

Biological aspects of *Omalonyx convexus* (Mollusca, Gastropoda, Succineidae) from the Rio Grande do Sul State, Brazil

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Submetido em 12/04/2011
Aceito para publicação em 10/09/2011

Resumo

Aspectos biológicos de *Omalonyx convexus* (Mollusca: Gastropoda: Succineidae) do estado do Rio Grande do Sul, Brasil. *Omalonyx convexus* é amplamente distribuída no estado do Rio Grande do Sul, Brasil. Os espécimes estudados apresentaram, *in vivo*, colorações de tegumento e manto que variaram entre branco leitoso, alaranjado e bege. A concha encontra-se encoberta pelo manto em diferentes extensões e nenhum dos espécimes estudados exibiu a concha completamente encoberta pelo manto. A dieta constituiu-se basicamente de tecido vegetal, embora alimentos não vegetais tenham sido encontrados. Os espécimes foram encontrados tanto em ambientes de água doce preservados quanto poluídos, em substratos naturais e artificiais. A temperatura ao longo do dia influenciou sua posição sobre o substrato.

Palavras-chave: Coloração, Dieta, Distribuição, *Omalonyx convexus*

Abstract

Omalonyx convexus (Heynemann, 1868) is widely spread throughout the Rio Grande do Sul State, Brazil. The studied specimens presented *in vivo*, tegument and mantle coloring in variations between milky-white, orange and beige. The shell presented itself covered by the mantle in different extents; however, it was not completely covered on any of the specimens. The feeding diet is basically constituted by vegetal tissues, although non-vegetal food items were also found. The specimens were found in preserved and in polluted fresh water environments, as well as on natural and artificial substrates. The temperature throughout the day influences their placement on habitat substrates.

Key words: Coloring, Diet, Distribution, *Omalonyx convexus*

Introduction

Omalonyx d'Orbigny, 1837 includes slugs with a reduced, flat and fingernail-like shell (ARRUDA; THOMÉ, 2008b) and a pattern of yellow coloring with two black longitudinal stripes and blackish stains throughout the entire body, including the mantle (BARKER, 2001). The former covers the visceral mass and the edge of the shell (BAKER, 1926). They are herbivorous, feeding on living plant tissues (BARKER, 2001; FRANCESCHINI, 2003). According to Patterson (1971), they occur in the Caribbean Islands and they are amply distributed throughout South America.

The species of *Omalonyx* are reported on macrophytes or emergent vegetation in the banks of lagoons, river floodplains, and streams (D'ORBIGNY, 1837; MARTENS, 1868; GUPPY, 1872; DOERING, 1873; MARTÍNEZ, 1993; BARKER, 2001). However, Parodiz (1963) affirmed that *Omalonyx* species are never found out of the water, they are always submerged among macrophytes or scraping the bottom.

Intending to extend the existent knowledge about this group, this paper focuses on the coloring, shell-mantle association, feeding diet, habitat and occurrence of *Omalonyx convexus* (Heynemann, 1868) in the Rio Grande do Sul State, Brazil.

Material and Methods

Field trips were performed in the following 19 municipalities within the Rio Grande do Sul State (Brazil): Caçapava do Sul, Cachoeira do Sul, Cachoeirinha, Camaquã, Campo Bom, Eldorado do Sul, Estrela, Igrejinha, Nova Hartz, Novo Hamburgo, Pelotas, Pinhal, Porto Alegre, Rolante, Santa Maria, Santo Angelo, Sapiranga, Taquara and Torres. These localities were chosen for presenting usual *Omalonyx* habitats and the expeditions were carried on between May 2005 and May 2006. All collected *Omalonyx* specimens were deposited in the MCP. The MCNZ collection was also investigated. The following lots were examined: BRAZIL, **Rio Grande do Sul**: Santa Maria, 3 *spec.*, Janine Arruda leg. (MCP 8829); Santa Maria, (29°41'15.3"S 53°43'10.5"W) 3 *spec.*, 8.V.2005,

F. Engler, J. Arruda, P. Bergonci leg. (MCP 8831); Torres, (rio Mampituba, 29°15'26.8"S 49°51'09.1"W) 2 *spec.*, E. da Silva, J. Arruda, J. Picanço, L. Araújo leg. (MCP 8832); Cachoeira do Sul, (BR 290, km 255 perto do rio Piquiri B, 30°14'55.7"S 52°46'33.8"W) 1 *spec.*, 9.X.2005, F. Engler, J. Arruda, P. Bergonci leg. (MCP 8840). Estrela, (29°29'45.0"S 51°54'51.3"W) 2 *spec.*, Janine Arruda leg. (MCP 8844); Novo Hamburgo, (Bairro Lomba Grande, 29°43'11.0"S 51°06'03.0"W) 1 *spec.*, C. Vilanova, J. Arruda leg. (MCP 8848); Vacaria (junto ao rio das Antas) 2 *spec.*, 15.VI.1983, C. J. Becker leg. (MCNZ 7559); Portão, 1 *spec.*, 27.III.1971, Liane Ely leg. (MCNZ 3264); Taquara, 1 *spec.*, 09.X.1969, J. C. Gonzáles leg. (MCNZ 2610); Sapiranga, (rodovia RS 240) 1 *spec.*, 25.VII.1970 (MCNZ 2877); Imbé, (Lagoa da Cadeia) 2 *spec.*, 14.VIII.1989, L. A. Pedroso e E.R.O. Silva leg. (MCNZ 31969); Canoas, (Capão do Corvo) 1 *spec.*, 23.IV.1966, J. W. Thomé leg. (MCNZ 597); Cachoeirinha, 1 *spec.*, A. Paladini, J. Arruda leg. (MCP 8839); Eldorado do Sul, 1 *spec.*, F. Engler, J. Arruda, P. Bergonci leg. (MCP 8835); Porto Alegre, (Ilha das Flores) 3 *spec.*, A. Paladini, J. Arruda leg. (MCP 8837); Triunfo, (arroio Bom Jardim) 1 *spec.*, 16.VIII.1979, E. L. de Souza leg. (MCNZ 8058); Porto Alegre, (Ilha das Flores, 29°59'20.9"S 51° 15'56.0"W) 4 *spec.*, 13.IV.2006, E. Moysés, J. Arruda leg. (MCP 8842); Porto Alegre (Parque Farroupilha) 1 *spec.*, L. Araújo, J. Arruda leg. (MCP 8849); Porto Alegre, (Banhado do Dique do rio Gravataí) 1 *spec.*, 17.VII.1963, Thales de Lema leg. (MCNZ 1524); Porto Alegre, (Jardim Botânico) 1 *spec.*, 3.IV.1984, Jane e Mônica leg. (MCNZ 30142); Porto Alegre, (Rio Guaíba) 1 *spec.*, 27.X.1987, Mansur leg. (MCNZ 31590); Porto Alegre, (arroio Agronomia) 1 *spec.*, .IX.1971, Ir. Morais leg. (MCNZ 3424); Porto Alegre, (Parque Farroupilha) 1 *spec.*, 10.IX.1975 Veitenheimer e Lopes leg. (MCNZ 4439); Porto Alegre, (açude Morro Santana) 1 *spec.*, 28.II.1978, Pons da Silva e Lanzer leg. (MCNZ 5501); Porto Alegre, (Ilha do Pavão) 1 *spec.*, 19.X.1999, I. Heydrich leg. (MCNZ 35546); Viamão, (Chácara N. Sra. Das Graças) 1 *spec.*, 26.IV.1969, J. W. Thomé leg. (MCNZ 2506); Guaíba, (arroio Petim) 1 *spec.*, 30.I. 1979, M. H. Galileo leg. (MCNZ 6000); Camaquã, (30°54'00.7"S 51°47'57.5"W) 5 *spec.*, E. Moysés, F.

Engler, J. Arruda leg. (MCP 8841); Pelotas, (Estrada para Rio Grande) 8 *spec.*, A. Paladini, J. Arruda leg. (MCP 8836).

Institutional abbreviations: MCNZ, Museu de Ciências Naturais da Fundação Zoobotânica do Rio Grande do Sul (Porto Alegre, Brazil); MCP, Museu de Ciências e Tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul (Porto Alegre, Brazil).

In order to investigate food items constancy in *Omalonyx convexus* from Rio Grande do Sul State, the crop contents of 49 specimens from Cachoeira do Sul (3), Cachoeirinha (4), Camaquã (5), Estrela (5), Novo Hamburgo (3), Pelotas (8), Porto Alegre (8), Santa Maria (8) and Torres (5) were examined. The animals were dissected under a stereomicroscope and crop contents were fully extracted using a hypodermic needle. The entire content triage was made under an optical microscope, using slides and coverslips.

Results

We found *Omalonyx convexus* specimens in ten of 19 investigated municipalities (Table 1).

In cloudy days, we found 191 specimens in 163 sampling effort hours, which corresponded to one specimen *per* 51 minutes. In sunny days, we found 164 specimens in 184 sampling effort hours, which corresponded to one specimen *per* 67 minutes of effort.

In the early morning (between 7a.m. and 10a.m.) and in the end of the afternoon (between 4p.m. and 6p.m.) of sunny days, the animals were observed on the stem and on the adaxial surface of the macrophyte leaves, on grasses in flooded areas and under adjacent vegetation on the banks of dikes and lakes. In this last case, they presented themselves as mimetic to the environment, making visualization very difficult. During the hottest hours of the day (between 10a.m. and 4p.m.), they were found on flowers, roots, abaxial surface of leaves and close to the base of macrophyte flowers.

The specimens studied presented up to four centimeters in total length and, *in vivo*, tegument and mantle coloring in variations between milky-white, orange and beige, with irregularly sized and distributed

blackish spots, which, depending on their quantity, may give the slug a darkish-gray appearance (Figure 1). Beige was the most commonly observed coloring. Milky-white slugs can present, by translucency, the color of substrates on which they lie.

The shell was translucent, with an amberish tint, and presented itself covered by the mantle in different extents; however, it was not completely covered on any of the specimens.

TABLE 1: Investigated municipalities of the Rio Grande do Sul State (Brazil) and their collecting data.

City	N	Sampling effort (hours)	Weather
Caçapava do Sul	0	54	sunny
Cachoeira do Sul	5	3	cloudy
Cachoeirinha	34	6	sunny
Camaquã	41	30	sunny
Campo bom	0	4	sunny
Eldorado do Sul	5	2	sunny
Estrela	23	8	sunny
Igrejinha	0	8	cloudy
Nova Hartz	0	2	sunny
Novo Hamburgo	3	10	cloudy
Pelotas	48	45	cloudy
Pinhal	0	18	sunny
Porto Alegre	105	45	cloudy
Porto Alegre	23	44	sunny
Rolante	0	2	sunny
Santa Maria	38	51	sunny
Santo Angelo	0	42	sunny
São Borja	0	45	sunny
Sapiranga	0	8	cloudy
Taquara	0	8	cloudy
Torres	30	60	cloudy

We found *Omalonyx convexus* on adjacent vegetation in draining ditches of paddy rice irrigations, floodplains, dikes and lakes, rivers and streams, and on the trunk (dry portion) of a semi-submerged tree in a temporarily flooded location. They were mainly seen on macrophytes *Eichhornia azurea* Kunth, *Salvinia auriculata* Aubl., *Pistia stratiotis* L. and *Eryngium* sp.; however, they were also found on artificial substrates such as canvases, cardboards, plastic bottles, tetra-pak boxes and Styrofoam (Table 2).



FIGURE 1: Tegument and mantle coloring variety in *Omalonyx convexus* (Heynemann, 1868). A: orange coloring, B: beige coloring, C: beige coloring with a darkish-gray appearance.

TABLE 2: Habitats and municipalities where *Omalonyx convexus* (Heynemann, 1868) was collected between May 2005 and May 2006.

Habitats	Municipalities								
	Cachoeira do Sul	Cachoeirinha	Camaquã	Estrela	Novo Hamburgo	Pelotas	Porto Alegre	Santa Maria	Torres
On macrophytes in draining ditches of paddy rice irrigations			X	X				X	
On emergent vegetation on dike / lake banks								X	X
On floodplain macrophytes and emergent Vegetation	X	X				X	X		
On stream / river macrophytes					X				X
On the trunk (dry portion) of a semi-submersed tree in a temporarily flooded location							X		
On flooded pasture grass							X		
On artificial floodplain substrates							X		

The feeding diet of *Omalonyx convexus* was basically constituted by vegetal tissues. Among 49 examined crop contents, 100% contained vegetal tissues, from which 6% also contained pollen grains and 2% also contained mites (Table 3).

TABLE 3: Feeding diet (N and % constancy) of *Omalonyx convexus* (Heynemann, 1868).

Diet items	N of crops containing diet item	% Constancy
Vegetal tissues	49	100
Pollen grains	3	6
Mite	1	2

Discussion

Omalonyx convexus had been previously recorded for the municipalities of Cachoeirinha (ARRUDA; THOMÉ, 2008b), Cachoeira do Sul (ARRUDA; THOMÉ, 2008b), Canoas (MEDEIROS et al., 2002), Camaquã (PEREIRA et al., 2000a, ARRUDA; THOMÉ, 2008b; PEREIRA et al., 2011), Novo Hamburgo (ARRUDA; THOMÉ, 2008b), Pelotas (ARRUDA; THOMÉ, 2008b), Porto Alegre (MARTENS, 1868; SILVA, 1995; PEREIRA, et al., 2002; SCHRÖDER-PFEIFER; LOPES-PITONI, 2003; ARRUDA; THOMÉ, 2008b), Santa Maria (ARRUDA; THOMÉ, 2008b),

Torres (ARRUDA; THOMÉ, 2008b), and Triunfo (PEREIRA et al., 2000b), in the Rio Grande do Sul state, Brazil. This paper extends its occurrence to Eldorado do Sul, Estrela, Guaíba, Imbé, Portão, Sapiranga, Taquara, Vacaria, and Viamão (Figure 2). Although we did not find *O. convexus* in Taquara and Sapiranga, this species has been recorded for both municipalities based on the examined MCNZ material (MCNZ 2610 for Taquara and MCNZ 2877 for Sapiranga). *Omalonyx brasiliensis* (Simroth, 1896) has also been recorded for the Rio Grande do Sul State, occurring in partial sympatry with *O. convexus* (ARRUDA; THOMÉ, 2008a); however, we did not find it in this study.

The coloring was used to describe and characterize *Omalonyx* species (D'ORBIGNY, 1837; GUPPY, 1872; DOERING, 1873; DOERING, 1877; PATTERSON, 1971). Due to the wide coloring variability that we observed for *O. convexus*, it can be confused with *O.*

unguis (d'Orbigny, 1837), *O. matheroni* (Potiez & Michaud, 1835); and *O. pattersonae* Tillier, 1981. The greenish color mentioned by d'Orbigny (1837) for *O. unguis* could also be interpreted as milky-white, as observed for *O. convexus* specimens. Guppy (1872) described *Amphibulima (Omalonyx) felina* [= *O. matheroni* according to Tillier (1981)] with a slightly yellowish white color. Doering (1873) characterized *O. unguis* with a blackish-gray coloring. Posteriorly, Doering (1877) mentioned, for the *O. unguis* population from Santa Fé (Argentina), a pale coloring as well as the same coloring described by d'Orbigny (1837) for this species. Patterson (1971) characterized *O. felina* [= *O. pattersonae* according to TILLIER, 1981] with a translucent white color. All the abovementioned colorations were also found in the studied *O. convexus* specimens. This great coloring variation concerning one *Omalonyx* species is being reported for the first time, in this study.



FIGURE 2: Municipalities in the Rio Grande do Sul State (Brazil) where *Omalonyx convexus* (Heynemann, 1868) was recorded.

Mantle-covered shell extensions are controversial for *Omalonyx* species. Guppy (1872) affirmed that *Amphibulima (Omalonyx) felina* from Trinidad had its shell completely covered by the mantle, with an occasionally retracted central portion. Gibbons (1879) disagreed with Guppy's observation and replied saying that he had never observed more than a limited portion of the shell border covered in Demerara (Guiana) and Bahia (Brazil) specimens. Besides Guppy (1872), only Simroth (1896) described another species with a completely mantle-covered shell, being *Neohyalimax brasiliensis* [= *Omalonyx brasiliensis* according to Arruda and Thomé, 2008a] from Rio Grande do Sul state (Brazil). In *O. convexus*, the mantle covers the shell in different extents; however, never completely.

The specimens of *O. convexus* were found on emergent vegetation in lentic environments, as well as submerged among macrophytes, concurring with d'Orbigny (1837), Martens (1868), Guppy (1872), Doering (1873), Martínez (1993) and Barker (2001) observations and diverging with Parodiz (1963). Hermann and Dundee (1967) reported *Omalonyx* specimens swimming in the water in Ecuador; however, we did not observe this occurrence. Although *Omalonyx* species had only been recorded in preserved environments, *O. convexus* specimens were also found in sites polluted by household sewage. This is the first record of an *Omalonyx* species living in a polluted area. Given that they avoid desiccation, *O. convexus* specimens can be found on different substrate portions throughout the day.

The examined crop contents showed bright green and beige fragments of plant tissues. Based on this, we presumed that *Omalonyx convexus* eats living plant tissues. The only available information regarding crop contents for other *Omalonyx* species concerns *O. brasiliensis*. Simroth (1896) reported fibers and very dark contents, which induced him to conclude that *O. brasiliensis* fed on dead leaves that had fallen to the ground in the species habitat. Although slug of the genus *Omalonyx* has been considered herbivorous, non-vegetal food items were found in the *O. convexus* diet. The low consistency of these items suggests their occasional ingestion. Franceschini (2003) described the damage caused by *Omalonyx unguis* in macrophytes. According

to her, the tissues consumed are the epidermis, palizade parenchyma, aerenchyma, sclerenchyma, phloem, and xylem. Among the ingested tissues within examined *O. convexus* crop contents, parenchyma was identified.

We have approached original *Omalonyx convexus* biological aspects which have added knowledge towards the genus *Omalonyx* and can be used as comparative parameters for future studies about other species of *Omalonyx*, and other neotropical succineids.

Acknowledgments

We are grateful to Ingrid Heydrich (MCNZ) and Lúcia Maria Z. Richinitti (MCP) for loaning material; Vanessa Gazulha for the feeding diet analysis; to Andressa Paladini, Cíntia S. Vilanova, Eleandro Moysés, Estevam Silva, Fernando Engler, Juliane B. Picanço, Luiz Augusto F. Araújo and Paulo Eduardo A. Bergonci for helping with the collection of material; to Luiz Augusto F. Araújo for the English translation; to Centro Nacional de Desenvolvimento Científico e Tecnológico for the financial support (CNPq 131716/2005-0 for JOA, 500032/2003-3 for JWT).

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