

Digenea trematodes in fish of the North Adriatic Sea

Vesna PARADIŽNIK * and Branko RADUJKOVIĆ

Podgorica University, Department of Biology, Cetinjski put bb., 81 000 Podgorica

** Corresponding author, e-mail: yogapopetre@yahoo.com*

The paper gives an overview of trematodes that have been isolated from the north Adriatic Sea fish, during a 10-year research program. A total of 63 marine fish species of pelagic and benthic fish of the classes Chondrichthyes and Osteichthyes were analyzed. We found that 21 fish species hosted digenean trematodes (33.33% prevalence), and 12 fish species are reported as hosts for the first time. During our research, 63 species of fish (total of 2659 fish) were examined and 25.16 % were found invaded by endohelminths, belonging to 22 digeneans species.

Key words: Trematoda, Digenea, flukes, north Adriatic

INTRODUCTION

The objective of the paper is to give a list of trematodes species found in marine fish species in the north Adriatic, and present their morphology, based on 10-year investigations.

While the first research on trematodes in marine fish was carried out in the north Adriatic Sea, most of the flukes occur frequently in the fish of the Adriatic Sea, (STOSSICH, 1883-1901; MONTICELLI, 1893; LOOSS, 1907). Afterwards the research was continued by JANISZEWSKA (1953) who described 22 digenean species, and SEY (1970) isolating 33 species in the middle Adriatic. In 1985, JARDAS & HRISTOVSKI examined 220 fish of 63 species and found 13 species of digenean trematodes. A ten years research by Yugoslav and French parasitologists, culminated with a monograph that documented some 26 species of digenean trematode in 124 examined species



Fig. 1. Location of gill-netting lines

of sea fish (3341 examples) (RADUJKOVIĆ *et al.*, 1989). In the area of the north Adriatic Sea (Fig.1) further research was carried out by BRGLEZ & PARADIŽNIK (1988) and PARADIŽNIK (1989, 1991a,b, 1992).

MATERIALS AND METHODS

Fish were collected daily from 1993-2003 from local fishermen. They were caught by gill-netting in Slovenian coastal waters, refrigerated, and examined in the laboratory for the presence of digenean trematodes on the same day. Endoparasites were put in Petri dishes with seawater and physiologic saline, and observed *in*

vivo. The measurements were carried out using a micrometric ocular. Trematodes were pressed between two glass slides, fixed in Bouin-Hollande fixative or in 70% alcohol, stained by Grenacher borax carmine and mounted in Canadian balsam. Isolated helminthes were determined in the Institute for Biology of the Sea in Kotor, at the Biological Institute of Montpellier II (Sciences et Techniques), as well as in the laboratory of the National Museum of Natural Science in Paris where the specimens were photographed and deposited.

Table 1 shows isolated digeneans and respective hosts. Drawings were previously published in Acta Adriatica (RADUJKOVIĆ *et al.*, 1989).

Table 1. Isolated digeneans and respective hosts

TREMATODE	HOST
<i>Hemiurus appendiculatus</i> Rudolphi, 1802	<i>Sardina pilchardus</i> *
<i>Aphanurus stossichi</i> Monticelli, 1891	<i>Sardina pilchardus</i> , <i>Scomber scombrus</i> *, <i>Boops boops</i> , <i>Pagellus erythrinus</i> *
<i>Lecithochirium musculus</i> Looss, 1907	<i>Trachurus trachurus</i> *, <i>Serranus hepatus</i> *, <i>Crenilabrus cinereus</i> *, <i>Conger conger</i> *, <i>Atherina hepsetus</i> *
<i>Lecithaster atherinae</i> Orecchia, Paggi, Radujković, 1988	<i>Serranus hepatus</i> *, <i>Atherina hepsetus</i> *
<i>Derogenes latus</i> Janiszewska, 1953	<i>Mullus barbatus</i> , <i>Trisopterus minutus capellanus</i> *
<i>Helicometra fasciata</i> Rudolphi, 1819	<i>Lepidotrigla cavillone</i> *, <i>Conger conger</i> , <i>Scomber scombrus</i>
<i>Monorchis monorchis</i> Stossich, 1890	<i>Boops boops</i> *, <i>Spicara flexuosa</i> *
<i>Bacciger bacciger</i> Rudolphi, 1819	<i>Atherina hepsetus</i> *
<i>Metadena depressa</i> Stossich, 1883	<i>Boops boops</i> *
<i>Lepocreadium album</i> Stossich, 1890	<i>Diplodus annularis</i> , <i>D. sargus</i> *
<i>Holorchis pycnopus</i> Stossich, 1901	<i>Sardina pilchardus</i> *

Legend:

* New host species in the north Adriatic Sea

RESULTS

Family: Hemiuridae Lühe, 1901

Genus: *Hemiurus*, Rudolphi, 1809

Species: *Hemiurus appendiculatus* (Rudolphi 1802)

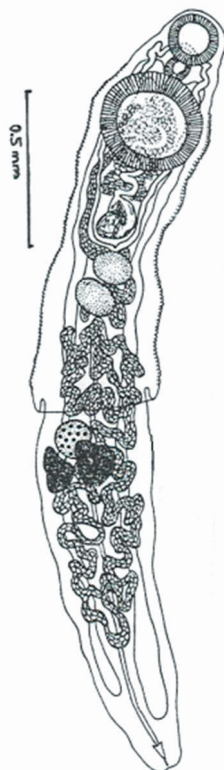


Fig. 2. *Hemiurus appendiculatus*, adult

Synonyms: *Fasciola appendiculata* Rudolphi, 1802; *Distoma appendiculatum*, Rudolphi, 1808; *Distoma ventricosum* Wagner, 1860; *Apoblemma appendiculatum* Rudolphi

Host: *Sardina pilchardus* Wal. (European pilchard)

Sites: Intestine of 1.3% *Sardina pilchardus* Wal.

Localities: North Adriatic Sea

Description

Body elongated, long 3.5 mm and wide 0.3 to 0.5 mm. Tail relatively elongate, 1 mm long. Cuticula covered with tiny spines until the ovary. Oral sucker and acetabulum located in the front of the body; oral sucker measuring 0.18 mm in diameter, longer acetabulum 0.25 mm x 0.21 mm. Pharynx oval, long 0.20 mm, wide

0.10 mm. Caeca bifurcation begin near pharynx, reaching the end of the tail. Testes two, oval, oblique, 0.18 mm in diameter. Seminal vesicle overlapping acetabulum and bipartite. Genital pore located submedian, postacetabular. Ovary oval, located far from testes in the tail, 0.15 mm in diameter. Uterus entering tail until the end of the caeca. Eggs yellowish, 0.08 mm x 0.01 mm. Vitellaria postovarian, with irregular form, compactly, measuring 0.30 x 0.22 mm. Mature and juvenile forms were found only in the spring time. In the wintertime no infection was observed.

Discussion

H. appendiculatus was found in the Adriatic Sea by STOSSICH (1898) and FISCHTHAL (1980), in the stomach of *Boops boops*. In the Skadar lake the trematode was discovered in migratory fish species *Alosa fallax* by KAŽIĆ (1970).

This is the first finding of *H. appendiculatus* in *Sardina pilchardus* in the Adriatic Sea.

Family: Hemiuridae Lühe, 1901

Genus: *Aphanurus* Looss, 1907

Species: *Aphanurus stossichi* (Monticelli, 1891)

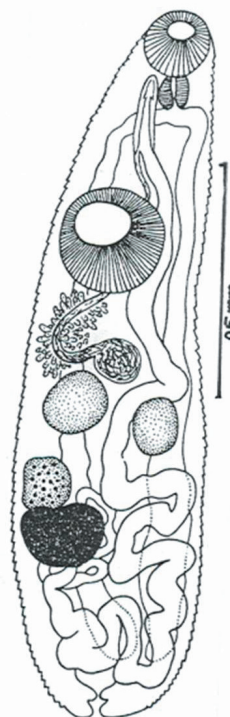


Fig. 3. *Aphanurus stossichi*, adult

Synonyms: *Aphanurus balticus* Slusarski, 1958; *Apoblema stossichi* (Stossich, 1883)

Host: *Sardina pilchardus* (European pilchard), *Scomber scombrus* (Atlantic mackerel), *Boops boops* (Bogue), *Pagellus erythrinus* (Common pandora)

Sites: Intestine of 6.6 % *Sardina pilchardus* Wal.; 2.01 % *Scomber scombrus* L.; 10 % *Boops boops* L. and 1.08 % *Pagellus erythrinus* L.

Localities: North Adriatic Sea

Description

Body elongate, subcylindrical, narrow in frontal part of the body. Little contractile tail, frequently non visible, on the end of the body. Cuticula wrinkled. Parasite long 0.5 to 1.5 mm and wide 0.13 to 0.38 mm. Oral sucker terminal, measuring 0.03 to 0.05 mm in diameter. Pharynx oval, oesophagus long, caeca wide, reaching the top of the body. Acetabulum is larger than oral sucker, 0.12 - 0.15 mm in diameter. Testes two, 0.05 mm in diameter, located in second part of the body. Seminal vesicle pretestical, genital pore near the oral sucker, ovary oval, 0.03 mm, in the last third of the body. One compact large vitellaria, 0.2 mm x 0.25 mm, postovarian. Uterus with eggs situated behind the vitellaria, distending until the end of the body. Eggs yellow-brown, 0.02 - 0.03 mm x 0.01 - 0.02 mm. The excretory vessels united in forebody, excretory pore large within vestige of ecsoma.

Discussion

Apoblema stossichi was isolated from the intestine of *Sardina pilchardus* for the first time by STOSSICH (1883) in Trieste, and neighboring waters. MONTICELLI (1893) noted the trematode and LOOSS (1907) changed its name to *Aphanurus stossichi*. In the coastal waters of Split the trematode was isolated by NIKOLAEVA (1966) in the intestine of *Engraulis encrasicolus* L., *Boops boops* L. and *Myctophum punctatum* Raf., while SEY (1970) found the trematode in the intestine of *Boops boops* L. In the Aphanurinae, *Neoaphanurus* (TANG *et al.*, 1983) is considered to be a synonym of *Aphanurus* (LOOSS, 1907). BRAY (1990) synonymized, *Minutocauda* (SRIVASTAVA and SAHAY, 1977) with *Aphanurus*. OKTENER

(2005) found the parasite in fish *Boops boops* from the Aegean Sea.

Scomber scombrus and *Pagellus erythrinus* are the new host for *A. stossichi* in the Adriatic Sea.

Family: Lecithochiridae Skrjabin, in Guschanskaja 1954

Genus: *Lecithochirium* Lühe, 1901

Species: *Lecithochirium musculus* (Looss, 1907)

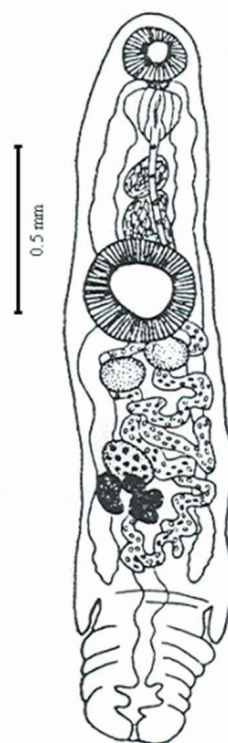


Fig. 4. *Lecithochirium musculus*, adult

Synonyms: *Sterrhurrus musculus* (Looss, 1907) Nasir and Diaz, 1971; *Brachyphallus musculus* (Looss) Skrjabin and Guschanskaja, 1955; *Lecithochirium branchialis* Stunkard and Nigrelli, 1966; *Lecithochirium floridensis* (Mantel, 1974)

Host: *Trachurus trachurus* L. (Atlantic horse-mackerel), *Serranus hepatus* L. (Brown comber), *Crenilabrus cinereus* Bon. (Tort roquer), *Conger conger* L. (Conger eel) and *Atherina hepsetus* L. (Atherina).

Sites: Intestine of 1.2% *Trachurus trachurus* L., 1.6% *Serranus hepatus* L., 9.1% *Crenilabrus cinereus* Bon., 25% *Conger conger* L. and 1.2% *Atherina hepsetus* L.

Localities: North Adriatic Sea

Description

Body elongate with strong ecsoma, cuticula smooth. Mature trematod long 1 - 3 mm and wide 0.3 - 0.5 mm. Oral sucker muscled, subterminal, measuring 0.10 - 0.15 mm in diameter. Pharynx oval, measuring 0.07 mm in diameter. Oesophagus short, caeca wide, riching the anterior part of the tail. Seminal vesicle bipartite. Acetabulum rounded, placed on the end of the first quarter of the body, measuring 0.30 mm in diameter. Testes two, rounded, postacetabular, measuring 0.17 - 0.20 mm in diameter. Cirrus pouch large, near the caeca bifurcation. Ovary rounded, 0.15 mm in diameter, at the middle of the body. Vitellaria postovarian, lobed. Uterus coiled from acetabulum to the end of caeca. Eggs yellowish, 0.02 x 0.01 - 0.02 mm.

Discussion

The trematode was found in the Adriatic Sea by LOOSS (1907) in *Anguilla anguilla*, *Dentex dentex*, *Acipenser sturio*, *Lichia amia*, *Psetta maxima*, *Lophius piscatorius*, *Gobius niger*, *Ophidion barbatum*, *Trachinus draco*, *Pagellus erythrinus*, *Merlangius merlangus*, *Dicentrarchus labrax*, *Serranus cabrilla*, *Arisoma balearicum*, *Citharus linguatula*, *Merluccius merluccius*, *Gobius cruentatus*. NIKOLAEVA (1966) noted it in *Arnoglossus laterna* and *Solea lutea* and JARDAS & HRISTOVSKI (1985) isolated it in *Symphodus tinca*. RADUJKOVIĆ *et al.* (1989) isolated it from the intestine of *Citharus linguatula* and *Arnoglossus laterna* from the Bay of Boka Kotorska, while in the Mediterranean *S. musculus* was described by DOLLFUS (1962), BRINKMANN (1967), PAPOUTSOGLU (1976), ORECCHIA & PAGGI (1978) and SAAD-FARÈS (1985) from 13 fish species.

Trachurus trachurus L., *Serranus hepatus* L., *Crenilabrus cinereus* Bon., *Conger conger* L. and *Atherina hepsetus* L. are the five new hosts for this parasite in the northern Adriatic.

Family: Lecithasteridae Skrjabin in Guschanskaja, 1954

Genus: *Lecithaster* Lühe, 1901

Species: *Lecithaster atherinae* Orecchia, Paggi, Radujković, 1988

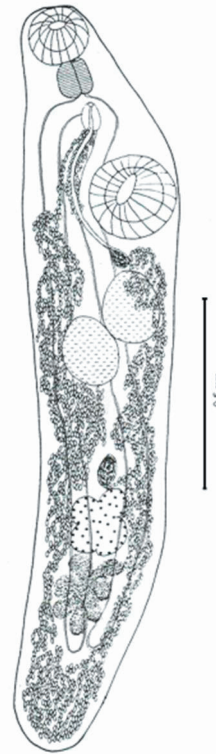


Fig. 5. *Lecithaster atherinae*, adult

Host: *Serranus hepatus* L. (Brown comber), *Atherina hepsetus* L. (Atherina)

Synonyms: *Anadichadena* Dutta, 1995

Sites: Intestine of 3.3% *Serranus hepatus* L.; 1.3 % *Atherina hepsetus* L.

Localities: North Adriatic Sea

Description

The adult is elongated, long 1.2 - 2.0 cm, wide 0.3 - 0.5 mm. Cuticula smooth, oral sucker subterminal, projecting up, 0.15 mm in diameter. Pharynx oval, long 0.12 mm and wide 0.08 mm. Oesophagus short, goes in caecal branches, reaching the end of the body. Acetabulum rounded, larger than oral sucker, situated on the end of the first third of the body, 0.23 mm in diameter. Testes two, oval shape, oblique, 0.16 mm in diameter. Seminal vesicle situated above testes. Cirrus pouch visible under caeca bifurca-

tion, 0.12 mm x 0.08 mm. Genital pore short, medioventral near caeca bifurcation. Ovary 0.20 mm x 0.13 mm, lobed, situated on the beginning of the last third of the body. Seminal receptaculum situated preovarian, 0.12 mm x 0.07 mm. Vitellaria postovarian, lobed. Uterus coiled from acetabulum until the end of the body. Eggs yellowish, 0.02 mm.

Discussion

Previously the parasite was found in the Adriatic Sea (Bay of Boka Kotorska) by ORECC-HIA *et al.* (1988) in the intestine of 5.13 % *Atherina boyeri*. In the northern Adriatic two new fish species were found hosting this trematode for the first time.

Family: Halipegidae Poche, 1925

Genus: *Derogenes* Lühe, 1900

Species: *Derogenes latus* Janiszewska, 1953

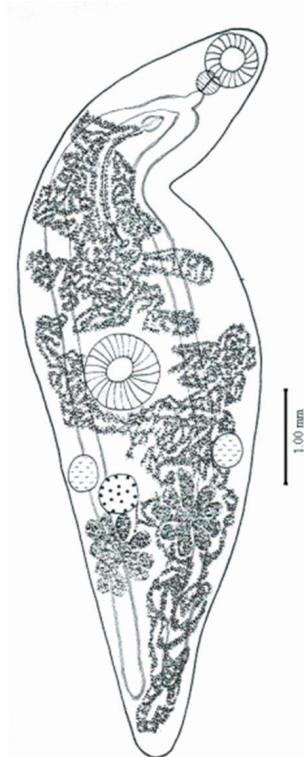


Fig. 6. *Derogenes latus*, adult

Host: *Mullus barbatus* L. (Red mullet), *Trisopterus minutus capelanus* Risso. (Poorcod)

Synonyms: *Liopyge* Looss, 1889; *Liocerca* Looss, 1902

Sites: Intesine of 4.6% *Mullus barbatus* L. and 14.28% *Trisopterus minutus capelanus* Risso.

Localities: North Adriatic Sea

Description

Body fusiform, rounded at the anterior end, sharply narrowing at the posterior end. Cuticula thick. Preoral lip present. Oral sucker beaker-like, 0.50 x 0.45 mm. Pharynx oval 0.18 x 0.16 mm. Oesophagus shorter than pharynx, 0.13 x 0.06 mm. Caeca ending past the vitelline gland. Acetabulum spherical, 0.80 x 0.63 mm, below the middle of the body. Testes two, oval, below the ventral sucker, symmetrical, 0.34 x 0.19 mm. Vesicula seminalis small, below the half distance between porus genitalis and acetabulum. Pars prostatica conspicuous, short, surrounded by well developed glandular cells. Hermaphroditic pouch globular, 0.17 x 0.20 mm. Porus genitalis opposite the pharynx. Ovary oval, 0.34 x 0.1 mm, below testis. Receptaculum seminis resembling in shape the ovary, between the testes and the ovary, 0.31 x 0.09 mm. Vitellaria behind ovary, distant one to another, 0.54 x 0.35 mm. Uterus in the whole posterior part of the body, behind the vitellaria, extending upwards in transversale coils. Eggs 0.05 x 0.25 mm, thick-shelled, dark yellow.

Discussion

The trematode was discovered by Janiszewska (1953) in the intestine of *Mullus barbatus* in the Adriatic Sea. RADUJKOVIĆ *et al.* (1989) noted the parasite in 13.3% of examined *Lithognathus mormyrus* from the Bay of Boka Kotorska. NIKOLAEVA (1966) found the parasite in *Aspitrigla cuculus*. *Trisopterus minutus capelanus* Risso is a new host in the Adriatic Sea.

Family: Opecoelidae Ozaki, 1925

Genus: *Helicometra* Odhner, 1902

Species: *Helicometra fasciata* (Rudolphi, 1819)

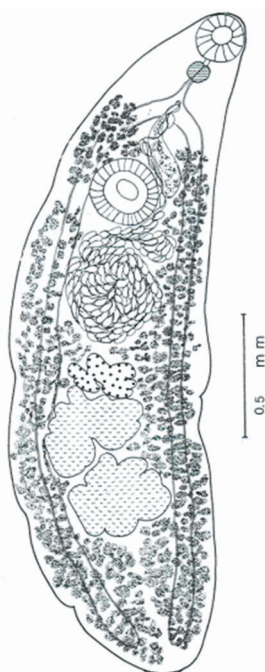


Fig. 7. *Helicometra fasciata*, adult

Synonyms: *Distoma fasciatum* Rudolphi, 1819; *Distoma gobii* Stossich, 1883; *Laborchis mutabilis* Stossich, 1902, *Allocreadium fasciatum* Rudolphi, 1819; *Distoma (Dicrocoelium) fasciatum* Rudolphi, 1819; *Helicometra mutabilis* Stossich, 1903; *Helicometra gobii* Stossich, 1883; *Helicometra flava* Stossich, 1903

Host: *Lepidotrigla aspera* GTHR (Large-scaled), *Conger conger* L. (Conger eel) and *Scomber scombrus* L. (Atlantic mackerel)

Sites: Intestine of 50% *Lepidotrigla aspera* GTHR, 25 % *Conger conger* L. and 0.5 % *Scomber scombrus* L.

Localities: North Adriatic Sea

Description

Body oval, 2.6 – 4.0 mm x 0.6 – 0.7 mm. Oral sucker subterminal, 0.20 mm in diameter. Prepharynx short, oesophagus spherical, 0.09 mm in diameter, divided into branches reaching the end of the body. Acetabulum pedunculated, longer than oral sucker, 0.16 mm in diameter, placed at the end the first third of the body. Testes two lobed, tandem post ovarian. Lobes vary in number having deep lobation, 0.30 – 0.40 mm. Cirrus pouch situated between caeca bifurcation and acetabulum, 0.38 mm x 0.10 mm. Atrium genital short, genital pore medioventral

near caeca bifurcation. Ovarium lobed, 0.14 mm x 0.26 mm. The globular vitelline follicles occupy the whole lateral part of the body, from caeca bifurcation until the end. Uterine coils spherical, confined to the intercaeca, between ovary and acetabulum. Eggs 0.06 x 0.03 mm, having long tails.

Discussion

Found in the Adriatic Sea for the first time by STOSSICH 1883, while PALOMBI (1929) made a revision of the genus *Helicometra* Odhner. The trematode was isolated by JANISZEWSKA (1953), ERGENS (1960), SEY (1970), JARDAS and HRISTOVSKI (1985) and RADUJKOVIĆ *et al.* (1989) in 23 fish species from the middle and southern Adriatic while in the Mediterranean it was noted by RUDOLPHI (1819) and PAPOUTSOGLU (1976) in four fish species. AKMIRZA (2004) found the parasite in the greater weever (*Trachinus draco* L.) from Gokceada, Turkey.

Lepidotrigla cavillone is a new host for *H. fasciata* in the Adriatic Sea.

Family: Monorchidae Odhner, 1911

Genus: *Monorchis* Looss, 1902

Species: *Monorchis monorchis* (Stossich, 1890)



Fig. 8. *Monorchis monorchis*, adult

Synonyms: *Distomum monorchis* Stossich, 1890; *Distomum tartinii* Stossich

Host: *Boops boops* L (Bogue), *Spicara flexuosa* Val. (Mendole)

Sites: Intestine of 10 % *Boops boops* L, 1.8% *Spicara flexuosa* Val.

Localities: North Adriatic Sea

Description

The body spherical, 0.9 – 1.0 mm x 0.7 – 0.8 mm. Cuticula covered with tiny spines, oral sucker subterminal, 0.15 mm in diameter. Pharynx spherical, 0.07 mm in diameter. Oesophagus very short, dividing into caecal, reaching the end of the body. Acetabulum rounded, medial, smaller than oral sucker, 0.90 mm. Large testis, laterally placed in last third of the body, 0.25 x 0.16 mm. Cirrus pouch between acetabulum and caeca bifurcation, 0.40 x 0.13 mm. Pars prostatica, vesicula seminalis and cirrus covered with spines. Genital atrium located medial, near caeca bifurcation. Ovary lobed, situated between testis and cirrus pouch, 0.15 mm x 0.12 mm. The globular vitelline divided in two lateral groups, near the caeca bifurcation. Uterine coils occupy the whole middle part of the body. Eggs 0.02 x 0.01 mm.

Discussion

The trematode was discovered by Stossich (1890) in the Adriatic Sea, and confirmed by LOOSS (1902), ODHNER (1911) and SEY (1970) in the fish *Spondyliosoma cantharus*, *Oblada melanura*, *Sparus aurata*, *Diplodus vulgaris*, *D. annularis* and *Parablennius gattorugine*. RADUJKOVIĆ *et al.* (1989) discovered the parasite in the intestine of 75% of examined *Arnoglossus laterna* and 14.11% *D. annularis* in the Bay of Boka Kotorska.

It was also quoted by WLASENKO (1931), POGORELTSEVA (1952), DOLGIKH & NAIDENOVA (1967) and NAIDENOVA & GAEVSKAYA (1978) in *Spicara maena*, *S. smar*is and *D. annularis* from the Black Sea. TIMON-DAVID (1967), PAPOUTSOGLU (1976) and ORECCHIA & PAGGI (1978) isolated it in *Parablennius gattorugine*, *Blennius pavo*, *Diplodus sargus*, *D. annularis*, *D. vulgaris*, *D. puntazzo*, *Sparus aurata*, *Spicara*

smaris and *Sardinella aurita* in the Mediterranean. OKTENER (2005) found the parasite in the fish *Gaidropsarus mediterraneus*, *Gobius cobitis*, *Symphodus tinca* and *Zosterisessor ophiocephalus* from the Sea of Marmora.

Boops boops L. and *Spicara flexuosa* Val. are the new hosts for *M. monorchis* in the Adriatic Sea.

Family: Faustulidae Poche, 1926

Genus: *Bacciger* Nicoll, 1914

Species: *Bacciger bacciger* Rudolphi, 1819; Nicoll, 1914

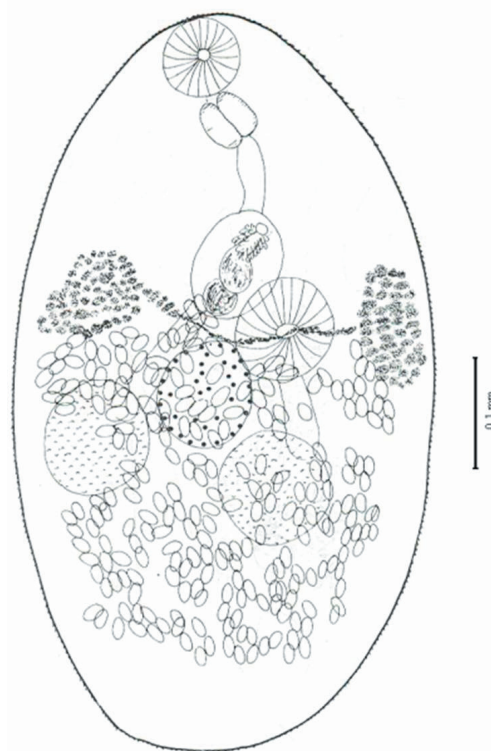


Fig. 9. *Bacciger bacciger*, adult

Synonyms: *Distoma baccigerum* Rudolphi, 1819; *Distomum (Dicrocoelium) baccigerum* Rudolphi 1898; *Dicrocoelium baccigerum* Rudolphi, 1913; *Bacciger nicolli* Palombi, 1934; *Pseudobacciger nicolli* Palombi, 1929

Host: *Atherina hepsetus* L. (Atherina)

Sites: Intestine of 1.2% *Atherina hepsetus* L.

Localities: North Adriatic Sea

Description

The body oval, very wide, cuticula covered with spines. Mature parasite measuring 0.50 – 1.20 mm x 0.30 – 0.50 mm. Oral sucker subterminal, 0.10 mm in diameter. Prepharynx short, pharynx spherical, 0.05 mm in diameter. Oesophagus long 0.11 mm, caeca short, ending above testes. Ventral sucker spherical, longer than oral sucker, 0.20 mm. Testes two, spherical 0.17 mm in diameter. Cirrus pouch large, 0.10 mm x 0.09 mm, located along caeca bifurcation. Genital atrium deep, genital pore above ventral sucker. Ovary oval, between ventral sucker and testes, 0.22 mm in diameter. Vitelline follicles lateral at each side of the body, at the level of ventral sucker. Uterine coils occupy the last part of the body. Eggs 0.02 mm.

Discussion

The trematode was found in the Adriatic Sea by STOSSICH (1888,1889) and SEY (1970) in *Atherina hepsetus* and *Boops boops*. RADUJKOVIĆ *et al.* (1989) isolated the parasite from 5.13% *Atherina boyeri*, while in the Mediterranean and the Black Sea, it was noted by RUDOLPHI (1819), PALOMBI (1934), CARRERE (1937), SKRJABIN & KOVAL (1957), NIKOLAEVA (1963), PARUKHIN *et al.* (1971), PAPOUTSOGLU (1976), ORECCHIA & PAGGI (1978) and RENAUD *et al.* (1980) from *Atherina hepsetus*, *Atherina pontica*, *Engraulis encrasicolus*, *E. encrasicolus ponticus* and *Boops boops*.

In the Atlantic it was found by NICOLL (1914) and BRAY & GIBSON (1980) from *Atherina presbyter*. Genus *Bacciger* (NICOLL, 1924) is now considered to belong in the family Faus-tulidae (POCHE, 1926). Molecular evidence has indicated that this family is distant from the true fellodistomes and close to the zoogonids (HALL *et al.*, 1999, CRIBB *et al.*, 2001, GIBSON *et al.*, 2002). OKTENER (2005) found the parasite in fish *Boops boops* and *Scomber japonicus* from the Aegean Sea.

Family: Cryptogonimidae Ward, 1917

Subfamily: Metadeninae Yamaguti, 1958

Species: *Metadena depressa* Stossich 1883

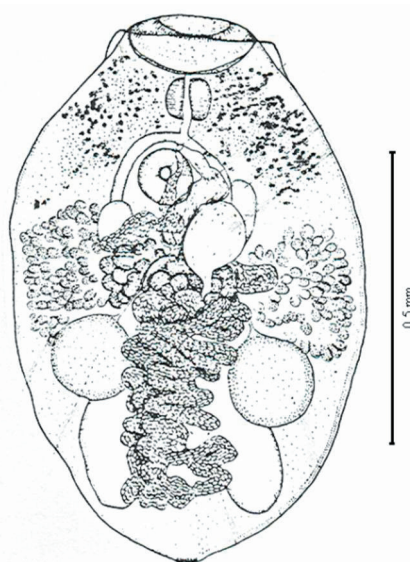


Fig. 10. *Metadena depressa*, adult

Synonyms: *Distomum depressum* Stossich, 1883

Host: *Boops boops* L. (Bogue)

Sites: Two mature and one juvenile form in the intestine of *Boops boops*.

Localities: North Adriatic Sea

Description

Body oval, covered by thin cuticle, 1.0 – 1.3 mm x 0.8 mm, at the widest point, measuring 0.97 - 1.5 mm. Oral sucker well developed, disc-like, terminal, surrounded by a collar-shaped fold of muscles, 0.30 x 0.22 mm. Prepharynx very short, passes in well developed pharynx, 0.15 in diameter. Oesophagus very short, dividing in two caecal branches reaching the end of the body. Ventral sucker on the end of the first third of the body, smaller than oral sucker, 0.12 mm. Testes globular, lateral, in the posterior half of the body, separated by the convolutions of the uterus. Vesicula seminallis posteriorly extending from the edge of the ovary, until the bifurcation of the intestine, afterwards opening into a very small atrium genital, lying before acetabulum. Cirrus and pars prostatica are not developed. Testes 0.18 – 0.20 mm. Ovary divided in several small lobes, situated anterior to the testes, behind the ventral sucker, in the middle of the body. Receptaculum seminis large, oval and near ovary. Vitellaria divided in two follicular groups

on the lateral part of the body, under ventral sucker. Uterus forms many coils, between caeca and testes. Eggs, dark brown, 0.02 x 0.02 mm.

Discussion

Metadena depressa is not a very well known parasite. According to JANISZEWSKA (1953) it is identical to *Distomum depressum*, and described by STOSSICH (1886, 1898) and CARUS (1885) from *Dentex dentex*. Because of the characteristic morphologies of members of the genus *Metadena*, LINTON (1910), JANISZEWSKA (1953) suggested the name *Metadena depressa* instead of *Distomum depressum* Stossich (1883). This species is quite different from other parasites of *Metadena* genus, like *M. pagrosomi* Yamaguti, (1938) and *M. crassulata* Linton (1910), especially due to the structure of the oral sucker, spherical muscular disc and location of the uterus.

Family: Lepocreadiidae Odhner, 1905

Genus: *Lepocreadium* Stossich, 1903

Species: *Lepocreadium album* (Stossich, 1890)

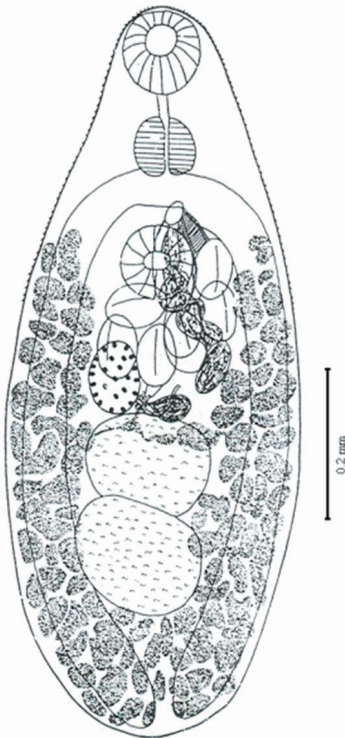


Fig. 11. *Lepocreadium album*, adult

Synonyms: *Distomum album* Stossich, 1890; *Allocreadium album* Stossich, 1901

Host: *Diplodus annularis* L. (Annular sea bream), *D. sargus* L. (White sea bream)

Sites: Intestine of 6.7% *Diplodus annularis* L. and 5.8% *D. sargus* L.

Localities: North Adriatic Sea

Description

The body oval, 2 mm x 0.90 mm. Cuticula covered with spines. Oral sucker subterminal, 0.20 mm in diameter. Prepharynx short, pharynx spherical, 0.18 mm x 0.15 mm. Oesophagus short. The curved caeca reach the posterior part of the body. Ventral sucker spherical, equal to oral sucker, located under the caeca bifurcation, on the end of the first third of the body. Testes two, subspheric tandem, in the second part of the body near the ovary, 0.25 x 0.20 mm. Vesicula seminalis visible, situated above the testes. Cirrus pouch situated above ventral sucker 0.20 x 0.09 mm, comprising vesicula seminalis interna, pars prostatica and ductus ejaculatorius. Genital atrium wide, visible above ventral sucker. Genital pore median, in the level of ventral sucker. Ovary oval, pretestical, 0.15 x 0.12 mm. Vitellaria filling all the lateral place of the body, from ventral sucker until the end of the body. Uterus in the middle with low number of the eggs, 0.09 x 0.05 mm. Excretory pore posterior, terminal.

Discussion

This trematod was found in Adriatic Sea for the first time by STOSSICH (1890) and SEY (1970) in the fish *Spondyliosoma cantharus* and *Oblada melanura*. RADUJKOVIĆ *et al.* (1989) isolated it in 11.8% of *Diplodus annularis*. It was found in the Mediterranean by PAPOUTSOGLU (1976), PAGGI & ORECCHIA (1976), ORECCHIA & PAGGI (1978), FISCHTAL (1980,1982) and SAAD-FARÈS (1985) in *Boops boops*, *Spondyliosoma cantharus*, *Chromis chromis*, *Diplodus annularis*, *D. sargus*, *D. vulgaris*, *Spicara maena*, *S. flexuosa*, *S. smaris*, *Oblada melanura*, *D. puntazzo*, *Sparus aurata*, *Sarpa salpa*, *Pagrus pagrus* and *Blennius pavo*. OKTENER (2005) found the parasite in fish *Boops boops*, *Diplodus annularis*, *D. vulgaris*, *D. sargus*, *Spondyliosoma cantharus*,

Oblada melanura and *Spicara smaris* in the Aegean Sea.

Diplodus sargus is a new host for *L. album* in the Adriatic Sea

Family: Lepocreadidae Odhner, 1905

Genus: *Holorchis* Stossich, 1901

Species: *Holorchis pycnopus* Stossich, 1901

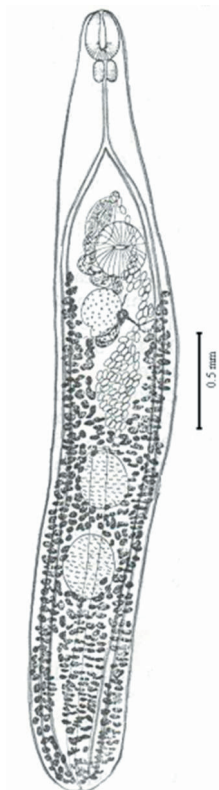


Fig. 12. *Holorchis pycnopus*, adult

Synonyms: *Holorchis legendrei* Dollfus, 1948; *Holorchis ioannoui* Brinkmann, 1967

Host: *Sardina pilchardus* Wal. (European pilchard)

Sites: Intestine of 1.6% *Sardina pilchardus* Wal.

Localities: North Adriatic Sea

Description

Body elongated, wormlike, 1.8 – 5.5 mm x 0.5 to 1.0 mm. Oral sucker subterminal, 0.28 mm. Pharynx spherical 0.12 mm in diameter, oesophagus long, 0.28 mm. Ventral sucker rounded, 0.32 mm, located on the end of the first third of the body. Testes two, subspherical, at

the beginning of the last third of the body, 0.27 mm. Vesicula seminalis externa long, tubular between ovary and cirrus pouch, above ventral sucker, 0.28 x 0.18 mm. Cirrus pouch comprises vesicula seminalis interna, tubular, short, pars prostatica and a well developed ductus ejaculatorius. Genital atrium deep, genital pore lining median between caeca bifurcation and ventral sucker. Ovary irregular, spherical, spliced, below the ventral sucker, 0.25 x 0.19 mm. Receptaculum seminalis is near the ovary. Vitellaria glands occupying space between ventral sucker until the end of the body. Uterus located pretesticular. Eggs 0.07 x 0.04 mm. Excretory pore terminal.

DISCUSSION

In the Adriatic the trematode was discovered by Stossich (1901) and Dollfus (1946, 1948) in *Diplodus vulgaris*, *Mullus barbatus* and *M. surmuletus*. RADUJKOVIĆ *et al.* (1989) isolated the parasite from the intestine of 10% *Pagellus erythrinus* and 13.3% *Lithognathus mormyrus*. In the Mediterranean it was isolated by BRINKMANN (1967), PAGGI & ORECCHIA (1974), ORECCHIA & PAGGI (1974), PAPOUTSOGLU (1976), BARTOLI & PREVOT (1978), FISCHTHAL (1980) & SAAD-FARÈS (1985) in *Uranoscopus scaber*, *Diplodus annularis*, *D. vulgaris*, *Lithognathus mormyrus*, *Pagellus erythrinus*, *Bothus podas* and *Pagrus pagrus*. OKTENER (2005) found the parasite in the fish *Lithognathus mormyrus* from the Aegean Sea.

Sardina pilchardus is a new host for *H. pycnopus* in the Adriatic Sea.

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Digene trematode u sjevernom Jadranu

Vesna PARADIŽNIK* i Branko RADUJKOVIĆ

Sveučilište u Podgorici, Odsjek biologije, Cetinjski put bb., 81 000 Podgorica

**Kontakt adresa, e-mail: yogapopetre@yahoo.com*

SAŽETAK

U ovom radu dat je pregled trematoda koje su pronađene u sjevernom Jadranu tijekom desetogodišnjih parazitološko-faunističkih istraživanja. Pregledane su 63 vrste pelagičkih i bentičkih riba sjevernog Jadrana koje pripadaju razredima hrskavičnjača i koštunjača (ukupno 2.659 primjeraka). Utvrdili smo da 21 riblja vrsta udomljava parazite, tj. da su digene trematode bile prisutne kod 33,33% invadiranih riba. Nadalje smo ustanovili 12 novih domaćinskih vrsta riba za digene trematode.

Ključne riječi: Trematoda Digenea, flukes, sjeverni Jadran