Trematodes from Red Sea fishes: *Prosteganoderma brayi* gen. nov., sp. nov. (Zoogonidae Odhner, 1902) and *Forticulcita mugilis* sp. nov. (Haploporidae Nicoll, 1914)

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Summary

Specimens of the fishes *Scarus ghobban* Forsskål (Scaridae) and *Crenimugil crenilabis* Forsskål (Mugilidae) were caught in the Red Sea off the coast of Sharm El-Sheikh, South Sinai, Egypt. Ten (20 %) and 15 (50 %) of these fishes, respectively, were found to harbour intestinal trematodes. *Scarus ghobban* was parasitised by *Prosteganoderma brayi* gen. nov., sp. nov. (Zoogonidae) and *C. crenilabis* by *Forticulcita mugilis* sp. nov. (Haploporidae). *Prosteganoderma* gen. nov. is similar to *Steganoderma* Stafford, 1904, but clearly differs from it and from all the other genera of the subfamily Lepidophyllinae Stossich, 1903 in having a large ventral sucker surrounded by a large prominent fleshy fold of the body wall and a pre-testicular uterus. *Forticulcita mugilis* sp. nov. is similar to *F. glabra* Overstreet, 1982, the type and the only species of the genus, but clearly differs in having a larger body size, a longer forebody, an intestinal bifurcation in the middle of the body, subequal gonads, Laurer's canal opening dorsally at a considerable distance posterior to the testis and a much larger egg size.

Key words: Digenea; Zoogonidae; *Prosteganoderma brayi* gen. nov.; sp. nov.; Haploporidae; *Forticulcita mugilis* sp. nov.; fishes; Red Sea.

Introduction

Studies on the helminth parasites of Red Sea fishes tend to be limited to short papers describing new taxa or longer works where the Red Sea is dealt with in larger studies on the Indian Ocean. Consequently, parasitic helminths are one of the least known parts of the Red Sea fauna (Hassanine & Gibbon, 2005a). This is one of a series of recent papers on the trematode fauna of Red Sea fishes (see Hassanine, 2005; Hassanine & Gibbon, 2005a, b; Hassani-

ne, 2006 a, b, c, 2007). It deals with two new species including a new genus, collected from scarid and mugilid fishes.

Materials and methods

During October of 2006, 50 and 30 specimens of the fishes *Scarus ghobban* Forsskål (Scaridae) and *Crenimugil crenilabis* Forsskål (Mugilidae), respectively, were caught in the Red Sea off the coast of Sharm El-Sheikh, South Sinai, Egypt, and kept alive in aquaria. Fish identifications were based on Randall (1983) and the names follow Froese and Pauly (2006). Living fish were killed using an overdose of benzocaine anaesthetic, pithing through the brain, or by a blow to the head prior to dissection. The entire alimentary canal of each fish was immediately removed. Trematodes were carefully teased from the gut of each fish under a dissecting stereomicroscope, and the opened gut was then shaken vigorously in a jar of saline to dislodge further worms and to remove mucus. Some worms were fixed in hot alcohol-formalin-acetic acid (AFA) under a slight coverslip pressure and preserved in 75% ethyl alcohol. Whole-mounts were stained in alum carmine, cleared in terpineol and mounted in Canada balsam. Drawings were prepared with the aid of a drawing tube. Measurements are quoted as the range, with mean in parentheses, and are given in micrometres. The specimens are deposited in the Helminthological Collection of the Red Sea Fishes, Suez Canal University, Ismailia, Egypt.

Results and Discussion

Family Zoogonidae Odhner, 1902

Subfamily Lepidophyllinae Stossich, 1903

The Zoogonidae Odhner, 1902 is a large family, containing

a widespread group of trematodes parasitising marine and freshwater teleosts. The validity of many of its subfamilies and genera has long been in dispute and a large number of synonyms were proposed (see Dollfus 1952; Bray 1987 a, b; Brooks 1990; Brooks & McLennan 1993). Recently, Bray (2007) has comprehensively reviewed this family recognising two subfamilies, the Zoogoninae Odhner, 1902 and Lepidophyllinae Stossich, 1903. He accepted 19 genera as valid within the Lepidophyllinae; *Lepidophyllum* Odhner, 1902, *Steganoderma* Stafford, 1904, *Deretrema* Linton, 1910, *Lecithostaphylus* Odhner, 1911, *Proctophantastes* Odhner, 1911, *Urinatrema* Yamaguti, 1934, *Cephaloporus* Yamaguti, 1934, *Brachyenteron* Manter, 1934, *Pseudochetosoma* Dollfus, 1951, *Pseudopalaeorchis* Kamagai, 1970, *Anarhichotrema* Shimazu, 1973, *Yamaguti-plectognathotrema* Parukhin, 1977, *Panopula* Overstreet et Pritchard, 1977, *Steganodermatoides* Parukhin et Lyadov, 1979, *Overstreetia* Bray, 1985, *Limnoderetrema* Bray, 1987, *Parasteganoderma* Machida et Araki, 1990, *Koiea* Bray et Campbell, 1995 and *Sacculoacetabulum* Machida et Kuramochi, 1999. These genera are easily distinguished from each other by the professional keys given by Bray (2007).

Prosteganoderma gen. nov.

Diagnosis: Zoogonidae, Lepidophyllinae. Body plump, stout, somewhat dorso-ventrally flattened. Tegument spined throughout. Numerous gland-cells scattered in parenchyma of forebody. Oral sucker ventro-terminal. Ventral sucker large, sessile, without lips, undivided, situated in middle of body, surrounded by large prominent fleshy fold of body wall. Prepharynx very short. Pharynx globular. Oesophagus short. Intestinal bifurcation in forebody; caeca long, extending posteriorly to the mid-testicular level, blind. Testes 2, oval, contiguous, symmetrical at middle of hindbody. Cirrus sac claviform, diagonal, reaching to middle of ventral sucker posteriorly, containing bipartite seminal vesicle, oval pars prostatica and short ejaculatory duct. Genital atrium small, oval; periatral gland absent. Genital pore submarginal to left, at level of intestinal bifurcation. Ovary medial, immediately posterior to ventral sucker. Seminal receptacle large, dextral to ovary. Laurer's canal post-ovarian, opens submarginally to right side of body. Mehlis' gland, post-ovarian. Uterus inter-caecal, winding between ovary and testes; metraterm well differentiated. Eggs thin-shelled, few. Vitellarium follicular, posterior to ventral sucker, forming two symmetrical lateral groups of 8 globular follicles in the ovarian zone. Excretory vesicle elongate, extending anteriorly as far as testes; excretory pore terminal. Intestinal parasites of marine teleosts. Type species: *P. brayi* sp. nov.

Prosteganoderma brayi gen. nov., sp. nov. (Fig. 1)

Description: Based on 15 fully-gravid specimens. Body plump, stout, tapered anteriorly, somewhat dorso-ventrally flattened, 2,446 – 3,660 (3,053) in length, 934 – 1,380 (1,157) wide at mid-body. Forebody 734 – 1,256 (995) in length, representing c.30 – 34% of total body length. Te-

gument minutely spined throughout. Numerous gland-cells scattered in parenchyma of forebody. Oral sucker ventro-terminal, globular, 270 – 477 × 240 – 455 (373 × 347). Ventral sucker large, stout, sessile, spherical, without lips, undivided, 690 – 1,048 (869) in diameter, situated in middle of body, surrounded by large prominent, subglobular to subrectangular fleshy fold of body wall, which may act as supplementary attachment organ. Sucker-width ratio 1:2.30 – 2.87. Prepharynx very short, entirely dorsal to oral sucker in all specimens. Pharynx globular, well developed, 118 – 162 × 135 – 189 (140 × 162). Oesophagus consistently short, 85 – 124 (104) in length. Intestinal bifurcation about midway between suckers; caeca simple, long, extending posteriorly to mid-hindbody or to mid-testicular level. Testes 2, oval, symmetrical at middle of hindbody, contiguous; right testis, 310 – 445 × 209–306 (377 × 257); left testis 318 – 455 × 236 – 342 (386 × 289); post-testicular region 260 – 410 (335) in length. Cirrus sac claviform, oriented diagonally, 634 – 919 (776) in length, 142 – 155 (148) wide near its base, reaching to middle of ventral sucker posteriorly, containing bipartite seminal vesicle, oval pars prostatica and short ejaculatory duct. Genital atrium small, oval, relatively inconspicuous; periatral gland absent. Genital pore sub-marginal to left, at level of intestinal bifurcation. Ovary medial, round, immediately posterior to ventral sucker, 138 – 202 (170) in diameter. Seminal receptacle large, round, dextral to ovary. Laurer's canal post-ovarian, transversely oriented, opens submarginally on right side of body. Mehlis' gland discrete, post-ovarian. Uterus inter-caecal, short, winding between ovary and testes, modified terminally into a well differentiated metraterm extending adjacent to the cirrus sac. Eggs thin-shelled, yellowish, few in number, large, 94 – 110 × 55 – 67 (102 × 61). Vitellarium follicular, posterior to the ventral sucker, forming two symmetrical lateral groups of 8 globular follicles in ovarian zone. At level of ovary, transverse vitelline collecting ducts arise from vitelline follicles on each side, open into triangular vitelline reservoir situated ventral to ovary. Excretory vesicle I-shaped, extends anteriorly as far as testes; excretory pore terminal. Type host: *Scarus ghobban* Forsskal (Scaridae).

Site: Middle intestine.

Type locality: Red Sea off Sharm El-Sheikh, South Sinai, Egypt.

Prevalence: 10/50 fishes examined; 20 %.

Type material: Holotype and paratypes are deposited in the Helminthological Collection of the Red Sea Fishes, Suez Canal University, Ismailia, Egypt, Reg. no. 2006.12.20.1 – 3 and 2006.12.20.4 – 7.

Etymology: The generic name *Prosteganoderma* is from *Pro* (= relation) and from *Steganoderma* and indicates a relationship with this genus. The specific name *brayi* is for Dr R.A. Bray, Department of Zoology, Natural History Museum, London, in recognition of his great contributions to marine helminthology.

Discussion: The zoogonid subfamilies are easily distinguished from each other; in the Zoogoninae, the vitellarium is a single or a compact mass, while in Lepi-

Fig. 1. *Prosteganagerma brayi* gen. nov. sp. nov. (ventral view) from *Scarus ghobban*, Red Sea. A. Whole-mount (holotype). B. Terminal genitalia. C. Female genital complex. Scale bars= 500 μ m (A) and 250 μ m (B, C).

dophyllinae, the vitellarium is comprised of two symmetrical fields of distinct globular or subglobular follicles. As mentioned above, 19 valid genera are presently recognised within the Lepidophyllinae. According to the diagnoses of these genera given by Bray (2007), the current trematode (described above) is mostly similar to *Steganagerma*, but clearly differs in having a large prominent fleshy fold of the body wall around the ventral sucker and a pre-testicular uterus. These characteristics are also unique among all other genera of the Lepidophyllinae, and sufficient to differentiate the current trematode from the other similar genera in this subfamily, i.e. *Lecithostaphylus*, *Proctophantastes*, and *Steganagermatoides*. However, each of these genera possesses at least a unique generic character lacking in the current trematode; for example, *Lecithostaphylus* possesses a pedunculate ventral sucker, *Proctophantastes* possesses a distinct peritrial gland surrounding the genital atrium and the distal part of the metraterm, and *Steganagermatoides* possesses a ventral sucker divided equatorially by an internal row of large papillae. Generally, the characteristics of the present trematode exclude it from all known genera of the Lepidophyllinae. Therefore, *Prosteganagerma* gen. nov., as defined above, is proposed as a new zoogonid genus for this species.

Family Haploporidae Nicoll, 1914
Subfamily Haploporinae Nicoll, 1914

Forticulcita Overstreet, 1982

The Haploporidae Nicoll, 1914 is a medium-sized family of trematodes parasitising marine and freshwater fishes. In a comprehensive revision on this family, Overstreet and Curran (2005) recognized four subfamilies, the Haploporinae Nicoll, 1914, Megasoleninae Manter, 1935, Waretrematinae Srivastava, 1937 and Chalcinotrematinae Overstreet et Curran, 2005. They listed 7 genera as valid within the Haploporinae; *Haploporus* Looss, 1902, *Saccocoelium* Looss, 1902, *Lecithobotrys* Looss, 1902, *Dicrogaster* Looss, 1902, *Unisaccus* Martin, 1973, *Forticulcita* Overstreet, 1982 and *Rondotrema* Thatcher, 1999. *Forticulcita* was erected by Overstreet (1982) for *F. glabra* Overstreet, 1982 from the intestine of the mugilid fish *Valamugil seihli* off the Gulf of Aqaba (northern Red Sea). He differentiated it from the other related haploporid genera known at that time by a combination of characters, mainly by its single vitellarium, unarmed ejaculatory organ, powerful muscular ventral sucker, conspicuous intestinal caeca and prepharynx which is shorter than the pharynx. To date, *Forticulcita* is known only from its type species.

Forticulcita mugilis sp. nov. (Fig. 2)

Description: Based on 20 fully-gravid specimens. Body elongate, sub-cylindrical, tapered anteriorly, 1,814 – 2,761 (2,287) in length, 530 – 810 (670) in maximum width posterior to its middle. Forebody long, 543 – 930

Fig. 2. *Forticulcita mugilis* sp. nov. (ventral view) from *Crenimugil crenilabis*, Red Sea. A. Whole-mount (holotype). B. Terminal genitalia. C. Female genital complex. Scale bars = 500 μ m (A) and 250 μ m (B, C).

(736) in length, representing 30 – 33% of body length. Tegument minutely spined throughout. Numerous gland-cells scattered in parenchyma of forebody. Eyespot pigment dispersed. Oral sucker ventro-terminal, almost spherical, 200 – 245 (222) in diameter. Ventral sucker fairly large, subspherical, just pre-equatorial, 310 – 439 (374) in diameter. Sucker-width ratio 1:1.55 – 1.79 (1:1.67). Pre-pharynx consistently short, 66 – 93 (79) in length. Pharynx well developed, globular, 130 – 176 $\times$ 138–186 (153 $\times$ 162). Oesophagus very long, 571 – 825 (698) in length. Intestinal bifurcation in middle of body or just posterior to ventral sucker; caeca short, cylindrical, simple, ending at beginning of posterior third of body. Testis single, round, situated medially between caecal extremities, 125 – 168 $\times$ 142 – 187 (146 $\times$ 164); post-testicular region 436 – 625 (530) in length. External seminal vesicle subcylindrical, 308 – 435 (371) long, 23 – 28 (25) wide. Hermaphroditic sac claviform, dextral to ventral sucker, curved towards the median line, 344 – 490 (417) in length, 118 – 160 (139) wide in middle, containing long tubular internal seminal vesicle, well-developed prostatic complex, long muscular metraterm and relatively long, unarmed, eversible hermaphro-

ditic duct. Genital atrium very short, semi-tubular. Genital pore medial, at short distance anterior to ventral sucker. Ovary spherical, immediately pre-testicular, slightly submedian, 118 – 170 (144) in diameter. True seminal receptacle not present; proximal portion of uterus filled with sperms (uterine seminal receptacle). Laurer's canal long, median, opens dorsally at considerable distance posterior to testis. Uterus long, descending to near posterior end of body, then ascending to join hermaphroditic sac. Eggs thin-shelled, yellowish, numerous, containing oculate miracidia, 45 – 54 $\times$ 30 – 36 (49 $\times$ 33). Vitellarium represented by single irregular compact mass sinistral to ovary, 93 – 130 $\times$ 132–115 (111 $\times$ 120). Excretory vesicle I-shaped, with prominent refractory concretion near its base, extending anteriorly to midway between posterior end of body and ovary; excretory pore terminal.

Type host: *Crenimugil crenilabis* Forsskål (Mugilidae).

Site: Upper intestine.

Type locality: Red Sea off Sharm El-Sheikh, South Sinai, Egypt.

Prevalence: 15/30 fishes examined; 50 %.

Type material: Holotype and paratypes are deposited in the Helminthological Collection of the Red Sea Fishes, Suez Canal University, Ismailia, Egypt, Reg. no. 2006.12.20.1 – 5 and 2006.12.20.6 – 10.

Etymology: The specific name *mugilis* refers to the family Mugilidae of the type host.

Discussion: The above description of *F. mugilis* sp. nov. agrees with the concept of *Forticulcita* and is similar to the description of *F. glabra* by Overstreet (1982), the type and the only species of the genus. Although the two species are from closely related hosts inhabiting the same locality (northern Red Sea), the new species clearly differs in having a larger body size (1,814 – 2,761 vs 1,185 – 1,767), a longer forebody representing 30 – 33 % of body length (vs 17 – 22 % of body length), an intestinal bifurcation at the middle of the body (vs at the end of the first third of the body), sub-equal gonads (vs the testis is much larger, about 5 times, than ovary), Laurer's canal opening dorsally at a considerable distance posterior to the testis (vs dorsal to the testis) and a much larger egg size (45 – 54 $\times$ 30 – 36 vs 25 – 34 $\times$ 14 – 17). In view of these differences, the present species is considered to be new.

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