

***Pseudopycnadena tendu* sp. nov. (Digenea, Opecoelidae) in the yellow-spotted triggerfish *Pseudobalistes fuscus* (Perciformes, Balistidae) and additional opecoelids parasitizing fishes from the waters off New Caledonia**

Rodney A. Bray^{1*} and Jean-Lou Justine²

¹Department of Zoology, Natural History Museum, Cromwell Road, London SW7 5BD, UK; ²Équipe Biogéographie Marine Tropicale, Unité Systématique, Adaptation, Évolution (CNRS, UPMC, MNHN, IRD), Institut de Recherche pour le Développement, BP A5, 98848 Nouméa Cedex, Nouvelle-Calédonie

Abstract

Pseudopycnadena tendu sp. nov. is described from the balistid *Pseudobalistes fuscus* from the waters off New Caledonia. It differs from the only other member of the genus *P. fischthali* Saad-Fares et Maillard, 1986, in its broad cirrus-sac, with the wide field of large gland-cells, its less nearly circular body shape, its dorsal excretory pore, its shorter post-testicular region, its relatively larger ventral sucker and its smaller eggs. The genus is re-defined to take these distinctions into account. Other opecoelid species reported from New Caledonia are *Allopodocotyle epinepheli* (Yamaguti, 1942) from *Epinephelus cyanopodus*, *E. fasciatus* and *E. merra*, *Cainocreadium epinepheli* (Yamaguti, 1934) from *E. coeruleopunctatus*, *E. fasciatus* and *Variola louti*, *Hamacreadium mutabile* (Linton, 1910) from *Lutjanus fulviflamma* and *L. kasmira*, *Helicometra epinepheli* Yamaguti, 1934 from *E. fasciatus* and *E. merra*, *Orthodena tropica* Durio et Manter, 1968 from *Lethrinus lentjan*, *Pacificreadium serrani* (Nagaty et Abdel-Aal, 1962) from *Plectropomus leopardus* and *Pseudoplagioporos interruptus* Durio et Manter, 1968 from *Lethrinus rubrioperculatus*.

Résumé

Pseudopycnadena tendu sp. nov. est décrit du baliste *Pseudobalistes fuscus* pêché en Nouvelle-Calédonie. L'espèce diffère du seul autre membre du genre, *P. fischthali* Saad-Fares et Maillard, 1986, par son sac du cirre plus épais avec un champ large de cellules glandulaires, sa forme du corps presque circulaire, son pore excréteur dorsal, sa partie post-testiculaire plus courte, sa ventouse ventrale relativement plus grande et ses œufs plus petits. Le genre est redéfini pour prendre en compte ces distinctions. D'autres Opecoelidae sont mentionnés de Nouvelle-Calédonie: *Allopodocotyle epinepheli* (Yamaguti, 1942) de *Epinephelus cyanopodus*, *E. fasciatus* et *E. merra*, *Cainocreadium epinepheli* (Yamaguti, 1934) de *E. coeruleopunctatus*, *E. fasciatus* et *Variola louti*, *Hamacreadium mutabile* (Linton, 1910) de *Lutjanus fulviflamma* et *L. kasmira*, *Helicometra epinepheli* Yamaguti, 1934 de *E. fasciatus* et *E. merra*, *Orthodena tropica* Durio et Manter, 1968 de *Lethrinus lentjan*, *Pacificreadium serrani* (Nagaty et Abdel-Aal, 1962) de *Plectropomus leopardus* et *Pseudoplagioporos interruptus* Durio et Manter, 1968 de *Lethrinus rubrioperculatus*.

Key words

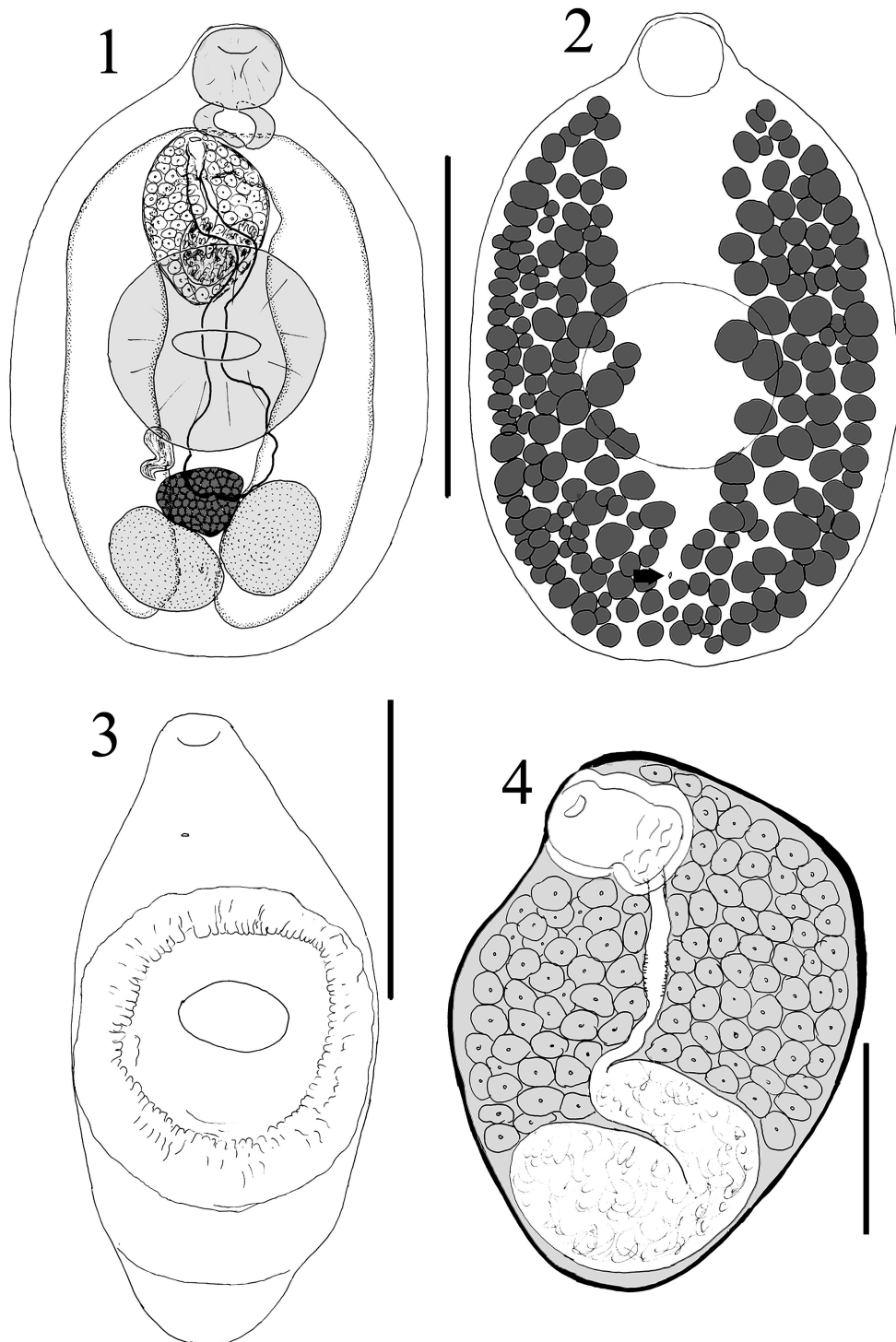
Digenea, *Pseudopycnadena tendu*, Balistidae, *Pseudobalistes fuscus*, New Caledonia, *Allopodocotyle epinepheli*, *Cainocreadium epinepheli*, *Hamacreadium mutabile*, *Helicometra epinepheli*, *Orthodena tropica*, *Pacificreadium serrani*, *Pseudoplagioporos interruptus*

Introduction

According to Cribb (2005) the family Opecoelidae Ozaki, 1925 is one of the largest found in fishes, comprising some 85 genera and 800 species. They are frequently encountered in

coral reef fishes, particularly serranids, lutjanids and lethrinids. They are less frequently found in balistids, but we here describe a new and unusual opecoelid from *Pseudobalistes fuscus*, a fish which harbours several other digenean species. We have recovered seven species from just two host speci-

*Corresponding author: rab@nhm.ac.uk



Figs 1–4. *Pseudopycnadena tendu* sp. nov. **1.** Ventral view of holotype, omitting vitellarium, uterus in outline. **2.** Ventral view of holotype, showing vitellarium and excretory pore (arrowed). **3.** Ventral surface of paratype, showing accessory attachment organ. **4.** Cirrus-sac. Scale bars = 500 µm (1, 2, 3); 100 µm (4)

mens in New Caledonian waters. Three are lepecreadiids, *Hypocreadium toombo* Bray et Justine, 2006, *Lobatocreadium exiguum* (Manter, 1963) (see Bray and Justine 2006) and an as yet unidentified form, with one apocreadiid, *Sphincteristomum acollum* Oshmarin, Mamaev et Parukhin, 1961, one acanthocolpid, an immature *Stephanostomum* sp., one possible monorchiid, probably belonging to the enigmatic genus *Cableia*, and the opacoelid described here. In addition to describing this new species, we list the other opacoelids we have recovered from the reef-fishes of New Caledonia.

Materials and methods

Digeneans were collected alive, immediately fixed in hot seawater then transferred to ethanol. Wholemounds were stained with Mayer's paracarmine, cleared in beechwood creosote and mounted in Canada balsam. Measurements were made through a drawing tube on an Olympus BH-2 microscope, using a Digicad Plus digitising tablet and Carl Zeiss KS100 software adapted by Imaging Associates, and are quoted in micrometres, with the range and the mean in parentheses. The following abbreviations are used: BMNH, the British Museum (Natural History) Collection at the Natural History Museum, London, UK; MNHN, Muséum National d'Histoire Naturelle, Paris.

Results

Family Opacoelidae Ozaki, 1925
Subfamily Plagioporinae Manter, 1947

Genus *Pseudopycnadena* Saad-Fares et Maillard, 1986

Emended diagnosis: Body almost round to oval, robust, with distinct raised rugate annular ridge across entire ventral surface. Tegument unarmed. Oral sucker subglobular, terminal. Ventral sucker large, equatorial. Prepharynx short, wide. Pharynx large, oval. Intestinal bifurcation in mid-forebody. Caeca long, wide, reaching close to posterior extremity. Testes two, oval, symmetrical, in about mid-hindbody. Cirrus-sac variable, narrow or wide. Genital pore sinistrally or dextrally submedian or median, at or near pharyngeal or bifurcal level. Ovary oval, more or less median, more or less pre-testicular. Uterus mainly in intercaecal anterior hindbody and dorsal to ventral sucker, may pass into post-testicular region. Eggs numerous, tanned, operculate. Vitellarium follicular, fields cover much of dorsal plane between pharynx or oesophagus and posterior extremity. Excretory pore terminal or dorsal. Type-species *P. fischthali* Saad-Fares et Maillard, 1986.

Pseudopycnadena tendu sp. nov. (Figs 1–4)

Description: Based on 15 wholemounts, 13 measured. Body oval, robust, with distinct raised rugate annular ridge on ven-

tral surface around ventral sucker aperture; 863–1,292 × 475–753 (1,014 × 593); width 48.6–69.3 (58.6)% of length (Figs 1 and 3). Tegument unarmed. Oral sucker subglobular but somewhat angular, terminal; 119–166 × 137–233 (139 × 167). Ventral sucker large, rounded, equatorial; 275–464 × 253–427 (341 × 343). Sucker-length ratio 1:2.14–2.89 (2.47), width ratio 1.76–2.51 (2.08). Forebody 279–392 (329) long; 28.4–35.1 (32.6)% of body-length. Prepharynx short, wide, within posterior cavity of oral sucker. Pharynx wider than long, with wide lumen; 61–114 × 82–194 (82 × 133). Pharynx to oral sucker ratio 1:1.09–1.71 (1.27). Oesophagus short or not evident; 0–41 (9). Intestinal bifurcation in mid-forebody, 89–204 (138) from ventral sucker. Caeca long, wide, reaching just past testes, but posterior extremity often obscured by vitelline follicles; when seen reach to 27–90 (59) of posterior extremity.

Testes two, oval, symmetrical, contiguous, in about mid-hindbody; 81–219 × 104–217 (165 × 156). Post-testicular distance 56–137 (87); 5.81–12.2 (8.53)% of body-length. Cirrus-sac broadly oval, thick walled, overlaps ventral sucker; 210–295 × 169–276 (255 × 202); length 22.2–30.6 (25.3)% of body-length (Fig. 4). Internal seminal vesicle tubular, coiled in proximal third of cirrus-sac. Pars prostatica narrow, ensheathed in large, wide field of large, prominent gland-cells. Ejaculatory duct, wide, cup-shaped, thick-walled. Genital atrium small. Genital pore dextral, at bifurcal level or just prebifurcal, may overlie right caecum.

Ovary oval, more or less median, overlapping antero-median part of both testes; usually just posterior to ventral sucker by up to 89 (29), but may just overlap; 72–153 × 122–167 (110 × 146). Seminal receptacle oval, antero-dextral to ovary. Laurer's canal opens dorsally to ovary. Mehlis' gland anterior to ovary. Uterus mainly in intercaecal anterior hindbody, between testes and ventral sucker, lying ventrally to ovary, passes as wide tube dorsally to ventral sucker and ventrally to cirrus-sac. Metraterm thin-walled, runs over ventral surface of cirrus-sac, not clearly delimited from uterus. Eggs numerous, tanned, operculate; 49–63 × 18–28 (54 × 25). Vitellarium follicular, follicles reach from level of oesophagus, 129–259 (198) anterior to ventral sucker, to posterior extremity, lateral to caeca and encroaching dorsally throughout extent, confluent as fairly narrow band in post-testicular region (Fig. 2).

Excretory pore dorsal at posterior part of testicular region (Fig. 2). Vesicle extent not seen.

Type-host: *Pseudobalistes fuscus* (Bloch et Schneider, 1801), Balistidae, yellow-spotted triggerfish.

Site: Intestine.

Type-locality: Îlot Signal, off Nouméa, New Caledonia (22°17'S, 166°17'E, 30/05/2006, fish JNC1844).

Other locality: Récif Toombo, New Caledonia (22°26'S, 166°33'E, 13/12/2005, fish JNC1680).

Prevalence: 100%, 1/1 at each locality.

Type-specimens: holotype MNHN JNC1844D1, paratypes MNHN JNC1844D2–D6, JNC1680D1–D3, BMNH 2006.11.16.1–6.

Etymology: 'Te Ndu' is the kanak name of Îlot Signal, the type-locality.

Discussion: There are two particularly unusual features to this worm, which make its placement problematical. These are the cirrus-sac, which is broadly oval and contains a massive field of large gland-cells, and the annular ridge on the ventral surface, presumably forming an accessory attachment organ.

According to Cribb (2005) a robust, relatively squat body with a ventral ridge is a characteristic of several plagiopore genera, namely *Pycnadenoides* Yamaguti, 1938, *Pinguirema* Siddiqi et Cable, 1960, *Pachycreadium* Manter, 1954, *Pro-pycnadenoides* Fischthal et Kuntz, 1964 and *Pseudopycnadena* Saad-Fares et Maillard, 1986. None has a similar cirrus-sac, all having a more typical claviform plagiopore arrangement.

This species, however, keys to the genus *Pseudopycnadena*, sharing with the type and only species *P. fischthali* Saad-Fares et Maillard, 1986, most notably, the ventral accessory attachment organ and the symmetrical testes. The features that distinguish this species may be of generic status, but if, as here, it is considered provisionally congeneric with *P. fischthali*, it is necessary to emend the generic definition to include: The broad cirrus-sac, with the wide field of large gland-cells; the less nearly circular body shape; the dorsal excretory pore; the shorter post-testicular region; the relatively larger ventral sucker; the smaller eggs.

Pseudopycnadena fischthali was first mentioned as 'Pycnadena-like' worm from the sparid, the white seabream *Diplodus sargus* (Linnaeus, 1758) off the Mediterranean coast of Israel by Fischthal (1980). It was first described and named by Saad-Fares and Maillard (1986) from *D. sargus* and the common two-banded seabream *D. vulgaris* (Geoffroy Saint-Hilaire, 1817) off Lebanon. It was redescribed and a generic definition supplied by Bartoli *et al.* (1989) based on material from *D. sargus*, *D. vulgaris* and the annular sea bream *Diplodus annularis* (Linnaeus, 1758) off Corsica, in the western Mediterranean. Further reports from these *Diplodus* spp. by Sasal *et al.* (1999), Jousson *et al.* (1999) and Bartoli *et al.* (2005) [who also reported the species in the sharpnosed seabream *Diplodus puntazzo* (Cetti, 1777)] in the western Mediterranean indicate that, most probably, this species is restricted to perciforms of the family Sparidae and the genus *Diplodus* in the Mediterranean Sea.

Pseudopycnadena tendu, on the other hand, is found only in fishes of a different order, the Tetraodontiformes, the family Balistidae and the species *Pseudobalistes fuscus*. *Pseudobalistes* has been poorly sampled over its range, so any comments on the likely distribution of the species would be premature.

Further records of opecoelids from New Caledonia

Allopodocotyle epinepheli (Yamaguti, 1942) from intestine of the speckled blue grouper *Epinephelus cyanopodus* (Richardson, 1846) [Serranidae], Passe de Dumbéa (22°20'00"S,

166°15'00"E, 19/09/2004), MNHN JNC1267, BMNH 2006.11.8.44-45.

Allopodocotyle epinepheli (Yamaguti, 1942) from digestive tract of the blacktip grouper *E. fasciatus* (Forsskal, 1775) [Serranidae], Récif Le Sournois (22°31'30"S, 166°26'30"E, 28/11/2005), MNHN JNC1667, BMNH 2006.11.8.44-45.

Allopodocotyle epinepheli (Yamaguti, 1942) from intestine of the honeycomb grouper *E. merra* Bloch, 1793 [Serranidae], Bord Ouest du Récif Toombo, depth 7–20 m (22°32'48"S, 166°26'36"E, 25/01/2005), MNHN JNC1434, BMNH 2006.11.8.4.

Cainocreadium epinepheli (Yamaguti, 1934) from caeca of the whitespotted grouper *E. coeruleopunctatus* (Bloch, 1790) [Serranidae], Fausse Passe de Uitoé, (22°12'S, 166°7'E, 10/07/2006), MNHN JNC1905.

Cainocreadium epinepheli (Yamaguti, 1934) from intestine, stomach and caecum of *E. fasciatus*, off Ever Prosperity Wreck, external slope (22°27'30"S, 166°21'50"E, 26/04/2006), MNHN JNC1791, JNC1792, BMNH 2006.11.8.1-2 and 14-16.

Cainocreadium epinepheli (Yamaguti, 1934) from caecum of the yellow-edged lyretail *Variola louti* (Forsskal, 1775) [Serranidae], Récif Le Sournois (22°31'30"S, 166°26'30"E, 28/11/2005), MNHN JNC1662, BMNH 2006.11.8.17-18.

Hamacreadium mutabile (Linton, 1910) from intestine of the dory snapper *Lutjanus fulviflamma* (Forsskal, 1775) [Lutjanidae], Anse Vata, Nouméa, from the beach, 0.5 m depth, (22°18'13"S, 166°26'44"E, 20/09/2004), MNHN JNC1268C1.

Hamacreadium mutabile (Linton, 1910) from the intestine of the common bluestripe snapper *Lutjanus kasmira* (Forsskal, 1775) [Lutjanidae] Off Ever Prosperity, external slope, depth 60 m (22°27'30"S, 166°21'50"E, 22/08/2006), MNHN JNC1923.

Helicometra epinepheli Yamaguti, 1934 from intestine and caecum of *E. fasciatus*, Récif Kué (22°34'30"S, 166°28'20"E, 14/01/2004), MNHN JNC1023, BMNH 2006.11.8.27-29; Passe de Boulari (22°32'S, 166°28'E, 09/11/2005), MNHN JNC1636B, BMNH 2006.11.8.22; Côte Blanche, Nouméa (22°18'6"S, 166°26'00"E, 25/11/2005), MNHN JNC1658A, BMNH 2006.11.8.23-26; Récif Le Sournois (22°31'30"S, 166°26'30"E, 28/11/2005), MNHN JNC1664, JNC1666, JNC1667, BMNH 2006.11.8.19-21; off Ever Prosperity Wreck (22°27'S, 166°21'E, 26/04/2006), MNHN JNC1787.

Helicometra epinepheli Yamaguti, 1934 from intestine of *E. merra*, Bord Ouest du Récif Toombo, 7–20 m (22°32'48"S, 166°26'36"E, 25/01/2005), MNHN JNC1433, JNC1434, BMNH 2006.11.8.30-34; Côte Blanche, Nouméa (22°18'6"S, 166°26'00"E, 18 and 21/11/2005), MNHN JNC1649, JNC1650, JNC1652, JNC1653, BMNH 2006.11.8.35-40; Anse Vata, Nouméa, (22°18'30"S, 166°25'50"E, 12/05/2006), MNHN JNC1827.

Orthodena tropica Durio et Manter, 1968 from the digestive tract of the pink ear emperor *Lethrinus lentjan* (Lacepède, 1802) [Lethrinidae], Îlot Signal (22°18'30"S, 166°25'50"E, 17/05/2006), MNHN JNC1834, BMNH 2006.11.8.13.

Pacificreadium serrani (Nagaty et Abdel-Aal, 1962) from the stomach of the leopard coral grouper *Plectropomus leopardus* (Lacepède, 1802) [Serranidae], Îlot Signal (22°17'S, 166°17'E, 12/10/2004) MNHN JNC1392E1-E11, BMNH 2006.11.8.3-10.

Pseudoplagioporus interruptus Durio et Manter, 1968 from *Lethrinus rubrioperculatus*, Passe de Dumbéa, depth 35 m, (22°21'30"S, 166°15'20"E, 28/09/2004) MNHN JNC1360, BMNH 2006.11.8.11.

Acknowledgements. Ian Beveridge (Melbourne), František Moravec (České Budějovice), and several students, Eric Bureau, Amandine Marie, Géraldine Colli, Guilhem Rascalou, Matthias Vignon and Aude Sigura, participated in the fishing operations and parasitological survey. Claude Chauvet (UNC, Nouméa) and Gérard Mou-Tham (IRD, Nouméa) caught certain specimens. Sam Tereua, Miguel Clarque and Napoléon Colombani, captains of the NO "Coris" provided safe navigation. Angelo di Matteo (IRD) provided technical help. Tom Cribb (The University of Queensland) kindly read the manuscript.

References

- Bartoli P., Gibson D.I., Bray R.A. 2005. Digenean species diversity in teleost fish from a nature reserve off Corsica, France (Western Mediterranean), and a comparison with other Mediterranean regions. *Journal of Natural History*, 39, 47–70.
- Bartoli P., Gibson D.I., Bray R.A., Maillard C., Lambert M. 1989. The Opecoelidae (Digenea) of sparid fishes of the western Mediterranean. II. *Pycnadenoides* Yamaguti, 1938 and *Pseudopycnadena* Saad-Fares & Maillard, 1986. *Systematic Parasitology*, 13, 35–51.
- Bray R.A., Justine J.-L. 2006. *Hypocreadium toombo* n. sp. (Digenea: Lepocreadiidae) in the yellow-spotted triggerfish *Pseudobalistes fuscus* (Perciformes: Balistidae) and additional lepecreadiids parasitizing fishes from the waters off New Caledonia. *Zootaxa*, 1326, 37–44.
- Cribb T.H. 2005. Family Opecoelidae Ozaki, 1925. In: *Keys to the Trematoda*. Vol. 2 (Eds. A. Jones, R.A. Bray, and D.I. Gibson). CABI Publishing and The Natural History Museum, Wallingford, 443–531.
- Fischthal J.H. 1980. Some digenetic trematodes of marine fishes from Israel's Mediterranean coast and their zoogeography, especially those from Red Sea immigrant fishes. *Zoologica Scripta*, 9, 11–23.
- Jousson O., Bartoli P., Pawlowski J. 1999. Molecular identification of developmental stages in Opecoelidae (Digenea). *International Journal for Parasitology*, 29, 1853–1858.
- Saad-Fares A., Maillard C. 1986. Trématodes des poissons des côtes du Liban. I: *Pseudopycnadena fischthali* n. g. n. sp. (Trematoda: Opistholebetidae) parasite des *Diplodus* (Teleostei) des côtes du Liban. *Annales de Parasitologie Humaine et Comparée*, 61, 303–309.
- Sasal P., Niquil N., Bartoli P. 1999. Community structure of digenean parasites of sparid and labrid fishes of the Mediterranean Sea: a new approach. *Parasitology*, 119, 635–648.