Systematic Parasitology **51:** 149–153, 2002.

Steganoderma (Steganoderma) valchetensis n. sp. (Digenea: Zoogonidae) from the relict fish *Gymnocharacinus bergi* (Osteichthyes: Characidae) in Argentina

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Accepted for publication 6th June, 2001

Abstract

A new species of *Steganoderma* (*Steganoderma*) (Digenea: Zoogonidae) was found in the digestive tract of the southernmost, endemic and scale-less characid, *Gymnocharacinus bergi*, inhabiting thermal headwaters of the Valcheta Creek in northern Patagonia, Argentina. *Steganoderma valchetensis* n. sp. is included in the subgenus *Steganoderma* because of having a sessile ventral sucker and caeca reaching to the testes. This new species can be distinguished from other species of this genus on the basis of body-length, sucker-ratio, the length of the cirrus-sac, the morphology of the seminal vesicle and gonads, and the location of the vitelline follicles and genital pore. The taxonomic status of the species of *Steganoderma*, parasitising the freshwater fishes of Patagonia, in southern Argentina, and Chile, is also discussed.

Introduction

Gymnocharacinus bergi Steindachner is the only characiform fish with almost no scales in the adult (Miquelarena & Arámburu, 1983; Cussac & Ortubay, 1994). It is endemic and the only fish species inhabiting thermal headwaters of the endorrheic Valcheta Creek in the Somuncurá Plateau in northern Patagonia (40°50′S, 66°40′W) (Menni & Gómez, 1995; Escalante & Menni, 1999). Two introduced salmonids and two cyprinodontoids inhabit downstream waters at lower temperatures (Ortubay et al., 1997; Escalante & Menni, 1999). Chebez (1993) considered the naked characin an endangered species, the only fish included in a list of Argentinean vertebrates in danger of extinction (Menni & Gómez, 1995).

During an analysis of the diet of *G. bergi* specimens deposited at the Museo de La Plata Collection, La Plata, Argentina, zoogonid digeneans were observed, removed from the gut and collected. These specimens are described and characterised below, and their taxonomic status discussed.

Materials and methods

A total of 33 specimens of *Gymnocharacinus bergi* were collected with handnets during November, 1979 and March, 1980 from headwaters of the Valcheta Creek in the Somuncurá Plateau. In the laboratory, each digestive tract was removed and preserved in 10% formalin for dietary analysis. Later, digeneans removed from the intestine during a dietary study were transferred to 70% alcohol, stained with Semichon's acetocarmine, mounted in Canada balsam and studied using a light microscope. In addition, serial histological sections were made in order to complete the morphological study of the parasites. Drawings were made with the aid of a camera lucida. All measurements are given in micrometres.

***Steganoderma (Steganoderma) valchetensis* n. sp.**

Description (Figures 1-3)

Measurements based on 10 specimens. Body small, oval 523 (400-645) × 278 (168-392). Tegument spined along total body length. Oral sucker subterminal 119 (90-147) × 127 (80-155). Prepharynx apparently absent. Pharynx oval, 48 (33-65) × 37 (32-42). Oesophagus short, often indistinct. Caeca narrow, reaching testicular fields. Distance between anterior edges of oral sucker and ventral sucker 145 (99-199); forebody occupies 35% of body length. Distance between posterior edge of ventral sucker and end of body 154 (98-210). Ventral sucker simple, sessile, larger than oral sucker, 145 (90-199) × 154 (88-210). Sucker ratio 1:1.20 (0.99-1.64).

Testes rounded to oval, smooth, symmetrical, close to posterior margin of ventral sucker; right testis 71 (46-88) × 54 (41-67); left testis 65 (52-90) × 54 (40-72). Cirrus-sac claviform, extending from anterior margin of ventral sucker to level of pharynx, 145 (118-178) × 38 (30-50). Seminal vesicle bipartite, occupying approximately posterior third of cirrus-sac. Pars prostatica vesicular. Ejaculatory duct long, opens into genital atrium. Genital pore small, submarginal, sinistral, in mid-forebody, surrounded by sphincter.

Ovary pretesticular, oval to irregularly oval, 47 (32-56) × 41 (31-61), oblique to right testis, overlapping portion of posterior half of ventral sucker. Seminal receptacle full of sperm, 50 (31-66) × 34 (23-46). Details of eggs-forming complex not observed. Vitelline follicles 10 (8-13) on poral side, 10 (7-13) on antiporal side, in lateral fields extending posteriorly from intestinal bifurcation to about posterior half of ventral sucker. Uterus mainly in hindbody. Metraterm muscular, runs parallel with distal half of cirrus-sac to common genital pore. Eggs tanned, operculate, 31 (28-34) × 17 (15-19).

Excretory vesicle saccular; excretory pore terminal.

Type-host: Gymnocharacinus bergi Steindachner (Pisces: Characidae).
Type-locality: Valcheta Creek (40°50′S, 66°40′W), on the Somuncurá Plateau, northern Patagonia, Argentina.
Type-material: Holotype No.4855, paratypes No.4856 are deposited in the Helmintological Collection of the Museo de La Plata (CHMLP), La Plata, Argentina. Other paratype in The Natural History Museum, London, BMNH 2001.8.10.1.
Site: Intestine.
Prevalence and mean intensity: 33.3% and 3.0, respectively.
Etymology: The specific name is derived from the name Valcheta Creek, where the hosts were collected and *–ensis* (L. belonging to).

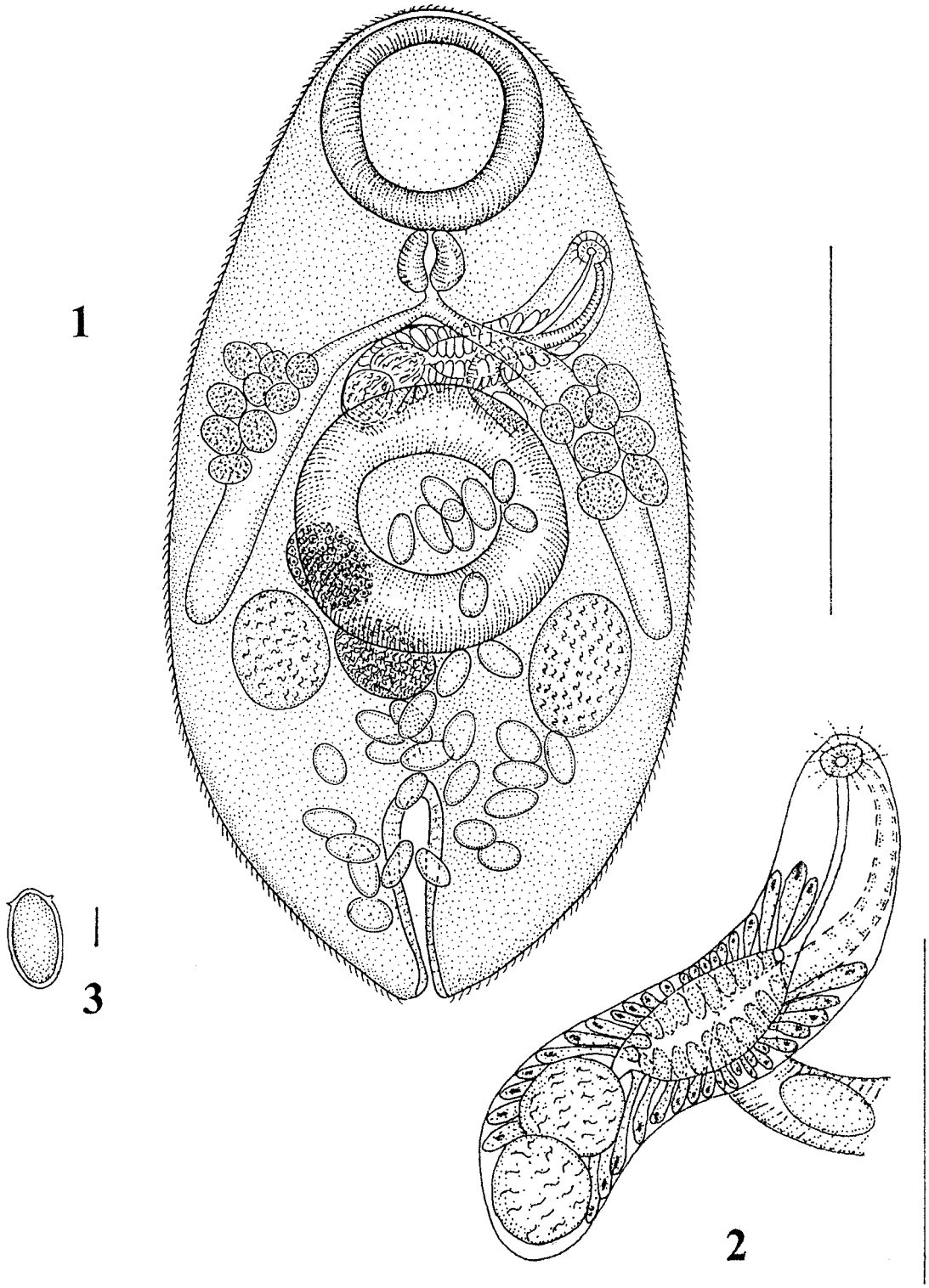
Remarks

According to the diagnoses of the genera of the family Zoogonidae Odhner, 1902 (subfamily Lepidophyllinae Stossich, 1903) given by Bray (1987), the specimens collected from *Gymnocharcinus bergi* can be related to the genera *Steganoderma* Stafford, 1904, *Deretrema* Linton, 1910 and *Limnoderetrema* Bray, 1987.

As pointed out by Viozzi et al. (2000), the morphological similarity between several genera of this family, including *Steganoderma* and *Deretrema*, was previously discussed by Manter (1947, 1954) and Szidat (1962). More recently, Cribb et al. (1992) estimated that, despite their morphological similarities, *Steganoderma* and *Deretrema* deserve to be kept separate because of the location of the vitelline follicles and the presence of a muscular metraterm in *Steganoderma*.

Comparing our material with the diagnoses of these two genera detailed in Bray (1987), our specimens differ from *Deretrema* (*sensu* Bray, 1987) in the position of the vitelline follicles, which are located mainly in posterior half of forebody, sometimes overlapping ventral sucker, in *Deretrema*, the muscular metraterm and size of the cirrus-sac. From *Steganoderma* (*sensu* Bray, 1987) they differ in the location of the vitelline follicles, which are located mainly in the lateral regions of the anterior hindbody in *Steganoderma*, and in having a longer ejaculatory duct. On the other hand, they differ from *Limnoderetrema* (see Bray, 1987) in having a genital pore which is submarginal, an ovary which is pretesticular, a uterus reaching beyond the anterior level of the testes and an excretory vesicle not reaching to the ovary.

On the basis of these comparisons, we consider that the present species fits best in *Steganoderma*. Our assumption is supported by the fact that the presence of a longer ejaculatory duct has been also reported by Viozzi et al. (2000) in *S. szidati* Viozzi, Flores & Ostrowski, 2000 and a similar location of vitelline follicles (in fields lateral to the ventral sucker) has been described for *S. macrophallus* Szidat & Nani, 1951,



Figures 1-3. Steganoderma valchetensis n. sp. 1. Ventral view. 2. Detail of terminal genitalia. 3. Detail of egg. *Scale-bars*: 1, 200 μm; 2, 100 μm; 3, 10 μm.

Table 1. Records of freshwater zoogonid species, indicating their hosts, site of infections and geographical distributions.

Freshwater zoogonid species	Host	Site of infection	Geographical distribution	Reference
Pseudochetosoma salmonicola Dollfus, 1951	Cyprinidae, Cobitidae, Siluridae, Cottidae and Salmonidae	gall-bladder	SE Europe, N Africa and SW Asia	Bray, 1987
Steganoderma macrophallus Szidat & Nani, 1951	*Basilichthys microlepidotus** (Atherinidae)	intestine	Limay River, Argentina	Szidat & Nani, 1951
Limnoderetrema minutum (Manter, 1954)†	*Galaxias maculatus* (Galaxiidae)	intestine	New Zealand	Manter, 1954
Steganoderma oviformis Szidat, 1962	*Haplochiton zebra* (Haplochitonidae)	intestine	Valdivia, Chile	Szidat, 1962
Deretrema plagiorchis Wang, 1984‡	*Monopterus alba* (Synbranchidae)	intestine	Fujian, China	Bray, 1987
Limnoderetrema tolosai Torres & Neira, 1991	*Basilichthys australis* (Atherinidae)	intestine	Riñihue and Ranco Lakes, Chile	Torres & Neira, 1991
Steganoderma szidati Viozzi, Flores & Ostrowski, 2000	*Galaxias maculatus* and *G. platei* (Galaxiidae)	intestine	Patagonian lakes, Argentina	Viozzi et al., 2000
Steganoderma valchetensis n. sp.	*Gymnocharacinus bergi* (Characidae)	intestine	Somoncurá Plateau, Argentina	Present study

*Now *Odontesthes hatcheri*.
†Synonym of *Deretrema philippae* Hine, 1977 (Bray, 1987).
‡Status indeterminate *sensu* Bray (1987).

S. oviformis Szidat, 1962 and for S. (*Lecithostaphylus) gibsoni* Cribb, Bray & Barker, 1992.

In the key to the subgenera and species of *Steganoderma*, Bray (1987) recognised two subgenera (*Steganoderma* and *Lecithostaphylus*); the new species clearly belongs to *Steganoderma* (*Steganoderma*) because it has a sessile ventral sucker and the caeca reach the testes. From the two species detailed in Bray's key, *S. valchetensis* n. sp. differs from *S.* (*S.*) *formosum* Stafford, 1904 in having a shorter, often indistinct oesophagus and in the location of the vitelline follicles (Bray, 1987). Similarly, it differs from *S.* (*S.*) *atherinae* (Price, 1934) in having gonads which are not irregularly lobed and in the location of vitelline follicles (Bray, 1987). Moreover, we have compared *S. valchetensis* with three species of this genus parasitising freshwater fishes from Patagonia. The new species differs from *S. macrophallus* in having a cirrus-sac, which does not extend beyond the middle of the ventral sucker, and a bipartite seminal vesicle (Szidat & Nani, 1951). From *S. oviformis* it differs in having a shorter body, a smaller sucker-ratio and unlobed gonads (Szidat, 1962). Finally, *S. valchetensis* differs from *S. szidati* in the location of the vitelline follicles and in having a submarginal genital pore (Viozzi et al., 2000).

Steganoderma valchetensis n. sp. constitutes the eighth species of zoogonid digeneans recorded from freshwater fishes (Table 1). It also represents the fifth species of this family recorded from South America. It is remarkable that, although these species of *Steganoderma* have been found in fish belonging to different families, they are restricted to Patagonia.

Given that Torres & Neira (1991) considered *S. macrophallus* as *Limnoderetrema macrophallus* n. comb., it was decided to compare our material with *L. tolosai* Torres & Neira, 1991, which parasitises a freshwater fish from Chilean Patagonia. *L. tolosai* differs from *S.valchetensis* n. sp. in having a larger body size, a different sucker-ratio, the location of the ovary, the morphology of the seminal vesicle and a cirrus with a conspicuous spine on its distal region (Torres & Neira, 1991).

Discussion

The inclusion in *Steganoderma* of two species described from Argentina and Chile, respectively, *S. macrophallus* and *S. oviformis*, was previously discussed by Bray (1987), Brooks (1990) and Brooks

& McLennan (1993). Bray (1987) stated that the taxonomic status of these species was not clear, although cladistic analysis suggested affinities to *S.* (*S.*) *atherinae*. Brooks (1990) suggested the inclusion of *S. macrophallus* and *S. oviformis*, together with *S.* (*S.*) *atherinae* in *Lepidophyllum* Odhner, 1902 or the creation of a new genus for these three species. Finally, Brooks & McLennan (1993) included the three species in *Lepidophyllum*.

Viozzi et al. (2000) considered that the species of *Steganoderma* described from Patagonia, *S. macrophallus*, *S. szidati* and *S. oviformis*, cannot be included in *Lepidophyllum*, because this genus exhibits a leaf-like flattening of the body, deeply lobed testes, a relative small, narrow cirrus-sac, an elongate excretory vesicle, vitelline follicles medial or antero-medial to the testes and large areas of the body free of uterus in fully mature specimens. The same authors stated that the erection of a new genus for these species is premature and that new investigations based on *S. macrophallus* and *S. oviformis* material needs to be made. They also considered that, until new investigations were carried out, these two species and *S. szidati* should remain in *Steganoderma*. We agree with Viozzi et al. (2000), and consider that the new species belongs to *Steganoderma*.

Acknowledgements

We would like to thank Teodoro Stadler and Fabián Tricárico from the Museo Argentino de Ciencias Naturales 'Bernardino Rivadavia', for the loan of Szidat'specimens, and María Cristina Estivariz for the drawings. The present study was partly funded by the Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET) and by the Universidad Nacional de Mar del Plata.

References

Bray, R.A. (1987) A revision of the family Zoogonidae Odhner, 1902 (Platyhelminthes: Digenea): subfamily Lepidophyllinae and some comments on some aspects of biology. *Systematic Parasitology*, **9**, 83–123.

Brooks, D.R. (1990) Phylogenetic systematic evaluation of a classification of the Zoogonidae Odhner, 1902 (Cercomeria: Trematoda: Digenea: Plagiorchiiformes). *Systematic Parasitology*, **16**, 127–137.

Brooks, D.R. & McLennan, D.A. (1993) *Parascript. Parasites and the language of evolution*. Washington: Smithsonian Institution Press, 429 pp.

Chebez, J.C. (1993) Listado de vertebrados argentinos en peligro de extinción. *Nuestras Aves* (Asociación Ornitológica del Plata), **1**, 1–14.

Cribb, T.H., Bray, R.A. & Barker, S.C. (1992) Zoogonidae (Digenea) from southern Great Barrier Reef fishes with a description of *Steganoderma (Lecithostaphylus) gibson* n. sp. *Systematic Parasitology*, **23**, 7–12.

Cussac, V.E. & Ortubay, S.G. (1994) Significado de la reabsorción de las escamas de *Gymnocharacinus bergi* (Pisces, Characidae): su relación con la talla. *Tankay*, **1**, 226–228.

Escalante, A.H. & Menni, R.C. (1999) Feeding ecology of the relict fish *Gymnocharacinus bergi*, a characid from southern South America. *Water S.A.*, **25**, 529–532.

Manter, H.W. (1947) The digenetic trematodes of marine fishes of Tortugas, Florida. *American Midland Naturalist*, **38**, 257–416.

Manter, H.W. (1954) Some digenetic trematodes from fishes of New Zealand. *Transactions of the Royal Society of New Zealand*, **82**, 475–568.

Menni, R.C. & Gómez, S.E. (1995) On the habitat and isolation of *Gymnocharacinus bergi* (Osteichthyes: Characidae). *Environmental Biology of Fishes*, **42**, 15–23.

Miquelarena, A.M. & Arámburu, R.H. (1983) Osteología y lepidología de *Gymnocharacinus bergi* (Pisces, Characidae). *Limnobios*, **2**, 491–512.

Ortubay, S.G., Gómez, S.E. & Cussac, V.E. (1997) Lethal temperatures of a Neotropical fish relic in Patagonia, the scale-less characinid *Gymnocharacinus bergi*. *Environmental Biology of Fishes*, **49**, 341–350.

Szidat, L. & Nani, A. (1951) Diplostomiasis cerebralis del Pejerrey. Una grave epizootia que afecta a la economía nacional producida por larvas de Trematodes que destruyen el cerebro de los pejerreyes. *Revista Nacional del Instituto de Investigación de las Ciencias Naturales anexo al Museo Argentino de Ciencias Naturales 'Bernardino Rivadavia'*, **1**, 323–394.

Szidat, L. (1962) *Steganoderma oviformis* (Trematoda) del intestino de *Haplochiton zebra* Jenyns. *Neotrópica*, **8**, 67–72.

Torres, P. & Neira, A. (1991) A new species of *Limnoderetrema* (Trematoda, Digenea) from the freshwater atherinid fish *Basilichthys australis* Eigenman, 1927 from the south of Chile. *Memorias do Instituto Oswaldo Cruz*, **86**, 433–436.

Viozzi, G., Flores, V. & Ostrowski de Nuñez, M. (2000) *Steganoderma szidati* n. sp. (Trematoda: Zoogonidae) from *Galaxias maculatus* (Jenyns) and *G. platei* Steindachner in Patagonia, Argentina. *Systematic Parasitology*, **46**, 203–208.