

Studies on *Phallotorynus fasciolatus* HENN, 1916 and *P. victoriae* OLIVEROS, 1983, with remarks on additional recognized species and ecology of the genus (Teleostei: Cyprinodontiformes: Poeciliidae)

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Abstract. The meristic, morphometric data and color patterns of the Brazilian members of the cnesterodontiniid genus *Phallotorynus* (*P. fasciolatus*, *P. jucundus* and *P. pankalos*) are compared with a lot of different populations of *P. victoriae* and *P. pankalos* from Paraguay. The investigations show that the populations of *P. victoriae* are more variable in meristic data and color patterns as mentioned by LUCINDA, ROSA & REIS (2005), but this species distinguishes well from *P. fasciolatus*, *P. jucundus* and *P. pankalos*. For the first time a drawing of the gonopodium of a male of *P. pankalos* is published.

Resumen. A base de caracteres merísticos, morfométricos y de patrones de coloración se hicieron estudios comparativos de representantes del Brasil del género *Phallotorynus* (*P. fasciolatus*, *P. jucundus* und *P. pankalos*) para diferenciarlos de diversas poblaciones de *P. victoriae* y *P. pankalos* de Paraguay. Esto dio como resultado que tanto los datos merísticos como los de ciertos patrones de coloración de *P. victoriae* son más variables de lo que señalan LUCINDA, ROSA & REIS (2005). Sin embargo *P. victoriae* es perfectamente diferenciable de *P. fasciolatus*, *P. jucundus* y *P. pankalos*. Por primera vez se publica un dibujo del gonopodio de un ejemplar macho de *P. pankalos*.

Kurzfassung. Meristische und morphometrische Merkmale sowie Zeichnungsmuster wurden für vergleichende Untersuchungen herangezogen, um die brasilianischen Vertreter der Gattung *Phallotorynus* (*P. fasciolatus*, *P. jucundus* und *P. pankalos*) von zahlreichen Populationen von *P. victoriae* und *P. pankalos* aus Paraguay voneinander abzugrenzen. Dabei stellte sich heraus, dass die meristischen Merkmale und bestimmte Färbungsmuster von *P. victoriae* variabler sind, als bei LUCINDA, ROSA & REIS (2005) angegeben. *P. victoriae* ist jedoch von *P. fasciolatus*, *P. jucundus* und *P. pankalos* sehr gut unterscheidbar. Erstmals wird eine Zeichnung eines Gonopodiums eines Männchens von *P. pankalos* veröffentlicht.

Key words. Neotropical region, Brazil, Paraguay, Poeciliidae, *Phallotorynus*.

Introduction

The cnesterodontiniid genus *Phallotorynus* is known from wide apart lying ranges in the upper and lower Paraná system of central South America. LUCINDA & REIS (2005) notice altogether six taxa with the main concentration of species in Paraguay. The type species *Phallotorynus fasciolatus* is only known from the upper rio Paraíba do Sul and upper rio Tietê drainages in the Brazilian state Paranapiacaba. Today *Phallotorynus fasciolatus* is kept on the official list of endangered species in Brazil (MMA, 2004) and is probably seriously endangered or even extinct (LUCINDA, ROSA & REIS, 2005). The lack of adequate specimens made it impossible until now for ichthyologists to undertake a complete study of the gonopodium. Therefore we give herein a drawing of the gonopodium, including the trowel-like terminal membranous appendix. The second endangered species in Brazil (MMA, 2004), namely *Phallotorynus jucundus*, including the lost type-series (LUCINDA, 2003), is known from corrego de Rincão, upper rio Mogyguassú and some headwaters of rio Tamanduá, rio Pardo drainage, São Paulo, Brazil. Because of its little more abundance *Phallotorynus jucundus* is well studied with regard to its morphology. LUCINDA & REIS (2005) described *Phallotorynus pankalos* from a

tributary of rio Iguatemi, rio Paraná drainage, Mato Grosso do Sul, Brazil. It is possibly a sister species of *Phallotorynus jucundus*. The description, however, is based on females only due to the lack of males. In our possession we have a lot of *Phallotorynus* cf *pankalos* of arroyo Henara, Paraguay. The anus of these females is light brown pigmented but lacks a dark ring around it. The lower jaw shows a dark brown band. In this publication we enclose a drawing of the gonopodium of a male. Also some morphometric and meristic data are given. In addition we have studied different populations of *Phallotorynus victoriae* from Paraguay. The validity of *Phallotorynus dispilos* LUCINDA, ROSA & REIS, 2005 from rio Paraná drainage, Caaguazú, Paraguay, and *Phallotorynus psittakos* LUCINDA, ROSA & REIS, 2005 from rio Paraguay drainage, Central, Misiones and San Pedro, Paraguay, are discussed.

Number of fin rays: the last two rays of gonopodium, anal and dorsal fin were counted as one ray. Only males with a fully developed gonopodium were investigated. The nomenclature of the gonopodial system follows ROSEN & BAILEY (1963).

Abbreviations. CM = fish collection of the Carnegie Museum (Pittsburgh), FMNH = fish collection of Field Museum of Natural History (Chicago), INALI = fish collection of the Instituto Nacional de Limnología (Santo Tomé), MCP = fish collection of Museu de Ciências de Tecnologia da Pontificia Universidade Católica do Rio Grande do Sul (Porto Alegre), MHNG = fish collection of Muséum d'histoire naturelle de la ville de Genève (Genf), MKMB = fish collection of M.K. Meyer Bad Nauheim, MMA = official list of endangered species in Brazil, MNHN = fish collection of the Museum National d'Histoire Naturelle (Paris), MTD F = fish collection of the Staatliche Naturhistorische Sammlungen (Dresden), MZUSP = fish collection of the Museu de Zoologia da Universidade de São Paulo (São Paulo), SL = standard length, SMF = fish collection of Senckenberg Museum (Frankfurt am Main), ZFMK = fish collection of the Zoologisches Forschungsinstitut und Museum Alexander Koenig (Bonn).

Phallotorynus fasciolatus HENN, 1916

(Fig. 1–3)

Phallotorynus fasciolatus – HENN, A. W. (1916). Ann. Carnegie Mus., 10 (1–2): 93–142. (original description; 1 mile north of Jacarehy (Jacarei), Rio Parahyba (Rio Parahiba), São Paulo, Brazil; holotype FMNH 55061 [before CM 3752], ♂, 15 mm SL).

Material. MKMB 0011-1-1.2.0, rio Paraíba do Sul basin, São Paulo, Brazil, 25. February 1987, A. DIAZ.

Diagnosis. *Phallotorynus fasciolatus* is a deep bodied species of *Phallotorynus* (♂♂ up to 22 mm SL, ♀♀ up to 28.50 mm SL). It is distinguished from all other species of *Phallotorynus* by the following characters: borders of teeth truncate or slightly oblique vs. pointed or oblique; terminal appendix (trowel) of gonopodium very large, in proximal direction reaching to the middle of the membranous lobe-like expansion of gonopodium ray 3 vs. small or medium-sized trowel, in proximal direction reaching to the subdistal segments of gonopodium ray 3; color pattern of lower flanks spotless vs. spotted.

Distribution. rio Paraíba do Sul basin, São Paulo, Brazil.

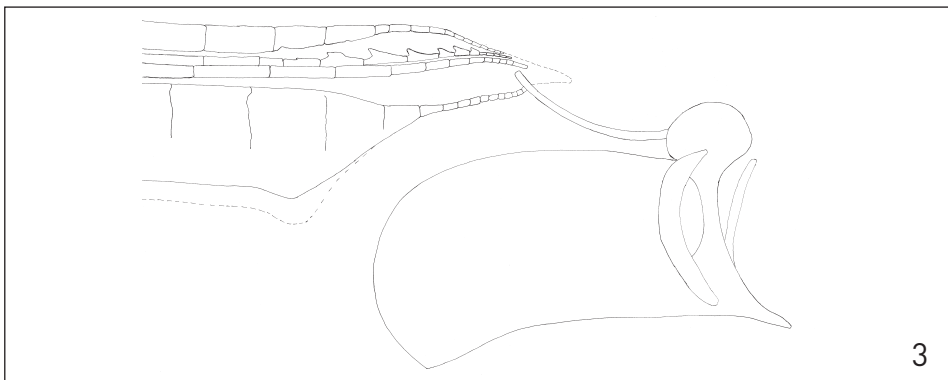


Fig. 1. *Phallotorynus fasciolatus*; Brazil: São Paulo, rio Paraíba do Sul basin, MKMB 0011-1-1.2.0, male, 17 mm SL.

Fig. 2. *Phallotorynus fasciolatus*; Brazil: São Paulo, rio Paraíba do Sul basin, MKMB 0011-1-1.2.0, female, 24 mm SL.

Fig. 3. *Phallotorynus fasciolatus*; Brazil: São Paulo, rio Paraíba do Sul basin, MKMB 0011-1-1.2.0, male, 17 mm SL; gonopodium.

***Phallotorynus jucundus* IHERING, 1930**

Phallotorynus jucundus – IHERING, R. (1930). Arch. Inst. Biol. São Paulo, 3: 93–104. (original description; tributary of rio Mogyguassú (Mogi-Guaçu), corrego de Rincão (Rincão), São Paulo, Brazil; syntypes where about unknown, neotype MCP 30467, ♂, 18.4 mm SL).

Diagnosis. *Phallotorynus jucundus* is a slender bodied species of *Phallotorynus* (♂♂ up to 24.30 mm SL, ♀♀ up to 29.70 mm SL). It is distinguished from all other species of *Phallotorynus* by the following characters: dorsal fin rays 9 to 10 (rarely 9) vs. 7 to 9; number of black spots of lower flanks numerous (4 to 7) vs. 6 to 10 in *pankalos*, 1 to 5 in *victoriae* and absent in *fasciolatus*.

Distribution. Upper rio Pardo basin, rio Grande drainage, Brazil.

***Phallotorynus pankalos* LUCINDA, ROSA & REIS, 2005 (Fig. 4–6)**

Phallotorynus pankalos – LUCINDA, P.H.; ROSA, R. & REIS, R.E. (2005): Copeia, 2005(3): 609–631. (original description; creek [23°32'11" S, 55°08'55" W], tributary of rio Puitá, rio Iguatemi system, rio Paraná drainage, at farm Sossego, road to Paranhos, Tacuru, Mato Grosso do Sul, Brazil; holotype MZUSP 79671, ♀, 27.1 mm SL).

Material. SMF 30165, MKMB 0011-2-4.3.2, arroyo Henara, north Colonia Ybycui, Canindeya, Paraguay, 12. April 1990, A. DIAZ.

Diagnosis. *Phallotorynus pankalos* is a slender bodied species of *Phallotorynus* (♂♂ up to 20.60 mm SL, ♂♂ up to 27.10 mm SL). It is distinguished from all other species of *Phallotorynus* by the following characters: spots of lower flanks large and irregular vs. small and mostly regular; number of black spots of lower flanks very numerous (6 to 10) vs. 4 to 7 in *jucundus*, 1 to 5 in *victoriae* and absent in *fasciolatus*.

Distribution. Known from the type locality and arroyo Henara, Paraguay.

***Phallotorynus victoriae* OLIVEROS, 1983 (Fig. 7–8, Tab. 1)**

Phallotorynus victoriae – OLIVEROS, O.B. (1983): Revista Asociación Ciencias Naturales Litoral, 14: 17–27. (original description; El Negro, Isla Los Mellados (Santa Fé), middle rio Paraná system, Argentina; holotype INALI-No.10, ♂, 15 mm SL).

Phallotorynus dispilos – LUCINDA, P.H., ROSA, R. & R.E. REIS, (2005). Copeia, (3): 609–631. (original description; creek crossing road from Colonia Sommerfeld to Repatriación, district Pueblo de Dios, Caaguazú, Paraguay; holotype MNHN 4620, ♂, 18.1 mm SL).

Phallotorynus psittakos – LUCINDA, P.H., ROSA, R. & R.E. REIS, (2005). Copeia, (3): 609–631 (original description; arroyo Clementina, east Santa Rosa, San Pedro, Paraguay; holotype MNHN 4621 (♂, 15.9 mm SL).

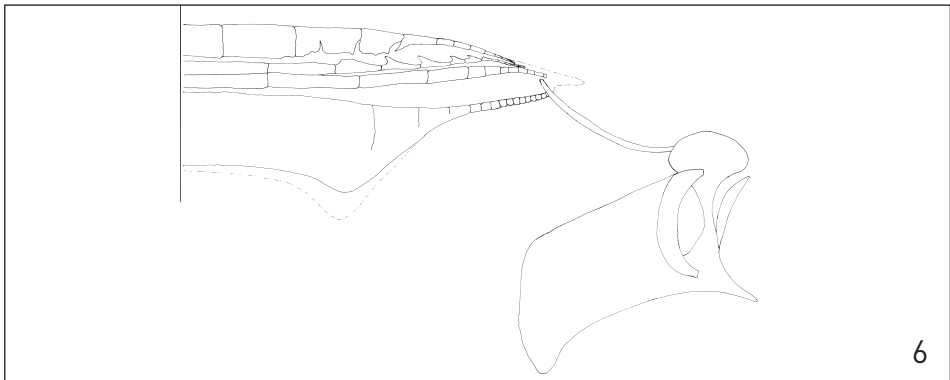
Material. MTD F 30604, MKMB 0011-3-1-1.1.0, brook at Pilar, rio Paraná drainage, Neembucú, Paraguay, 24. November 2001, V. ETZEL & G. HESSFELD, [lateral spot: one]; ZFMK 15767–15773 (by HIERONIMUS (1988) erroneously declared as *Phallotorynus jucundus*), brook at Caaguazú, rio Güyrauguá drainage, rio Paraná system, Paraguay, 5. August 1986, V. ETZEL & C. EHRLICH, [lateral spots: one to three (rarely four or five)]; MTD F 30605, rivulet at Capiata, rio Paraguay drainage, Paraguay, 21. November 2004, V. ETZEL & G. HESSFELD, [lateral spot: one



4



5



6

Fig. 4. *Phallotorynus pankalos*; Paraguay: Canindeya, arroyo Henara, north Colonia Ybycui, MKMB 0011-2-4.3.2, male, 19.5 mm SL.

Fig. 5. *Phallotorynus pankalos*; Paraguay: Canindeya, arroyo Henara, north Colonia Ybycui, MKMB 0011-2-4.3.2, female, 22 mm SL.

Fig. 6. *Phallotorynus pankalos*; Paraguay: Canindeya, arroyo Henara, north Colonia Ybycui, MKMB 0011-2-4.3.2, male, 19.7 mm SL; gonopodium.

to two (rarely three or four)]; [MHNG 2296.13](#) (including *Phalloceros* sp.), [MKMB 0011-5-1.0.0](#), Laguna Blanca, San Pedro, Paraguay, 29. October 1985, Expdt. du Muséum de Genève; [MHNG 2477.43](#), arroyo Hondo 15 km NE Carapo, Caaguazú, Paraguay, 22. October 1989,



Fig. 7. *Phallotorynus victoriae*; Paraguay: Neembucú, near Pilar, rio Neembucú drainage, aquarium specimen, male.

Fig. 8. *Phallotorynus victoriae*; Paraguay: Neembucú, near Pilar, rio Neembucú drainage, aquarium specimen, female.

Fig. 9. Habitat of *Phallotorynus victoriae*, Paraguay, near Yhú, 18.6.2006.

Expdt. du Muséum de Genève; MHNG 2477.44, arroyo Tepicuaray, 8 km E San Estanislao, San Pedro, Paraguay, 24. October 1989, Expdt. du Muséum de Genève; MHNG 2482.16, MKMB 0011-4-1.1.0, rio Acaray, Alto Paraná, Paraguay, 16. October 1986, Expdt. du Muséum de Genève; MHNG 2482.17, Juan O'Leary, Alto Paraná, Paraguay, 10. November 1988, Expdt. du Muséum de Genève.

Diagnosis. *Phallotorynus victoriae* is a slender bodied species of *Phallotorynus* (♂♂ up to 23.00 mm SL, ♀♀ up to 25.20 mm SL). It is distinguished from all other species of *Phallotorynus* by the following characters: expanded lateral processes of gonopodium trowel absent vs. present; pointed bony-projection in the centre of membranous lobe-like expansion of gonopodium ray 3 present vs. rounded bony-projection; membranous tack of gonopodium tip small vs. large membranous tack; black blotch series of lower flanks not very numerous (1 to 3, rarely 4 or 5) vs. numerous (up to 10) or absent.

Distribution. río Paraná system, Paraguay and Argentina. Additionally LUCINDA in REIS *et al.* (2003) and LUCINDA, ROSA & REIS (2005) report also Mato Grosso do Sul, upper rio Paraná drainage, Brazil.

Ecology

As far as known *Phallotorynus* mainly inhabits habitats in slow flowing creeks or near small brooks in swampy areas, ditches and ponds. The waters are often turbid and mostly overgrown with submersed plants or overhanging gras from the banks. The water temperatures usually vary from January to December between 15 and 30 °C. Nothing is known about their diet in nature. Possible syntopic genera of fishes: *Rivulus*, *Pterolebias*; *Bujurquina*, *Crenicichla*, *Gymnogeophagus*, *Cichlasoma*; *Leporinus*; *Bunocephalus*; *Steindachnerina*, *Cyphocharax*; *Hemigrammus*, *Astyanax*, *Oligosarcus*, *Hyphessobrycon*, *Psellogrammus*, *Holosthetes*, *Piabarchus*, *Characidium*, *Bryconamericus*, *Mimagoniates*, *Cheirodon*; *Phenacorhamdia*, *Heptapterus*; *Microlepidogaster*, *Hypoptopoma*, *Rineloricaria*, *Otocinclus*, *Ancistrus*, *Corydoras*.

Comparison

In comparison to *P. victoriae*, *dispilis* and *psittakos* the taxa from Caaguazú and Capiata can not be classified because the character differences given by LUCINDA, ROSA & REIS (2005) in the species diagnosis are not suitable because of their overlap. Furthermore in the description of *P. dispilos* two different statements are made referring to the number of epipleural ribs (11 to 12 and 11 to 13). According to the first description *P. psittakos* is diagnosed by the following autoapomorphy: very large lateral process on the base of the fifth median anal-fin radial of adult males [80-2]. In our investigated specimens in all populations of *Phallotorynus victoriae* we found large and small lateral processes on the base of the fifth median anal-fin radial. *Phallotorynus dispilis* is diagnosed by six autapomorphies: (1) first proximal radial of dorsal fin of adult females located between neural arches of 14th and 15th vertebrae [64-4]. This character was also found in the Capiata and Caaguazú populations. (2) to (4) trowel-like appendix of gonopodium tip of ray 3 wide and short [105-2], lateral border of left and right halves concave [107-1] and left and right halves separated along approximately five-sixths of its whole extension [108-2]. Our investigation shows a very variable situation reflecting the form of the trowel-like appendix of the gonopodium. It should be noted that the fixation in different media stretches or bends the membranous tissue of the gonopodium trowel. (5) two round to elliptical dark blotches along ventral half of flanks [136-2]. This character could not be found constantly in any investigated population, but the Capiata and Caaguazú populations

Tab. 1: Locations and their ecological dates of *Phallotorynus victoriae* in Paraguay.

location	day	time	temperature (°C)		pH	°GH	conductivity (µS/cm)
			air	water			
río Güyrauguá	08.09.1986	14:00	30.0	22.0	6.5	3	
20 km near Pilar	08.11.2001	13:00	39.0	30.8	6.1	<1	
	19.11.2004	14:30	29.7	29.3	5.8	<1	47
Luque	04.11.2004	14:30	35.6	30.8	5.8	<1	121
	21.11.2004	10:20	27.0	24.1	6.0	<1	
	06.06.2006	09:15	22.5	20.1	6.5	3	34
Capiata	21.11.2004	17:00	27.2	30.5	5.8	<1	106
San Carlos	17.06.2006	11:30	21.1	17.8	5.5	<1	
Yhú	18.06.2006	12:10	27.4	18.3	6.5	1	

include some individuals with two dark lateral spots. (6) presence of sexually dimorphic teeth. This character was not investigated by us.

Phallotorynus pankalos is diagnosed by LUCINDA, ROSA & REIS (2005) in comparison to *Phallotorynus jucundus* as follows: number of dorsal fin rays 7 vs. 8 or 9, number of anal fin rays in females 10 vs. 9, absence of a dark ring around the anus in females and presence of a dark brown band on lower jaw. These character differences correspond to *Phallotorynus pankalos* from arroyo Henara, Paraguay. In comparison of males of both taxa, *Phallotorynus pankalos* (Henara) shows 7 vs. 8 or 9 dorsal fin rays and 8 vs. 9 (one specimen investigated) gonopodial rays.

Discussion

In the species diagnosis for *Phallotorynus victoriae* the differences to other taxa of the genus are given by LUCINDA, ROSA & REIS (2005) as follows: *P. victoriae* [2 investigated specimens] can be distinguished from its congeners by the number of gonopodial rays 7 (8) vs. 8 (9). The number of epipleural ribs 11 or 12 vs. 13 or 14 distinguishes *P. victoriae* [4 investigated specimens] from *P. dispilos* and *P. psittakos*, and *P. victoriae* can be easily distinguished from *P. fasciolatus*, *P. dispilos*, *P. jucundus* and *P. pankalos* LUCINDA, ROSA & REIS, 2005 by the color pattern.

Our investigations on different populations of *P. victoriae* from Paraguay (see material list) shows in all respects a much more variable situation in color pattern and meristic data than LUCINDA, ROSA & REIS (2005) emphasize. On the other hand we have not seen the *P. victoriae* material from Argentina and Brazil. OLIVEROS (1983) pointed out for two populations of *P. victoriae* a color pattern with one dark spot and 7 (8) gonopodial rays. In our opinion the best way to find out whether a conspecific or a sister species situation exists between *P. victoriae* and other *Phallotorynus* populations, as well as *P. jucundus* and *P. pankalos*, is to include a mitochondrial DNA-sequence based molecular phylogenetic analysis in a revalidation study. On the basis of the new data a polymorphic situation for *P. victoriae* is likely probable. A species status for *P. dispilos* and *P. psittakos* are not justified. Therefore these variations are synonymized with *P. victoriae*.

LUCINDA, ROSA & REIS (2005) postulated in the genus diagnosis as follows: *Phallotorynus* species share the following uniquely derived and unreversed features: (2) large posteroventral projection of ventral flange of fourth anal-fin proximal radial in adult males [76-1**] and clade 90, for the members *P. jucundus*, *P. dispilos* and *P. psittakos*: small posteroventral projection of ventral flange of fourth anal fin proximal radial in adult males [76-2**]. This contradiction is not acceptable and must be deleted.

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