasites, Mediterranean, Syria

26 Parasites checklists are part of the FAO's continuing effort to address the need for
27 information on the occurrence of diseases and pathogens of aquatic animals. These checklists
28 are valuable information sources that can be used when conducting pathogen risk analysis, an
29 essential component of strategies on aquatic animal health management (Kirjušina and
30 Vismanis, 2007).

31 Studies concerning parasites of marine fish in Syria (Eastern Mediterranean) are very scarce
32 comparing to countries of Western Mediterranean. Actually, these studies have a short
33 history, in 2010, we initiated in this "*ignored region*" the original study and we described
34 some ectoparasites in three marine fish species for the first time in the Syrian marine waters
35 (Hassan *et al.*, 2010). Our idea of that founded study was to explore the adaptation extent of
36 parasitic fauna of lessepsian fish species in the new habitat in this part of Mediterranean Sea.

37 Syria is located on the east coast of the Mediterranean Sea, with a total coastline length of
38 202 km, expanding from the Turkish borders to Lebanon. Syrian seawaters are characterized
39 by a low fish species richness as reported by Ali (2018) that found (298) fish species (111
40 families, 220 genera), which present less than half of the total of 664 for the whole

41 Mediterranean fish fauna. This could be attributed to the limited number of taxonomic
42 studies, the lack of sampling efficiency of the fishing gears used and that deep-sea species of
43 this region have not been studied sufficiently.

44 The aim of the present work is to provide a first checklist of ectoparasitic fauna on free-living
45 marine fish species from the Syrian coast, which have potential to be cultured in Syria in
46 future. This checklist includes also original data collected during a survey in these waters.

47 Marine fish parasites from Syria are poorly known, especially, because most of articles
48 including the records of these parasites were published in Arabic with an abstract in English
49 (e.g., Hassan *et al.*, 2010; Salman *et al.*, 2017; Layka and Saleem, 2020). Consequently,
50 listing fish ectoparasites recorded in Syrian marine waters comes from the necessity to
51 highlight their presence and from the need of readily accessible information on these
52 parasites, their host range as well as their local geographic distribution. These data could be
53 also interesting to expect the geographic distribution range of these organisms in other
54 countries around the Mediterranean especially where they are not recorded yet. Therefore, we
55 have produced this checklist to unify all knowledge into a single source, which would list all
56 ectoparasites of marine fish recorded to date from Syria. Despite the low number of works on
57 fish parasites in Syria, this will constitute a baseline and hopefully encourage other studies in
58 the country. Moreover, because of the uncertainty on several parasite identification that more
59 studies are argued to be done in the region.

60 **Methods**

61 The data are presented as a table compiled from all published and non-published records
62 accomplished by or known to the authors. The parasites are presented in alphabetical order
63 under class, genus and species, with records of their hosts, infected site, and data sources. The
64 species were allocated into major groups (classes) according to the electronic site of World

65 Register of Marine Species (WoRMS, 2022). A total of 19 references (15 research papers and
66 4 unpublished masters theses) dealing with the parasites of marine fishes of Syria were used
67 to prepare this checklist. The checklist was in particular focused on the ectoparasites and their
68 fish hosts. When available, the prevalence (number of infected fish/ total examined fish x
69 100) and the intensity (number of ectoparasites/ number of infected fish) were also taken into
70 account.

71 **Results and Discussion**

72 This first original checklist of ectoparasites identified on marine fish in Syria from 2010 to
73 2022 provided by this paper, includes (28) species belonging to (20) genera, (15) families, (9)
74 orders and (8) classes. They were distributed on (15) fish host species (Tables 1 & 2). These
75 parasites were allocated into eight classes as follows: one species of each of Malacostraca,
76 Maxillopoda, Oligohymenophorea, Phyllopharyngea, and Trematoda, three species of
77 Hexanauplia, and four species of Myxozoa. The class Monogenea included the largest
78 number of identified parasites with 16 species.

79 Most of these ectoparasites were isolated from the fish gills, excepted *Gnathia sp.* Leach,
80 1814, *Chilodonella piscicola* Strand, 1928, and *Caligus apodus* (Brian, 1924), which were
81 isolated from the buccal cavity and skin in addition to gills, as well as, *Caligus pageti*
82 Russell, 1925, and *Trichodina sp.* Ehrenberg, 1830, which were isolated from the skin of
83 *Mugil cephalus* Linnaeus, 1758.

84 The infection rate or prevalence varied from very low (0.6%) for the parasite *Microcotyle*
85 *mugilis* Vogt, 1878 on *Siganus rivulatus* Forsskål & Niebuhr, 1775 gills to very high (88.9%)
86 on the gills of *Diplodus vulgaris* (Geoffroy Saint-Hilaire, 1817) when infected by
87 *Lamellodiscus elegans* Bychowsky, 1957. Over all, the prevalence of Monogenea parasites
88 was the highest. The intensity ranged between (1) parasite/fish for *Ligophorus cephalis*
89 Rubtsova, Balbuena, Sarabeev, Blasco-Costa & Euzet, 2006 on *Chelon auratus* (Risso, 1810)

90 and for *Choricotyle* sp. Van Beneden & Hesse, 1863 on *Pagellus erythrinus* (Linnaeus,
91 1758), and (64) parasites/fish for *Trichodina*, on *Mugil cephalus*. The highest infection rates
92 by the majority of exoparasites species cited in the present checklist were recorded in spring,
93 whereas the lowest rates were observed in winter.

94 The highest number of ectoparasites was recorded from Sparidae (11 species) followed by
95 Mugilidae (10), Mullidae and Siganidae (3 species each), Holocentridae (2), and only one
96 species from each Fistulariidae, Scombridae and Synodontidae.

97 The total number of ectoparasites listed here (28 species) from Syrian marine fish species, is
98 relatively low comparing to those in other Mediterranean countries. For instance, only for
99 Monogenea, (141) species were recorded in Italy (Strona *et al.*, 2010), (59) in Turkey (Özer,
100 2021), and (153) in Tunisia (Derbel *et al.*, 2022), versus (16) species listed in the present
101 study. In fact, in Turkey, an adjacent country up to 2021, the number of parasites species
102 reported from marine fishes are (326) at species level and (75) at genus level and these are
103 belonging to the higher taxa as follows: Ciliophora (19), Myxozoa (3), Monogenea (59),
104 Trematoda (105), Cestoda (33), Nematoda (36), Arthropoda (89), Cnidaria (35),
105 Microsporidia (1), Acanthocephala (14), Annelida (5), Mollusca (1) (Özer, 2021). Only seven
106 similar parasite species belonging to Monogenea: *Kuhnia scombri* (Kuhn, 1829) Sproston,
107 1945, *Axine belones* Abildgaard, 1794, *Choricotyle* sp., *Grubea cochlear* Diesing, 1858,
108 *Lamellodiscus elegans*, *Lamellodiscus ignoratus* Palombi, 1943, *Mazocraes* sp. Hermann,
109 1782, were recorded in both Syrian and Turkish marine waters. These species were isolated
110 in 14 fish species including only four similar hosts: *Scomber scombrus* Linnaeus, 1758,
111 *Pagellus erythrinus*, *Boops boops* (Linnaeus, 1758), *Sparus auratus* Linnaeus, 1758 (Table
112 3).

113 Nonetheless, in Lebanon, another adjacent country, studies of marine fish parasites are very
114 scarce, and only a preliminary checklist of Cymothoids (Crustacea: Isopoda) has been

115 provided, including three genera (*Anilocra* Leach, 1818, *Nerocila* Leach, 1818 and
116 *Ceratothoa* Dana, 1852) and seven species (Bariche and Trilles, 2005). Although, similar fish
117 species were studied, no similar parasite species in Syrian and Lebanese waters had been
118 recorded.

119 This difference in parasites diversity depends actually on the number of hosts examined as
120 well as the number of hosts in the regions.

121 It should be noted that the identification of some parasites provided here was limited to genus
122 level only, but the same genus (such as *Gnathia*) was recorded on different fish species. Such
123 genera in our checklist were counted once, that means, more ectoparasite species may be
124 present.

125 The (28) ectoparasite species recorded in (15) fish host species represent only (5%) of the
126 Syrian marine ichthyofauna. Most of the fish species included in the checklist are edible and
127 economically important, such as *M. cephalus*, *Mullus surmuletus* Linnaeus, 1758 and
128 *Scomber scombrus*.

129 When considering all host species listed in our work (Table 2), it appears that there are some
130 uncertainties in the parasite species found. For example, in the case of *Diplodus vulgaris* and
131 *D. sargus* (Linnaeus, 1758), *Chilodonella piscicola* has been reported (Sbeeh *et al.*, 2012),
132 however, this species is generally found on freshwater species (Li *et al.*, 2023). On the same
133 way, *Axine belones* has been reported from *Boops boops* (Hassan *et al.*, 2017) and from
134 *Lithognathus mormyrus* (Linnaeus, 1758) (Hassan *et al.*, 2018b). However, Axinidae
135 parasites are usually reported from needlefishes and halfbeaks (Belonidae and
136 Hemiramphidae) (Kritsky and Bakenhaster, 2022) and except these cited works, has never
137 been found in other species than *Belone belone* in the Mediterranean basin. As a
138 consequence, it appears clearly that more studies need to be done in the region and molecular

139 studies have to be performed on the collected parasites species especially because of the
140 proximity of potential lessepsian parasite species that may colonize closely related fish
141 species.

142

143

144 **Conclusions**

145 In view of great importance of parasites associated with aquaculture, more attention needs to
146 be paid to the increasing seriousness and frequency of diseases caused by parasites in marine
147 fishes. To accomplish this work, further studies to identify the ectoparasites and
148 endoparasites in other fish species, and studying their impact on survival and the chemical
149 composition of fish seem also of great importance. It will be necessary for Syrian researchers
150 to be familiar with advances made in related areas of parasitology, such as biology, ecology,
151 phylogeny and biogeography. Parasitological fauna of fish in the Mediterranean Sea is
152 relatively well known and quite a few species have already been partially sequenced. This
153 may help future work for the inventory of parasite diversity of fish from Syria. This could be
154 achieved with international collaboration with specialists from different countries in order to
155 undertake more detailed studies of these important parasites and to prevent potential diseases.

156 **Acknowledgments:** The authors are grateful to Sophie Arnaud-Haond for her advice during
157 the preparation of the manuscript.

158 **Authors' Contribution:** This work was carried out in collaboration between the authors. All
159 authors read and approved the final manuscript.

160 **Funding Information:** This research received no specific grant from any funding agency,
161 commercial or not-for-profit sectors.

162 **Conflict of interest declaration:** The authors declare none.

163 **Ethical standards:** The authors assert that all procedures contributing to this work comply
164 with the ethical standards of the relevant national and institutional guides on the care and use
165 of laboratory animals.

166 **References**

167 Ali, M. (2018). An updated checklist of the marine fishes from Syria with emphasis on alien
168 species. *Mediterranean Marine Science*, **19(2)**, 388-393.

169 Akmirza, A. (2000). Seasonal distribution of parasites detected in fish belonging to the
170 Sparidae family found near Gokçeada. *The Turkish Journal of Parasitology*, **24(1)**, 435-441.

171 Akmirza, A. (2003). Distribution of parasite fauna of Chub Mackerel in Aegean and
172 Mediterranean Sea. *Journal of the Black Sea/Mediterranean Environment*, **9(3)**, 187-195.

173 Akmirza, A. (2013). Monogeneans of fish near Gökçeada, Turkey. *Turkish Journal of*
174 *Zoology*, **37**, 441-448.

175 Bariche, M. & Trilles, J.P. (2005). Preliminary check-list of Cymothoids (Crustacea:
176 Isopoda) parasitic on marine fishes from Lebanon. *Zoology in the Middle East*, **34(1)**, 53-60.

177 Dayoub, A. (2020). First record of *Lamellodiscus elegans* (Monogenea: Dipletanidae) species
178 on the gills of *Diplodus vulgaris* fish (Eupercaria: Sparidae) bred in Al-Sinn fish farm. *Syrian*
179 *Journal of Agricultural Research*, **7(5)**, 89-100.

180 Dayoub, N. & Dayoub, A. (2020). Investigation on ecto-parasites in two fish species (*Liza*
181 *aurata*, *Mugil cephalus*) in the coastal waters of Latakia. M.S. thesis, Higher Institute for
182 Environmental Research, Tishreen University, Latakia, Syria. 80 pp.

183 Dayoub, A. & Dayoub, N. (2018). First record of *Ligophora mediterraneus* on *Mugil*
184 *cephalus* and *Liza aurata* gills in Latakia coast – Syria. *Tishreen University Journal for*
185 *Research and Scientific Studies - Biological Sciences Series*, **40(5)**, 301-309.

- 186 Derbel, H., Châari, M. & Neifar, L. (2022). Checklist of the Monogenea (Platyhelminthes)
187 parasitic in Tunisian aquatic vertebrates. *Helminthologia*, **59** (2), 179-199.
- 188 Fadel, M., Nisafi, A., & Hassan, M. (2018). Investigation of infection with some
189 ectoparasites in some fish species in the Syrian coast. M.S. thesis, Faculty of Agriculture,
190 Tishreen University, Latakia, Syria. 54 pp.
- 191 Guede, Sh., Hassan, M. & Dayoub, A. (2023). First record of *Kuhnia scombri* (Monogenea:
192 Mazocraeidae) on the gills of Mackerel *Scomber scombrus* in Syria. *Syrian Journal of*
193 *Agricultural Research*, **10**(2), *in press*.
- 194 Hassan, M. & Layka, T. (2018). First record of the parasitoid species *Didymozoon longicolle*
195 *on the gills of Mullus surmuletus* from Syrian marine waters in Mediterranean Sea. *Tartous*
196 *University Journal of Research and Scientific Studies, Engineering Sciences Series*, **2**(3).
- 197 Hassan, M., Nisafi, A. & Mosa, A. (2010). A study of some ectoparasites of four Lessepsian
198 migration fish species and their Intensity in the Syrian marine waters. *Tishreen University*
199 *Journal for Research and Scientific Studies - Biological Sciences Series*, **32**(5), 211-228.
- 200 Hassan, M., Layka, T. & Fadel, M. (2017). Investigation of ectoparasites in *Saprus aurata*
201 and *Boops boops* in the Syrian marine waters. *Tishreen University Journal for Research and*
202 *Scientific Studies - Biological Sciences Series*, **93**(5), 297-307.
- 203 Hassan, M., Layka, T. & Soultanah, R. (2018a). Taxonomic study of ectoparasites in
204 *Lithognathus mormyrus* in Syrian marine waters. *Tishreen University Journal for Research*
205 *and Scientific Studies - Biological Sciences Series*, **40**(5), 274-284.
- 206 Hassan, M., Nisafi, A. & Jabbour, R. (2018b). Taxonomic study of some ectoparasites of two
207 lessepsian fish species *Saurida undosquamis* and *Fistularia commersonii* in the Syrian coast.
208 *Tishreen University Journal for Research and Scientific Studies - Biological Sciences Series*,
209 **40**(1), 215-226.

- 210 Hassan, M., Dayoub, A., & Guede, Sh. (2022). First record of *Caligus pageti* (Copepoda:
211 Caligidae) on *Mugil cephalus* in Syrian marine waters. *Tishreen University Journal for*
212 *Research and Scientific Studies - Biological Sciences Series*, **44(4)**, 97-103.
- 213 Kirjušina, M. & Vismanis, K. (2007). *Checklist of the parasites of fishes of Latvia*. No. 369/3.
214 106 pp. FAO Fisheries Technical Paper Rome.
- 215 Kritsky, D.C. & Bakenhaster, M.D. (2022). Axinids (Monogeneoidea: Mazocraeidea:
216 Microcotylinea) infecting the gill lamellae of some beloniform fishes in the Gulf of Mexico,
217 with descriptions of *Axine buccina* n. sp. from *Hyporhamphus unifasciatus* (Ranzani)
218 and *Nudaciraxine timucua* n. sp. from *Strongylura timucu* (Walbaum). *Systematic*
219 *Parasitology*, **Doi: 10.1007/s11230-022-10060-6**.
- 220 Layka, T. & Hassan, M. (2017). Injury of *Mullus surmuletus* fish with *Kuhnia scombri*
221 (Monogenea: Mazocraeidae) parasites from Syrian marine waters in Mediterranean Sea. *Al-*
222 *Baath University Journal*, **39(46)**, 39-56.
- 223 Layka, T. & Badran, M. (2018). First report of monogenea parasite *Microcotyle mugilis*
224 infecting cultured *Siganus rivulatus* in AL-Sinn fish farm. *Al-Baath University Journal*,
225 **40(3)**, 111-133
- 226 Layka, T. & Badran, M. (2019). First record of *Ligophorus cephalis* (Monogenea:
227 Ancyrocephalidae) on *Liza aurata* from AL-Sinn marine fish farm (Syria). *Tishreen*
228 *University Journal for Research and Scientific Studies - Biological Sciences Series*, **41(1)**,
229 171-180.
- 230 Layka, T., Nisafi, A. & Hassan, M. (2016). First record of *Grubea cochlear* (Monogenea:
231 Mazocraeidae) from (*Mullus surmuletus* L.) in Syrian marine waters and Mediterranean Sea.
232 *Tishreen University Journal for Research and Scientific Studies - Biological Sciences Series*,
233 **38(5)**, 9-18.

- 234 Layka, T. & Saleem, N. (2020). Taxonomic Study of Monogenea parasitic worms on the gills
235 of *Pagellus erythrinus* in the Syrian Marine Waters. *Tishreen University Journal for*
236 *Research and Scientific Studies - Biological Sciences Series*, **42(6)**, 188-197.
- 237 Li, M., Bastos Gomes, G., Zhao, W., Hu, G., Huang, K., Yoshinaga, TG., Clark, T., Li, W.,
238 Zou, H., Wu, S. & Wang, G. (2023). Cultivation of fish ciliate parasites: Progress and
239 prospects. *Reviews in Aquaculture*, **15(1)**, 142- 162.
- 240 Öktener, A. (2005). A checklist of parasitic helminths reported from sixty-five species of
241 marine fish from Turkey including two new records of monogeneans. *Zootaxa*, **1063**, 33-52.
- 242 Özer, A. (2021). *Checklist of Marine, Freshwater, and Aquarium Fish Parasites in Turkey*.
243 No. 62. 311 pp. Istanbul, Turkey, Turkish Marine Research Foundation (TUDAV)
244 Publications.
- 245 Salman, H., Dayoub, A. & Kurhaily, N. (2017). First record of Myxosporean parasites in the
246 gills of Flathead Mullet (*Mugil cephalus*: Mugilidae) in Latakia coasts. *Tishreen University*
247 *Journal for Research and Scientific Studies - Biological Sciences Series*, **39(3)**, 133-147.
- 248 Sbeeh, D., Salman, H. & Hammoud, V. (2012). Contribution to identification of ectoparasites
249 of some species of genus *Diplodus* (Sparidae) in the waters of Latakia coasts. M.S. thesis,
250 Faculty of Sciences, Tishreen University, Latakia, Syria. 78 pp.
- 251 Soultanah, R., Layka, T. & Hassan, M. (2018). Taxonomic study of ectoparasites of some
252 fish species in Syrian marine waters. M.S. thesis, Faculty of Agriculture, Tishreen University,
253 Latakia, Syria. 65 pp.
- 254 Strona, G., Stefani, F. & Galli, P. (2010). Monogenoidean parasites of Italian marine fish: an
255 updated checklist. *Italian Journal of Zoology*, **77(4)**, 419-437.
- 256 Tareen, I.U. (1982). Parasitic infections of commercially important fish in Turkish water and
257 microhabitat utilization. *II Conferencia Mediterranea de parasitologia* (29 september-2
258 October), Granada (Spain), 175.

- 259 Tokşen, E., Çağırđan, H. & Tanrıkul, T. (2003). The morphology of *Lamellodiscus ignoratus*
260 Palombi, 1943, gill parasite of *Puntazzo puntazzo* Cetti, 1777. *XII National Aquatic Products*
261 *Symposium* (2-5 Eylül 2003 Elazıđ), Elazıđ, 195.

262 **Table 1. List of ectoparasites recorded in Syrian marine waters. Abbreviations: G: Gills, S: Skin, CF: Caudal Fin, BC: Buccal Cavity,**
 263 **S.S: Samlpe size (individuals), I.S: Infected Site, P%: Prevalence, Int: Mean Intensity, (-) no data.**

Class	Species: Family	Host: Family	S.S	I.S	P%	Int	Reference
Hexanauplia	<i>Caligus apodus</i> (Brian, 1924): Caligidae	<i>Mugil cephalus</i> : Mugilidae	124	G,S	-	-	Dayoub and Dayoub (2020)
	<i>Caligus apodus</i>	<i>Chelon auratus</i> : Mugilidae	142	G,S	-	-	Dayoub and Dayoub (2020)
	<i>Caligus pageti</i> Russell, 1925: Caligidae	<i>Mugil cepahlus</i>	238	CF	2.1	1.2	Hassan <i>et al.</i> (2022)
	<i>Hatschekia sp.</i> Poche, 1902: Hatschekiidae	<i>Lithognathus mormyrus</i> : Sparidae	54	G	14.3	2.2	Hassan <i>et al.</i> , 2018a
Malacostraca	<i>Gnathia sp.</i> Leach, 1814: Gnathiidae	<i>Siganus rivulatus</i> : Siganidae	50	G	8	2.5	Hassan <i>et al.</i> (2010)
	<i>Gnathia sp.</i>	<i>Siganus luridus</i> : Siganidae	50	G	10	1.8	Hassan <i>et al.</i> (2010)
	<i>Gnathia sp.</i>	<i>Fistularia commersonii</i> : Fistulariidae	150	G,BC	13.3	1.2	Hassan <i>et al.</i> (2018b)
	<i>Gnathia sp.</i>	<i>Lithognathus mormyrus</i>	54	G	8.6	1.7	Hassan <i>et al.</i> (2018a)
	<i>Gnathia sp.</i>	<i>Saurida undosquamis</i> : Synodontidae	100	G,BC	14	1.2	Hassan <i>et al.</i> (2018b)
	<i>Gnathia sp.</i>	<i>Sparus auratus</i> : Sparidae	55	G	3.6	2	Fadel <i>et al.</i> (2018)
Maxillopoda	<i>Ergasilus sp.</i> von Nordmann, 1832: Ergasilidae	<i>Mugil cephalus</i>	124	G	-	-	Dayoub and Dayoub (2020)
	<i>Ergasilus sp.</i>	<i>Chelon auratus</i>	142	G	-	-	Dayoub and Dayoub (2020)
Monogenea	<i>Ancyrocephalus sp.</i> Creplin, 1839: Ancyrocephalidae	<i>Sargocentron rubrum</i> : Holocentridae	50	G	28	2.1	Hassan <i>et al.</i> (2010)
	<i>Axine belones</i> Abildgaard, 1794: Axinidae	<i>Boops boops</i> : Sparidae	85	G	56.5	2.5	Hassan <i>et al.</i> (2017)
	<i>Axine belones</i>	<i>Lithognathus mormyrus</i>	54	G	8.6	2	Hassan <i>et al.</i> (2018a)
	<i>Furnistinia echeneis</i> (Wagener, 1857): Diplectanidae	<i>Sparus auratus</i>	55	G	32.7	1.6	Hassan <i>et al.</i> (2017)
	<i>Furnistinia echeneis</i>	<i>Boops boops</i>	85	G	-	-	Fadel <i>et al.</i> (2018)
	<i>Glyphidohaptor plectocirra</i> (Paperna, 1972): Dactylogyridae	<i>Siganus rivulatus</i>	50	G	70	3.9	Hassan <i>et al.</i> (2010)
	<i>Glyphidohaptor plectocirra</i>	<i>Siganus luridus</i>	50	G	70	3.1	Hassan <i>et al.</i> (2010)
	<i>Grubea cochlear</i> Diesing, 1858: Mazocraeidae	<i>Mullus surmuletus</i> : Mullidae	50	G	40	5	Layka <i>et al.</i> (2016)
	<i>Kuhnia scombri</i> (Kuhn, 1829) Sproston, 1945: Mazocraeidae	<i>Mullus surmuletus</i>	50	G	42	2	Layka and Hassan (2017)
	<i>Kuhnia scombri</i>	<i>Scomber scombrus</i> : Scombridae	224	G	4.5	1.5	Gnedet <i>et al.</i> (2023)
	<i>Lamellodiscus elegans</i> Bychowsky, 1957: Diplectanidae	<i>Diplodus sargus</i> : Sparidae	100	G	-	-	Sbeeh <i>et al.</i> (2012)
	<i>Lamellodiscus elegans</i>	<i>Lithognathus mormyrus</i>	54	G	68.6	39.5	Hassan <i>et al.</i> (2018a)
	<i>Lamellodiscus elegans</i>	<i>Sparus auratus</i>	55	G	20	2.4	Fadel <i>et al.</i> (2018)
	<i>Lamellodiscus elegans</i>	<i>Diplodus vulgaris</i> : Sparidae	18	G	88.9	-	Dayoub (2020)

Table 1. Continued

Class	Species: Family	Host: Family	S.S	I.S	P%	Int	Reference
Monogenea	<i>Lamellodiscus elegans</i>	<i>Pagellus erythrinus</i> : Sparidae	146	G	87.7	11.5	Layka and Saleem (2020)
	<i>Lamellodiscus ignoratus</i> Palombi, 1943: Diplectanidae	<i>Diplodus vulgaris</i>	104	G	-	-	Sbeeh <i>et al.</i> (2012)
	<i>Lamellodiscus ignoratus</i>	<i>Diplodus sargus</i>	100	G	-	-	Sbeeh <i>et al.</i> (2012)
	<i>Lamellodiscus sp.</i> Johnston & Tiegs, 1922: Diplectanidae	<i>Diplodus vulgaris</i>	104	G	-	-	Sbeeh <i>et al.</i> (2012)
	<i>Lamellodiscus sp.</i>	<i>Diplodus sargus</i>	100	G	-	-	Sbeeh <i>et al.</i> 2012
	<i>Ligophorus mediterraneus</i> Sarabeev, Balbuena & Euzet, 2005: Ancyrocephalidae	<i>Mugil cephalus</i>	133	G	17.4	-	Dayoub and Dayoub (2018)
	<i>Ligophorus mediterraneus</i>	<i>Chelon auratus</i>	133	G	25	-	Dayoub and Dayoub (2018)
	<i>Ligophorus cephalis</i> : Ancyrocephalidae	<i>Chelon auratus</i>	45	G	18.4	1	Layka and Badran (2019)
	<i>Mazocraes sp.</i> Hermann, 1782: Mazocraeidae	<i>Sargocentron rubrum</i>	50	G	56	3.9	Hassan <i>et al.</i> (2010)
	<i>Microcotyle mugilis</i> Vogt, 1878: Microcotylidae	<i>Siganus rivulatus</i>	60	G	0.6	-	Layka and Badran (2018)
	<i>Microcotyle spinicirrus</i> MacCallum, 1918: Microcotylidae	<i>Lithognathus mormyrus</i>	54	G	15.4	3	Soultanah <i>et al.</i> (2018)
	<i>Microcotyle sp.</i> Van Beneden & Hesse, 1863: Microcotylidae	<i>Pagellus erythrinus</i>	146	G	25.3	1.6	Layka and Saleem (2020)
	<i>Choricotyle sp.</i> Van Beneden & Hesse, 1863: Dicliphoridae	<i>Pagellus erythrinus</i>	146	G	0.7	1	Layka and Saleem (2020)
Myxozoa	<i>Myxobolus bizerti</i> Bahri & Marques, 1996: Myxobolidae			G	-	-	
	<i>Myxobolus ichkeulensis</i> Bahri & Marques, 1996: Myxobolidae	<i>Mugil cephalus</i>	557	G	-	-	Salman <i>et al.</i> (2017)
	<i>Myxobolus muelleri</i> Bütschli, 1882: Myxobolidae			G	-	-	
	<i>Myxobolus parvus</i> Shulman, 1962: Myxobolidae			G	-	-	
Oligohymenophorea	<i>Trichodina sp.</i> Ehrenberg, 1830: Trichodinidae	<i>Mugil cephalus</i>	124	S	8.1	64	Dayoub and Dayoub (2020)
Phyllopharyngea	<i>Chilodonella piscicola</i> Strand, 1928: Chilodonellidae	<i>Diplodus vulgaris</i>	104	G,S	-	-	Sbeeh <i>et al.</i> (2012)
	<i>Chilodonella piscicola</i>	<i>Diplodus sargus</i>	100	G,S	-	-	Sbeeh <i>et al.</i> (2012)
Trematoda	<i>Didymozoon longicolle</i> Ishii, 1935: Didymozoidae	<i>Mullus surmuletus</i>	50	G	-	-	Hassan and Layka (2018)

265 **Table 2. List of ectoparasites and host fish species recorded in Syrian marine waters.**
 266 **(PC): Potential to be cultivated.**

Host: Family	Parasite species: Family	Reference
<i>Boops boops</i> : Sparidae	<i>Axine belones</i> : Axinidae	Hassan <i>et al.</i> (2017)
	<i>Furnistinia echeneis</i> : Diplectanidae	Fadel <i>et al.</i> (2018)
<i>Diplodus sargus</i> : Sparidae	<i>Chilodonella piscicola</i> : Chilodonellidae	Sbeeh <i>et al.</i> (2012)
	<i>Lamellodiscus elegans</i> : Diplectanidae	=
	<i>Lamellodiscus ignoratus</i> : =	=
	<i>Lamellodiscus sp.</i> : =	=
<i>Diplodus vulgaris</i> : Sparidae	<i>Chilodonella piscicola</i> : Chilodonellidae	Sbeeh <i>et al.</i> (2012)
	<i>Lamellodiscus elegans</i> : Diplectanidae	Dayoub (2020)
	<i>Lamellodiscus ignoratus</i> : =	Sbeeh <i>et al.</i> (2012)
	<i>Lamellodiscus sp.</i> : =	=
<i>Fistularia commersonii</i> : Fistulariidae	<i>Gnathia sp.</i> : Gnathiidae	Hassan <i>et al.</i> (2018b)
<i>Lithognathus mormyrus</i> : Sparidae	<i>Axine belones</i> : Axinidae	Hassan <i>et al.</i> (2018a)
	<i>Gnathia sp.</i> : Gnathiidae	=
	<i>Hatschekia sp.</i> : Hatschekiidae	=
	<i>Lamellodiscus elegans</i> : Diplectanidae	=
	<i>Microcotyle spinicirrus</i> : Microcotylidae	Soultanah <i>et al.</i> (2018)
<i>Chelon auratus</i> : Mugilidae (PC)	<i>Caligus apodus</i> : Caligidae	Dayoub and Dayoub (2020)
	<i>Ergasilus sp.</i> : Ergasilidae	=
	<i>Ligophorus cephalis</i> : Ancyrocephalidae	Layka and Badran (2019)
	<i>Ligophorus mediterraneus</i> : =	Dayoub and Dayoub (2018)
<i>Mugil cephalus</i> : Mugilidae (PC)	<i>Caligus apodus</i> : Caligidae	Dayoub and Dayoub (2020)
	<i>Caligus pageti</i> : =	Hassan <i>et al.</i> (2022)
	<i>Ergasilus sp.</i> : Ergasilidae	Dayoub and Dayoub (2020)
	<i>Ligophorus mediterraneus</i> : Ancyrocephalidae	Dayoub and Dayoub (2018)
	<i>Myxobolus bizerti</i> : Myxobolidae	Salman <i>et al.</i> (2017)
	<i>Myxobolus ichkeulensis</i> : =	=
<i>Myxobolus muelleri</i> : =	=	

Table 2.
Continued

Host: Family	Parasite species: Family	Reference
<i>Mugil</i>	<i>Myxobolus parvus</i> : Myxobolidae	Salman <i>et al.</i> (2017)

<i>cephalus:</i> Mugilidae	<i>Trichodina sp.:</i> Trichodinidae	Dayoub and Dayoub (2020)
<i>Mullus surmuletus:</i> Mullidae	<i>Didymozoon longicolle:</i> Didymozoidae	Hassan and Layka (2018)
	<i>Grubea cochlear:</i> Mazocraeidae	Layka <i>et al.</i> (2016)
	<i>Kuhnia scombri:</i> =	Layka and Hassan (2017)
<i>Pagellus erythrinus:</i> Sparidae	<i>Choricotyle sp.:</i> Dicliphoridae	Layka and Saleem (2020)
	<i>Lamellodiscus elegans:</i> Diplectanidae	=
	<i>Microcotyle sp.:</i> Microcotylidae	=
<i>Sargocentron rubrum:</i> Holocentridae	<i>Ancyrocephalus sp.:</i> Ancyrocephalidae	Hassan <i>et al.</i> (2010)
	<i>Mazocraes sp.:</i> Mazocraeidae	=
<i>Saurida undosquamis:</i> Synodontidae	<i>Gnathia sp.:</i> Gnathiidae	Hassan <i>et al.</i> (2018b)
<i>Scomber scombrus:</i> Scombridae	<i>Kuhnia scombri:</i> Mazocraeidae	Gnede <i>et al.</i> (2023)
<i>Siganus rivulatus:</i> Siganidae (PC)	<i>Glyphidohaptor plectocira:</i> Dactylogyridae	Hassan <i>et al.</i> (2010)
	<i>Gnathia sp.:</i> Gnathiidae	=
	<i>Microcotyle mugilis:</i> Microcotylidae	Layka and Badran (2018)
<i>Siganus luridus:</i> Siganidae	<i>Glyphidohaptor plectocira:</i> Dactylogyridae	Hassan <i>et al.</i> (2010)
	<i>Gnathia sp.:</i> Gnathiidae	=
<i>Sparus auratus:</i> Sparidae (PC)	<i>Furnistinia echeneis:</i> Diplectanidae	Hassan <i>et al.</i> (2017)
	<i>Gnathia sp.:</i> Gnathiidae	Fadel <i>et al.</i> (2018)
	<i>Lamellodiscus elegans:</i> Diplectanidae	=

267

268

269

270

271

272

273

274 **Table 3. List of similar ectoparasites recorded in Syrian and Turkish waters. (-) no data.**

Parasite: Species - Class	Syrian waters		Turkish waters	
	Host	Reference	Host	Reference
<i>Kuhnia scombri</i> : Monogenea	<i>Mullus surmuletus</i>	Layka and Hassan (2017)	<i>Scomber japonicus</i> : Scombridae	Akmirza (2003)
	<i>Scomber scombrus</i>	Gnede <i>et al.</i> (2023)	<i>Scomber scombrus</i>	Tareen (1982)
<i>Axine belones</i> : Monogenea	<i>Boops boops</i>	Hassan <i>et al.</i> (2017)	<i>Belone belone</i> : Belonidae	Öktener (2005)
	<i>Lithognathus mormyrus</i>	Hassan <i>et al.</i> (2018a)	-	
<i>Choricotyle</i> sp: Monogenea	<i>Pagellus erythrinus</i>	Layka and Saleem (2020)	<i>Pagellus erythrinus</i>	Akmirza (2000)
		-	<i>Spondylisoma cantharus</i> : Sparidae	Akmirza (2013)
		-	<i>Boops boops</i>	Akmirza (2013)
<i>Grubea cochlear</i> : Monogenea	<i>Mullus surmuletus</i>	Layka <i>et al.</i> (2016)	<i>Scomber scombrus</i>	Tareen (1982)
<i>Lamellodiscus elegans</i> : Monogenea	<i>Diplodus sargus</i>	Sbeeh <i>et al.</i> (2012)	<i>Sparus auratus</i>	Tareen (1982)
	<i>Lithognathus mormyrus</i>	Hassan <i>et al.</i> (2018a)	-	
	<i>Sparus auratus</i>	Fadel <i>et al.</i> (2018)	-	
	<i>Diplodus vulgaris</i>	Dayoub (2020)	-	
	<i>Pagellus erythrinus</i>	Layka and Saleem (2020)	-	
<i>Lamellodiscus ignoratus</i> : Monogenea	<i>Diplodus vulgaris</i>	Sbeeh <i>et al.</i> (2012)	<i>Diplodus puntazzo</i> : Sparidae	Tokşen <i>et al.</i> (2003)
	<i>Diplodus sargus</i>	Sbeeh <i>et al.</i> (2012)	-	
<i>Mazocraes</i> sp: Monogenea	<i>Sargocentron rubrum</i>	Hassan <i>et al.</i> (2010)	<i>Alosa immaculata</i> : Clupeidae	Akmirza (2013)

275

276