

This article was downloaded by:[De Villalobos, Cristina]  
On: 21 April 2008  
Access Details: [subscription number 791825136]  
Publisher: Taylor & Francis  
Informa Ltd Registered in England and Wales Registered Number: 1072954  
Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



## Journal of Natural History

Publication details, including instructions for authors and subscription information:  
<http://www.informaworld.com/smpp/title~content=t713192031>

### Redescription of the genus **Noteochordodes**, reinterpretation of **Noteochordodes dugesi** (Camerano, 1898), a new combination of **Neochordodes talensis** (Camerano, 1897) and a description of a new species

Cristina De Villalobos <sup>ab</sup>; Fernanda Zanca <sup>ac</sup>; Liliana Salas <sup>d</sup>

<sup>a</sup> Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata,  
Argentina

<sup>b</sup> Comisión de Investigaciones Científicas de la Provincia de Buenos Aires, La Plata,  
Argentina

<sup>c</sup> Consejo Nacional de Investigaciones Científicas y Tecnológicas, Ciudad de  
Buenos Aires, Argentina

<sup>d</sup> Facultad de Ciencias Exactas y Naturales, San Fernando del Valle de Catamarca, Argentina

Online Publication Date: 01 January 2008

To cite this Article: De Villalobos, Cristina, Zanca, Fernanda and Salas, Liliana (2008) 'Redescription of the genus **Noteochordodes**, reinterpretation of **Noteochordodes dugesi** (Camerano, 1898), a new combination of **Neochordodes talensis** (Camerano, 1897) and a description of a new species', *Journal of Natural History*, 42:3, 189 - 204

To link to this article: DOI: 10.1080/00222930701848988

URL: <http://dx.doi.org/10.1080/00222930701848988>

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: <http://www.informaworld.com/terms-and-conditions-of-access.pdf>

This article maybe used for research, teaching and private study purposes. Any substantial or systematic reproduction, re-distribution, re-selling, loan or sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

## Redescription of the genus *Noteochordodes*, reinterpretation of *Noteochordodes dugesi* (Camerano, 1898), a new combination of *Neochordodes talensis* (Camerano, 1897) and a description of a new species

Cristina De Villalobos<sup>a,b,\*</sup>, Fernanda Zanca<sup>a,c</sup> and Liliana Salas<sup>d</sup>

<sup>a</sup>Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata, Paseo del Bosque, Argentina; <sup>b</sup>Comisión de Investigaciones Científicas de la Provincia de Buenos Aires, La Plata, Argentina; <sup>c</sup>Consejo Nacional de Investigaciones Científicas y Tecnológicas, Ciudad de Buenos Aires, Argentina; <sup>d</sup>Facultad de Ciencias Exactas y Naturales, San Fernando del Valle de Catamarca, Argentina

(Received 6 August 2007; final version received 5 December 2007)

Three species of the freshwater genus *Noteochordodes* (Nematomorpha) have been reported from Argentina. In this reinvestigation *Neochordodes talensis* is included into *Noteochordodes* on the basis of its cuticular structure. The ultrastructural study of the holotype of *N. dugesi* showed features which are correspondent with the genus *Pseudochordodes*. Consequently, some specimens formerly assigned to this species have been assigned to a new species, *Noteochordodes cymatium*. Another new species, *Noteochordodes achosmosus* is also described. Therefore, we regard five species to be valid for the genus *Noteochordodes*: *N. achosmosus*, *N. cymatium*, *N. desantisi*, *N. talensis* and *N. saltae*.

**Keywords:** *Noteochordodes*; Nematomorpha; revision

### Introduction

The genus *Noteochordodes* was created by Miralles and De Villalobos (2000) for freshwater Nematomorpha with conspicuous cuticular features such as the shape and arrangement of the areoles and the features of the interareolar furrow. To date, three species have been described as belonging to this genus: *Noteochordodes desantisi*, *N. dugesi* and *N. saltae*. The original description of *N. desantisi* and *N. saltae* was based on single female specimens.

After analyzing the museum specimens and collecting numerous hairworm specimens in Argentina belonging to *Noteochordodes*, the previously described *Noteochordodes* species are reviewed here. The investigations of the new specimens made it possible to describe the male posterior end (except for *N. desantisi*) and to add some remarks on each species of the genus *Noteochordodes*. In addition, we reinterpret *N. dugesi*, make a new combination of *Neochordodes talensis* and describe a new species. Also new data of the distribution of this genus have been provided.

---

\*Corresponding author. Email: villalo@fcnym.unlp.edu.ar

## Material and methods

New specimens, collected by a member of our research group, have been investigated. These new nematomorphs are deposited in the Invertebrate Department, Museo de Ciencias Naturales, La Plata, Argentina. Additional material from museums was investigated. The following abbreviations are used for the museums: MRSNT, Museo Regionale di Science Naturali, Torino, Italy; MLP, Museo de Ciencias Naturales, La Plata Argentina; MACNBR, Museo Argentino de Ciencias Naturales Bernardino Rivadavia Buenos Aires Argentina; MCNML, Museo de Ciencias Naturales Miguel Lillo, Tucumán Argentina. Also, after analysis by light microscopy (LM) 54 males and one female deposited in the Museo Regionale di Science Naturali, Torino, Italy as *Chordodes brasiliensis* (MRSNT G2, from Salta Tala, see Camerano 1897a, b), we discovered that 19 males and one female of this batch belong to *Noteochordodes talensis* (see below).

Body measurements were made with outstretched worms using a ruler. Diameters were measured under a dissecting microscope using a calliper ruler.

In all newly recorded specimens, tangential sections of the cuticle were removed from the middle region of the body with a razor blade, washed in lactophenol for 24 hours and observed with a Wild Mka 2 light microscope after cleaning and removing the remains of muscular tissue.

To examine specimens by scanning electron microscopy (SEM), fragments of the central region of the body (about 5 mm in length) and the entire posterior end were dehydrated in an increasing ethanol series, critically point-dried, mounted on bronze blocks and gold sputter-coated. Observations were performed using a JEOL JSM 6360 LV. All preparations, i.e. the SEM stubs, are stored together with the preserved specimens in the respective museums.

## Results

*Noteochordodes* Miralles and de Villalobos, 2000  
2000. *Noteochordodes* Miralles and De Villalobos.

### Diagnosis

Body colour varies from light brown to dark brown. Anterior end is slightly conical in shape. A white cap and a dark collar are not present. The male posterior end is undivided with a ventral groove. The cloacal opening is subterminal on the ventral side. The cloacal opening is oval and can be surrounded by bristles called circumcloacal bristles. Anterolateral of the cloacal opening are paired rows of scattered bristles. Posterior to the cloacal opening are short spine-like cuticular structures (Figure 2A).

The posterior end of females is round and rather distended in its apex. The cloacal opening is round and terminal.

The body cuticle contains one or two types of areoles. Areoles are arranged either isolated or grouped in two, three or more areoles. Areolar surface can be smooth or with a central depression. There are clusters of two areoles with a central tubercle between them; these areoles are not larger than the surrounding ones (Figure 5C). There are also isolated areoles very close to a tubercle with a round apex, placed laterally to the areole and not surpassing the areolar height (Figure 3D).

Another constant characteristic in the cuticle of the species of the genus *Noteochordodes* is the presence of a very wide interareolar furrow crossed by cuticular cords where scattered minute spines or round apex tubercles can be found.

### Comments

The genus *Noteochordodes* presents the male posterior end undivided, a characteristic shared with other genus of Gordiida such as *Chordodes* Creplin, 1847 (De Villalobos et al. 2004; De Villalobos et al. 2005; Zanca and De Villalobos 2005), *Euchordodes* Heinze, 1937 (Schmidt-Rhaesa et al. 1998), *Lanochordodes* Kirjanova, 1950 (Schmidt-Rhaesa 2002), *Neochordodes* Carvalho, 1942 (Miralles and De Villalobos 1996) *Pseudochordodes* Carvalho, 1942 (Carvalho 1942) and *Spinochordodes* Kirjanova, 1950 (Schmidt-Rhaesa 2001; Zanca and Schmidt-Rhaesa 2006). Additionally, *Noteochordodes* shows a cluster of two areoles with the central tubercle between them. This pattern has been described for other genus among gordiids (Schmidt-Rhaesa 2001) as in *Chordodes* (De Villalobos and Miralles 1997), *Euchordodes* (Schmidt-Rhaesa et al. 1998), *Gordionus* Müller, 1927 (Schmidt-Rhaesa 2001), *Parachordodes* Camerano, 1897 (Schmidt-Rhaesa 1997), *Paragordionus* Heinze, 1935 (Schmidt-Rhaesa 1997) and *Pseudochordodes* Carvalho, 1942 (Carvalho 1942). In spite of these similarities, *Noteochordodes* presents cuticular features with unique areolar types. There are one or two types of areoles both of which may be rounded or oval. In one type, the apical surface is depressed. Areoles are scattered over the cuticle or grouped in two, three or more areoles. A megareolar pattern is present. There are scattered areoles showing a round apex tubercle in one of their lateral parts, and the interareolar furrow is very wide and crossed by cuticular cords with minute spines. This whole set of features of *Noteochordodes*, makes this genus clearly different from the other known Gordiida genus.

### *Noteochordodes desantisi* Miralles & De Villalobos, 2000 (Figure 1)

*Noteochordodes desantisi* Miralles and De Villalobos 2000, p. 282, Figures 7–8.

*Holotype*. 1♀ (MLP 3143).

*Type locality*. Catamarca (unspecified locations).

*Material investigated*. Holotype. SEM mid-body and posterior end.

### Description

The body colour is light brown. Anterior end tapered, mouth terminal. Posterior end rounded and the cloacal opening is situated terminally (Figure 1A).

The body cuticle contains oval, narrow areoles of variable sizes (14.3 to 22.9 µm long) which appear isolated, in paired clusters with a short tubercle between them or occasionally in clusters of three areoles (Figures 1B, D). The apical surface of areoles is flaking. There are also scattered areoles showing a round apex tubercle in one of their lateral parts (Figures 1B, D). The interareolar furrow is wide with cord-like folds and scattered tubercles (5.8 µm high).

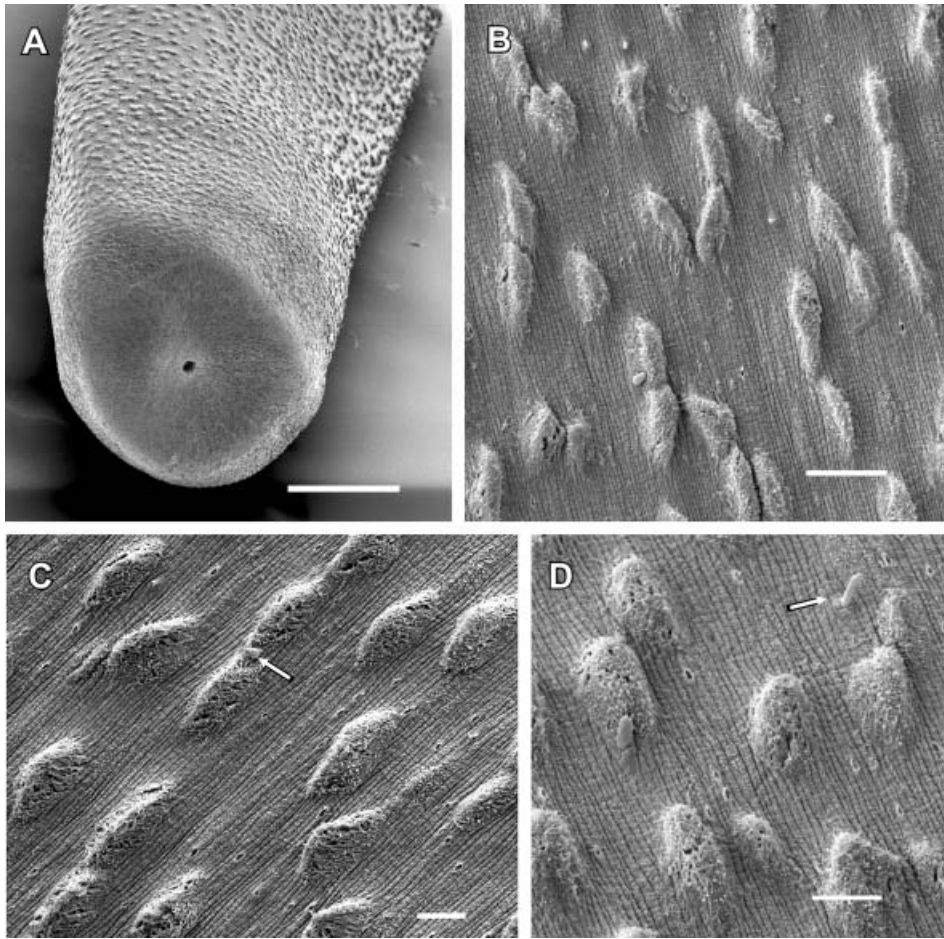


Figure 1. *Notochordodes desantisi* Holotype. A. Ventral view of the posterior end. B. General view of mid body cuticle. C. Detail of mid body cuticle showing a pair of areoles with a tubercle (arrow) between them. D. Detail of mid body cuticle showing areoles and the interareolar furrow with scattered tubercles (arrow). Bars: A 200  $\mu\text{m}$ , B 20  $\mu\text{m}$ , C, D 10  $\mu\text{m}$ .

### Comments

Miralles and De Villalobos (2000) described *Notochordodes desantisi* with two areolar types. This reinvestigation reveals that the differences in the size and arrangement of the areoles do not justify a separation of the areoles in two different types. *Notochordodes desantisi* differs from the other species of *Notochordodes* in the features of the apical surface of the areoles and in the arrangement of most of the areoles, which appear either isolated or forming groups of no more than three areoles.

*Notochordodes saltae* Miralles & De Villalobos, 2000

(Figure 2)

*Notochordodes saltae* Miralles and De Villalobos 2000, p. 281, Figures 4–6.

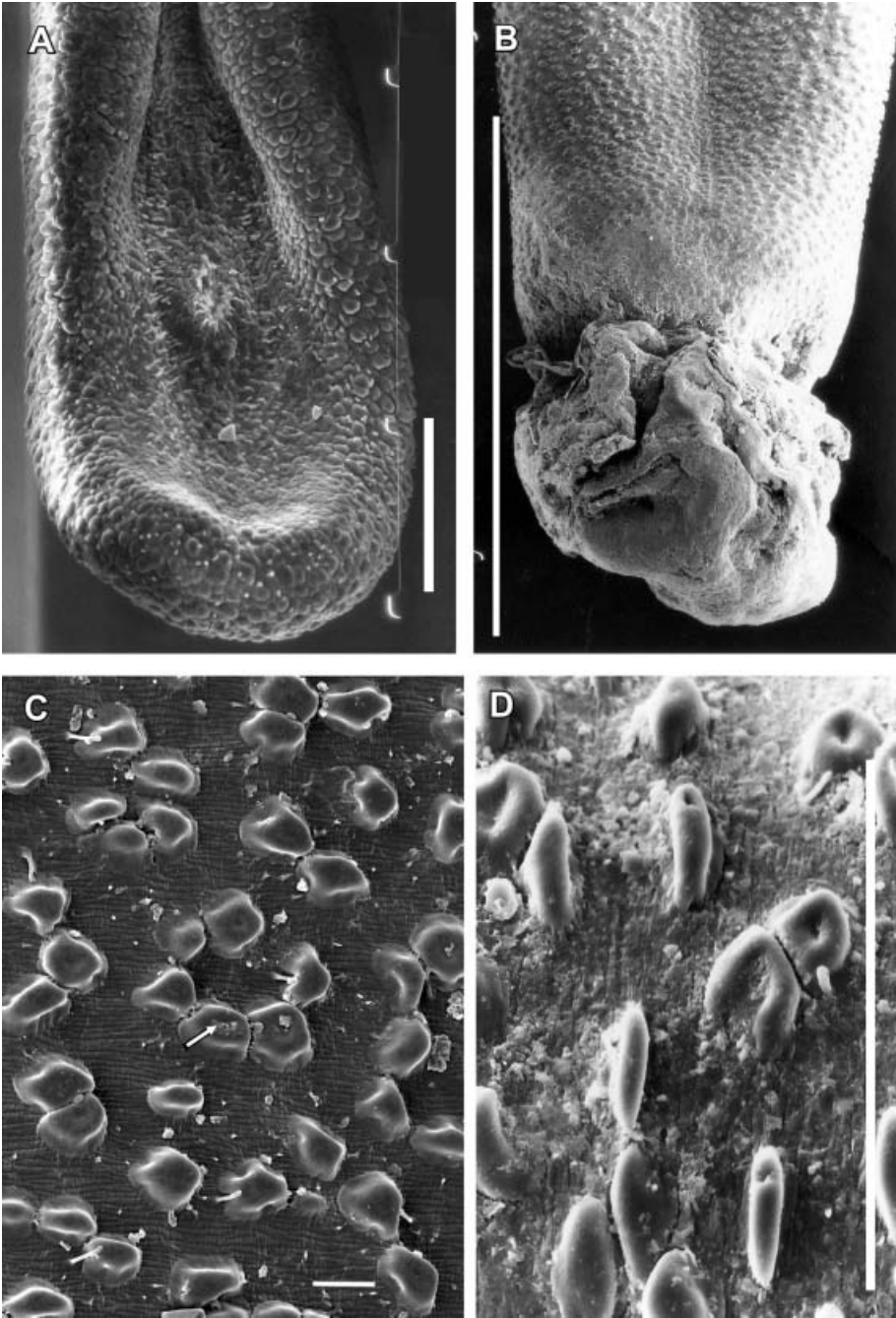


Figure 2. *Notochordodes saltae*. A. Male (MLP 5047), posterior end showing the cloacal opening with circumcloacal spines and rows of scattered bristles. B. Female (MLP 3144), posterior end covered with a sperm mass. C-D Male (MLP 5047), mid body cuticle showing areoles with the apical surface flat or depressed (arrow), clusters of two areoles with a central tubercle between them and areoles with a lateral tubercle. Note the interareolar furrow crossed by cuticular cords with minute spines. Bars: A, B 100  $\mu$ m, C 100  $\mu$ m, D 20  $\mu$ m.

*Holotype*. 1♀ (MLP 3144).

*Type locality*. Argentina: Salta, Campo Quijano.

*Material investigated*. SEM mid-body and posterior end. Holotype and specimens from new locations in **ARGENTINA**: **Salta**: Colorado stream, Cafayate 1♂ (MLP 5047) and **Catamarca**: Los Angeles stream 1♂ (MLP 5712), Concepción Capayán, El Simbolar stream 2♂♂ (MLP 5713).

### **Description**

*Male (MLP 5047)*. The body colour is light brown. The posterior end is undivided (Figure 2A). Cloacal opening, oval (37.5 µm long) and placed ventrally, 193.5 µm from the apex. The cloacal opening is surrounded by circumcloacal bristles. Anterolateral of the cloacal opening are paired rows of scattered bristles. The cuticle of the posterior end shows a different pattern from the rest of the body (see below), as the areoles are rounded with a smooth surface and the interareolar furrow is quite narrow. Scattered bristles are also found in this region (Figure 2A).

The body cuticle shows areoles arranged perpendicularly to the longitudinal axis of the body. There are oval (26.4 µm long) or rounded (14.5 µm) areoles (Figures 2C, D). The apical surface is depressed or flat. These areoles are isolated or form groups of two, three or six areoles. There are clusters of two areoles with a central tubercle between them; these areoles are not larger than the surrounding ones (Figure 2C). Some areoles show a lateral tubercle (Figure 2C, 2D). The interareolar furrow is wide and crossed by cuticular cords with minute spines.

The other male specimens investigated (MLP 5047, MLP 5712, MLP 5713), show the same features as the male (MLP 5047).

*Female holotype*. The posterior end is rounded, the details of the cloacal opening could not be observed because it was covered with a sperm mass (Figure 2B), and the cuticle pattern is similar to the body cuticle. The body cuticle shows the same features as in males.

### **Comments**

In this reinvestigation, the presence of a central tubercle between two areoles and the close relation with a lateral tubercle observed in some isolated areoles is described for the first time for *Noteochordodes saltae*. These two features were not mentioned in the original description (Miralles and De Villalobos 2000). Besides, the male of *N. saltae* is described for the first time in this work.

*Dimensions*. Holotype is 259 mm in length and 1.1 mm in diameter (Miralles and De Villalobos 2000). The newly reported specimens range in length from 72–191 mm. Diameters vary from 0.6–0.8 mm.

*Distribution*. **ARGENTINA**. **Salta**: Campo Quijano (1♀, Miralles and De Villalobos 2000); Cafayate, Colorado stream (25° 05' S, 65° 58' W) (1♂ (MLP 5047), new record). **Catamarca**: Los Angeles stream (28° 27' S- 66° 04' W) (1♂, new record); Concepción Capayán, El Simbolar stream (30° 48' S- 63° 97' W) (2♂♂, new record).

*Noteochordodes talensis* (Camerano, 1897) nov. comb.  
(Figure 3)

*Chordodes talensis* Camerano 1897b, p. 375, Figures 31–31a.  
*Neochordodes talensis* Carvalho 1942, p. 216.

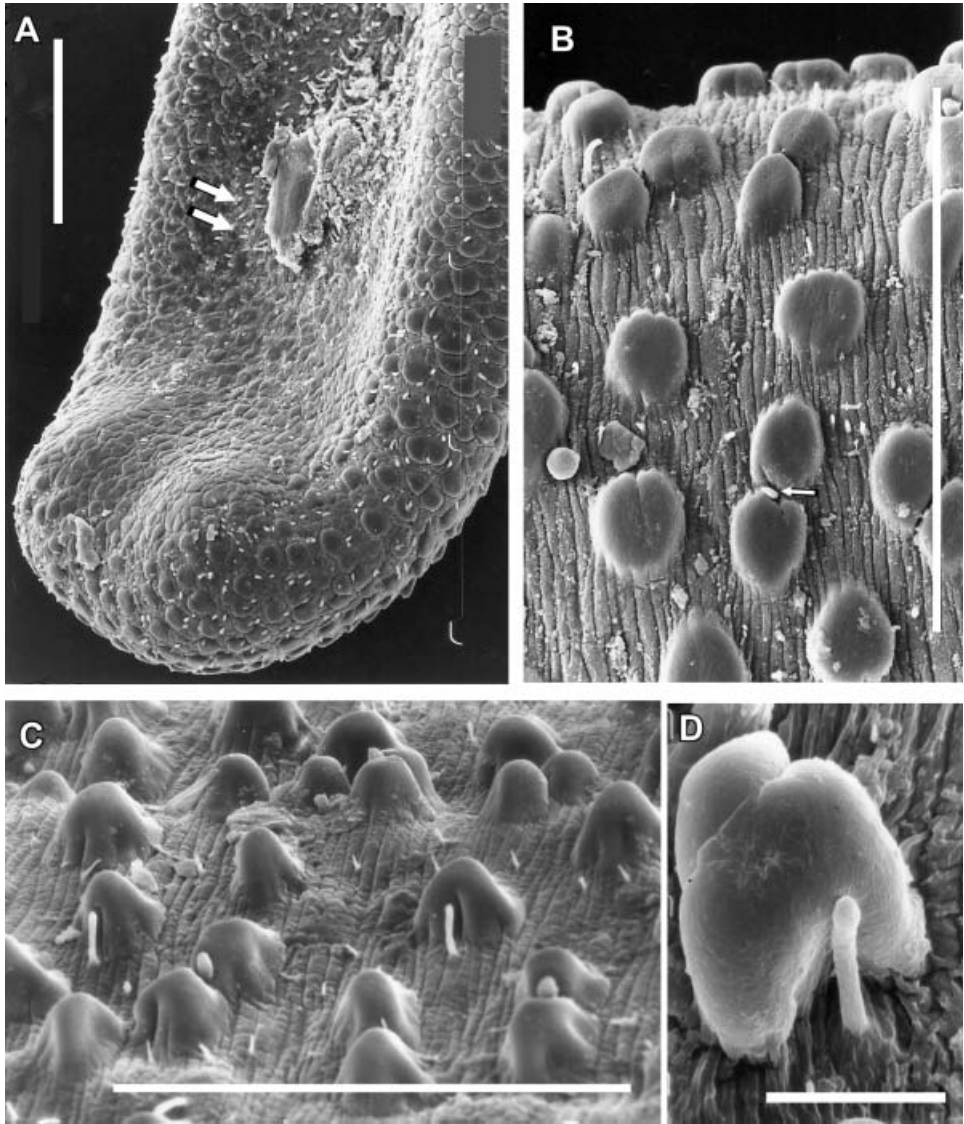


Figure 3. *Noteochordodes talensis*. A. Posterior end of male (MRSNT G6) showing scattered bristles (arrows), short spines and the cuticle covered by areoles. B. Mid body cuticle of female (MRSNT G41) showing areoles low and mainly arranged isolated or in areolar groups with no more than two areoles. Note a tubercle between two areoles (arrow). C. Cuticle pattern of male (MRSNT G6). D. Detail of isolated areole with a tubercle in a lateral concavity. Bars: A-C 100  $\mu$ m, D 10  $\mu$ m.

*Type locality.* Camerano (1897a) describes this species from specimens from Argentina: Jujuy, San Lorenzo (MRSNT G6); Salta, Tala and from Bolivia: Tarija, Mision San Francisco (MRSNT G41); without assigning the holotype.

*Material investigated.* SEM mid-body and posterior end. **BOLIVIA:** Tarija, Mision San Francisco 2♂♂, 1♀ (MRSNT G41); **ARGENTINA:** **Jujuy:** San Lorenzo 2♂♂ (MRSNT G6); **Salta:** Tala; 1♂, 1♀ (MRSNT G2a y G2b); Quebrada del Toro 1♂ (MLP 3620); Carapari 1♂ (MLP 2619); La Candelaria, Tala 1♂ (MLP 3617); Capital 1♂ (MLP 5061); Oran, Tabacal 1♂ (MACNBR 22367); **Neuquén:** Colonia Confluencia 1♀ (MLP 3618); Neuquén (deposition locality unknown) 1♂ (MLP3625); **Tucumán:** Estancia La Hiyada 2♂♂ (MRSNT G38); **Catamarca:** Concepción, Pampichuela stream 2♂♂, (MLP 5710), Padín, La Merced stream 1♂ (MLP 5711), Capital, El Tala stream 2♂♂ (MLP 5709), Concepción, El Simbolar stream 1♂ and 1♀ (MLP 5708).

### Description

*Male (MRSNT G6).* The body colour is dark brown. The posterior end is rounded with a medial groove (Figure 3A). The shape of the cloacal opening and the presence of circumcloacal bristles could not be observed due to the dirt or sperm covering the cloacal opening. Anterolateral of the cloacal opening are scattered bristles. Posterior to the cloacal opening are short spines (postcloacal spines). The cuticle at the posterior end is covered by areoles and the interareolar groove is more or less wide and with short bristles.

The body cuticle shows high (16.1 µm) and conical areoles (Figure 3C). The areoles are found isolated or forming groups of up to five areoles. Areoles are perpendicular to the anteroposterior axis of the body. A blunt tubercle is usually found between two areoles. There are isolated areoles with a tubercle in a lateral concavity (Figures 3C, D). Space among areolar groups is wide, crossed by cuticular cords and with minutes and scattered spines.

*Female (MRSNT G41).* The body colour is light brown. The posterior end is rounded.

The cuticle contains low (7.1 µm) rounded areoles with a flat and smooth apical surface (Figure 3B). The cuticle, as in males, presents a tubercle between two areoles and a lateral tubercle in some isolated areoles. As a difference to males the areoles are low and mainly arranged isolated or in areolar groups with no more than two areoles.

The analysis by SEM of the remaining specimens studied, male and female, did not show modifications of the described characteristics for the male (MRSNT G6) and the female (MRSNT G41), respectively.

### Comments

Camerano (1897a) describes this species as *Chordodes talensis* from Argentinian and Bolivian specimens without defining sex, measures or quantity of specimens analyzed from each locality. This information is included in this work (see below). Carvalho

(1942) transfers *C. talensis* to the genus *Neochordodes*. This study by SEM reveals that the features of the cuticle correspond to those of the *Noteochordodes* and we therefore consider this species as *Noteochordodes talensis*.

Present observations agree with Camerano (1897a, b): the females are different from the males in their cuticular features.

*Dimensions.* Specimens from the original description of Camerano (1987a) measured in length/diameter: males (MRSNT G6) 123/0.4 mm; 126/0.8 mm; 143/0.78 mm and 155/1 mm. Males (MRSNT G41) 70/0.5 mm; 72/0.6 mm; 88/0.47 mm; 115/0.53 mm; 121/0.7 mm; 123/1 mm; 145/0.6 mm. Female (MRSNT G41) measured 100 mm in length and 1 mm in diameter. According to the literature, the dimensions of males vary from 75–221 mm in length and from 0.9–1.1 mm in diameter. The female measures 84 mm in length and 0.4 mm in diameter (Camerano 1915). Males vary from 76–129 mm in length and are maximally 0.8 mm in diameter while females range from 115–285 mm in length and from 0.4–1.3 mm in diameter (Miralles 1975). The newly reported specimens range in length from 55–210 mm in males and from 238–460 mm in females. The diameter varied from 0.53–0.95 mm in males and from 1.41–2.03 mm in females.

*Distribution.* **ARGENTINA:** Buenos Aires: Sierra de la Ventana (Miralles and De Villalobos 1993). **Catamarca:** (1♀ unspecified location, Miralles 1975); Concepción, Pampichuela stream (28° 58' S–66° 11' W) (9♂♂, new record); Paclin, La Merced stream (27° 56' S–65° 50' W) (2♂♂, new record); Capital, El Tala stream (26°07' S–65°16' W) (9♂♂, new record); Concepción, El Simbolar stream (30° 21' S–63° 92' W) (35♂♂ and 2♀♀, new record). **Jujuy:** San Lorenzo (4♂♂, Camerano 1897a). **Neuquén:** Colonia Confluencia (38° 35' S–69° 21' W) (2♀♀, new record). **Salta:** Tala, Estancia San Felipe (19♂♂ and 1♀ as *Chordodes brasiliensis*, Camerano 1897a); Carapari, Carapari stream (23°39' S–63° 06' W) (1♂, new record), Campo Quijano (8♂♂ and 2♀♀, Miralles 1975); Tabacal (2♀♀, Miralles and Camino 1983). Quebrada del Toro (2♂♂, Miralles and De Villalobos 1996); Carapari, (1♂, Miralles and De Villalobos 1996), Salta Capital (1♂ unspecified locations, new record). **Tucumán:** Estancia Hoyada (2♂♂, Camerano 1915). **BOLIVIA.** Tarija, Mision San Francisco (7♂♂ and 1♀, Camerano 1897a), **BRASIL.** South Mato Grosso, Urucum (1♀, Camerano 1915). **CHILE.** Salto Quilpue (1♂, Camerano 1915).

*Noteochordodes cymatium* n. sp.

(Figure 4)

[non *Noteochordodes dugesi* Miralles and De Villalobos 2000, p. 280, figures 1–3.]

*Holotype.* 1♂ (MLP 5703) and *Paratypes* 5♂♂ (MLP 5704).

*Type locality.* Argentina, Catamarca province, El Tala stream.

*Material investigated.* SEM mid-body and posterior end: Holotype, Paratypes and specimens from newly locations: **ARGENTINA: Catamarca:** Las Trancas stream 1♂ (MLP 3145); Capayan, El Simbolar stream 2♂♂ (MLP 5707); La Toma,

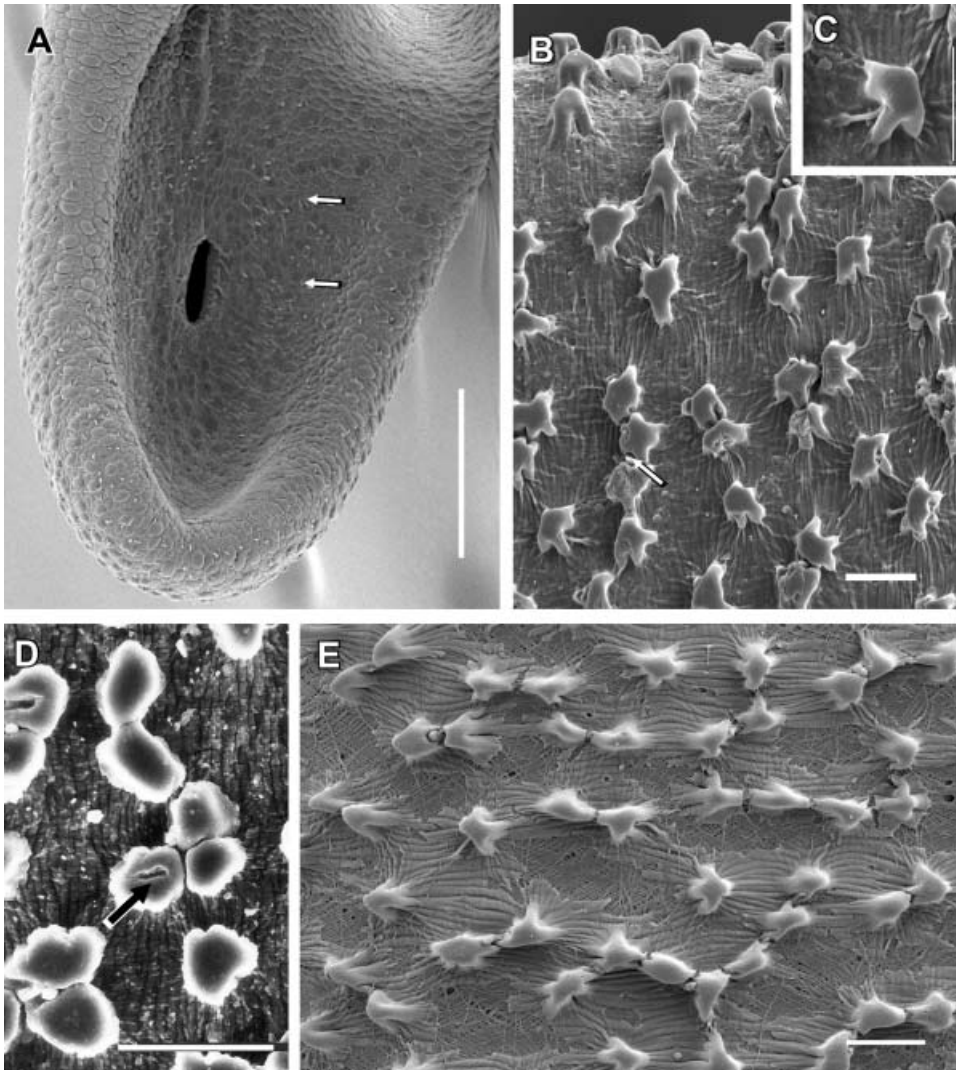


Figure 4. *Notochordodes cymatium* n. sp. Holotype. A. Posterior end showing the cloacal opening and scattered bristles over the ventral side (arrows). B-D. Mid body cuticle. B. General view of the cuticle showing areoles with undulated borders and a smooth surface. Note clusters of two areoles with central tubercle (arrow) and isolated areoles with a tubercle resting on one of their lateral faces. C. Detail of one areole with a tubercle in a lateral face. D. Areoles with flat surface or with a central depression (arrow). E. General view of the cuticle showing the cuticular pattern and the interareolar furrow crossed by thick cuticular fibres. Bars: A 100  $\mu$ m, B, C 20  $\mu$ m, C 25  $\mu$ m, D 10  $\mu$ m.

Miraflores stream 3♂♂ (MLP 5705); Cuesta de los Angeles stream 1♂♂ (MLP 5706). **Salta:** Tala 1♂ (MLP 3146).

*Description*

*Holotype.* The body colour is variable ranking from light brown to dark brown. The anterior end is tapering and a white cap and a dark calotte are not present. The

posterior end is undivided (Figure 4A). The cloacal opening is oval (50 µm long) 166.7 µm from the posterior end. Around the cloacal opening there are circumcloacal spines. Scattered short bristles are distributed over the ventral side of the posterior end (Figure 4A).

The body cuticle contains areoles with varying shape. Usually, they are oval, but they can also appear in rounded shape, with undulated borders. The surface of these areoles is smooth (Figures 4B, E) or less frequently with a central depression (Figure 4D). The areoles are arranged perpendicular to the longitudinal axis of the body (Figure 4B) isolated or in groups of two, three or more areoles. There are areoles forming clusters of two areoles with a rounded central tubercle as high as the areoles. Among these clusters other isolated areoles are usually found, with a tubercle resting on one of their lateral sides (Figures 4B, C, E). The interareolar furrow is wide, crossed by thick cuticular fibres and with minute and scarce bristles with sharp ends.

The paratypes as well as the remaining specimens investigated show the same features described for the holotype.

*Comments.* Miralles and De Villalobos (2000) transferred *Pseudochordodes dugesi* (Camerano, 1898) to the genus *Noteochordodes*. In the present study we analyzed, by SEM, the holotype of *P. dugesi*, from Veracruz Mexico (MRSNT G40) and could prove that the features of the cuticle are correspondent with those of the genus *Pseudochordodes* (see below), as considered by Carvalho (1942), and there are no structures characteristic of *Noteochordodes*. For this reason we transferred the specimens described as *Noteochordodes dugesi* (Miralles and De Villalobos 2000) to a new species *N. cymatium* n. sp.

*Dimensions.* Holotype: 141 mm in length and 0.6 mm in diameter. Paratypes measured in length and diameter 123/0.6 mm, 131/0.7 mm, 147/0.8 mm, 160/0.7 mm and 182/0.9 mm. Specimens from the description of Miralles and De Villalobos (2000) measured in length/diameter: (MLP 3145) 98/0.4 mm; (MLP 3146) 78/0.4 mm. Specimens from new locations are variable. They range in length from 83–235 mm. Diameters in mid-body range from 0.4–1 mm.

*Distribution.* **ARGENTINA: Catamarca:** El Tala stream (26°16' S, 65°22' W) (6 ♂♂, new record); Río Las Trancas (1 ♂ as *Noteochordodes dugesi* Miralles and De Villalobos 2000); Capayan, El Simbolar stream (30° 27' S, 63°17' W) (17 ♂♂ new record); La Toma, Miraflores stream (28°34' S, 65°54' W) (4 ♂♂, new record); Cuesta de los Angeles stream (28°27' S, 66°04' W) (1 ♂, new record). **Salta:** Tala (1 ♂, as *Noteochordodes dugesi* Miralles and De Villalobos 2000).

*Etymology.* The name of the new species comes from the Latin *cymatilis* that means waves, in relation to the features of the areolar borders.

***Noteochordodes achosmosus* n. sp.**

Figure 5

*Holotype.* 1 ♂ (MLP 5714)

*Type locality.* Argentina, Catamarca, Los Pinos stream.

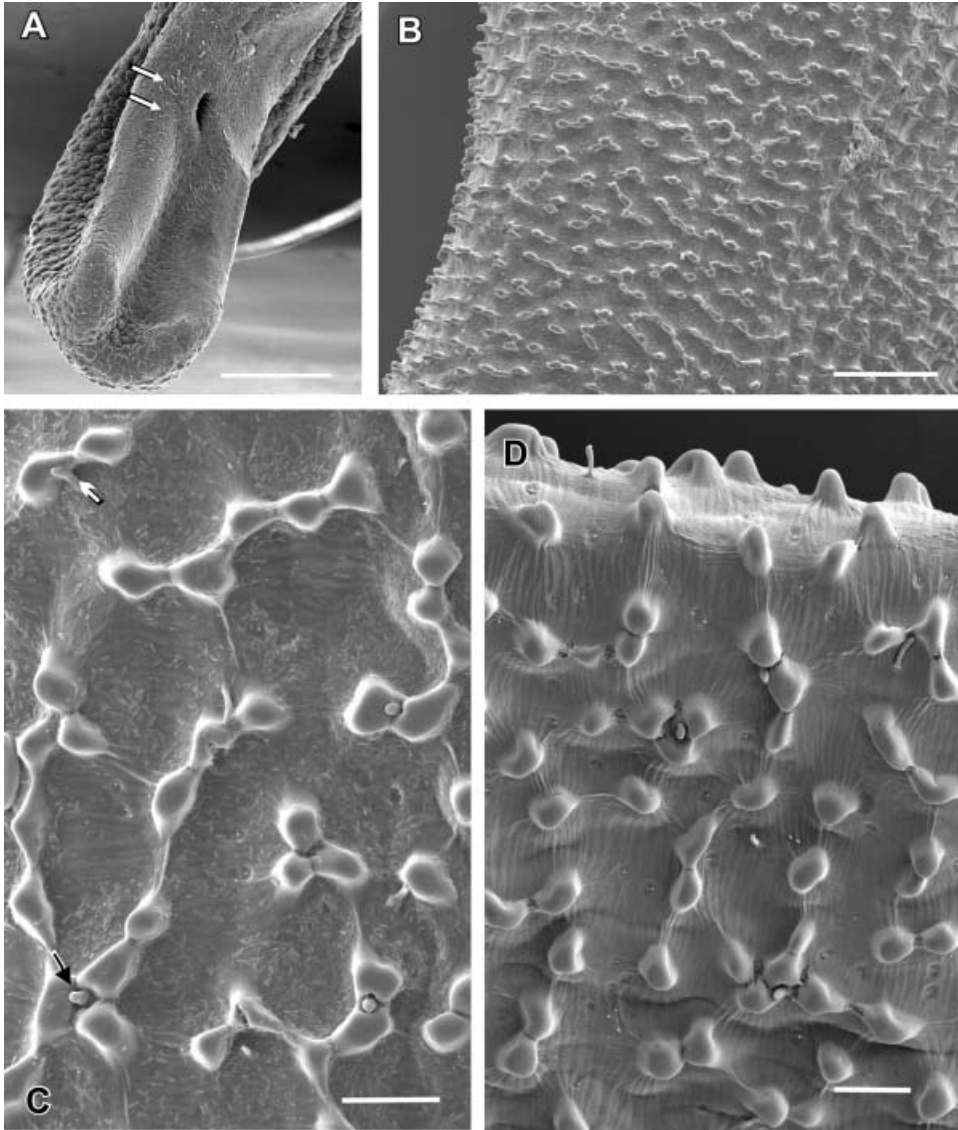


Figure 5. *Notochordodes achosmosus* n. sp. Holotype. A. Ventral view on posterior end showing the cloacal opening and scattered bristles over the ventral side (arrows). B. Cuticle from the anterior region of the body. C, D. Cuticle from mid body showing disorderly arranged. Note a tubercle between areoles which originates in a circular depression (black arrow) and a tubercle placed laterally to isolate areole (white arrow). Bars: A, B 100  $\mu$ m, C, D 20  $\mu$ m.

*Material investigated.* SEM mid-body and posterior end Holotype and 1♂ (MCNML 6882) from ARGENTINA Catamarca: El Lindero ranch, in pond.

*Description*

The body colour is light brown. The posterior end is rounded with a medial groove (Figure 5A). The cloacal opening is oval (40  $\mu$ m long), 240  $\mu$ m from the posterior

end. The cloacal opening is surrounded by circumcloacal spines. Scattered short bristles are distributed over the ventral side of the posterior end (Figure 5A).

The body showed a variation of the cuticular patterns. These variations are evident in the arrangement of the areoles along the whole body. In the anterior as well as in the posterior region the areoles are long and oval and are arranged in parallel groups of two, three or more areoles. These areolar lines maintain a clear transversal arrangement with respect to the longitudinal axis of the body (Figure 5B). The cuticle of the mid-body contains low (9.2 µm), rounded areoles (8.2–14.1 µm), arranged in a disorderly fashion. These areoles are rarely isolated and were distributed irregularly forming groups of two, three or five areoles. The areolar groups can connect to each other by means of cuticular projections forming strange shapes (Figures 5C, D). As the other species belonging to the genus *Noteochordodes*, *N. achosmosus* presents groups of two or three areoles with a thick tubercle of rounded apex among them which originates in a circular depression (Figures 5C, D). There are also isolated areoles with a tubercle arising directly from the cuticle of the interareolar furrow in one of their lateral faces (Figures 5C, D). The interareolar furrow is wide, with scattered tubercles and short, conical spines.

*Comments.* *Noteochordodes achosmosus* n. sp. is clearly different from the other species of *Noteochordodes* due to the variation in the areolar arrangement along the body, the shape of the areolar groups and the tubercle located between the areolar group which arises from a deep and evident pore.

*Dimensions.* The holotype measured 191 mm in length and 0.5 mm in diameter. The length of the male (MCNML 6882) is 197 mm with a maximal diameter of 0.7 mm.

*Distribution.* **ARGENTINA:** Catamarca Los Pinos stream (28°29' S, 65°36' W), El Lindero ranch (29°45' S, 64° 47' W) (1♂, new record).

*Etymology.* The name of the new species comes from the Greek: *akosmos* that means disorderly, in relation with the arrangement of the areolar groups of the cuticle.

***Pseudochordodes dugesi*** (Camerano, 1898)

(Figure 6)

*Chordodes dugesi* Camerano 1898, p. 73.

*Pseudochordodes dugesi* Carvalho 1942, p. 216.

[non] *Noteochordodes dugesi* Miralles & De Villalobos 2000, p. 280, figures 1–3.

*Holotype.* 1♂ (MRSNT G40).

*Type locality.* **MEXICO**, Veracruz, Altoyac.

*Material investigated.* SEM mid-body of the holotype.

*Description*

*Holotype.* The body colour is dark brown. Posterior end is undivided.

The body cuticle contains two areolar types (Figures 6A, B), one with big rounded areoles (24.4–37.3 µm) more or less protruding with a smooth surface or with minute pores. They are generally found isolated or in pairs, among the pairs of areoles a blunt tubercle not higher than the areoles can usually be found (megareolar

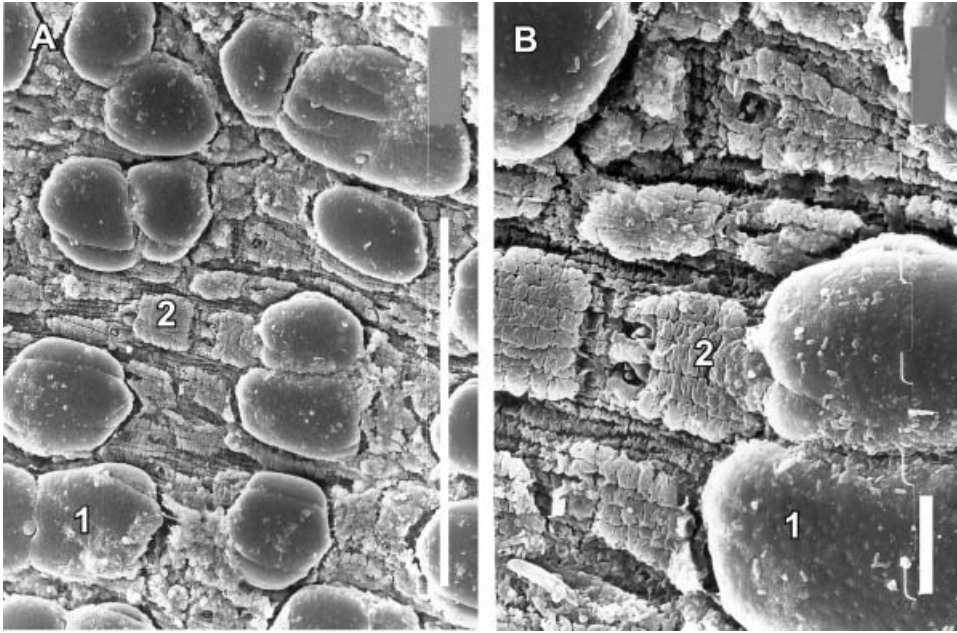


Figure 6. *Pseudochordodes dugesi*. Holotype. A- B. Mid body cuticle showing areoles with blunt tubercle between them (1), (megareolar pattern) and areoles with rugged surface (2). Bars: A 100µm, B 10µm. 172 × 226 mm (300 × 300 DPI)

pattern, Schmidt-Rhaesa 2001). The other type of areoles is small (13.9–16.6 µm) low, of irregular shape and rugged surface. In some of these areoles one or two pores with minute bristles of rounded apex can be observed (Figures 6A, B). The interareolar furrow is narrow and crossed by cuticular cords.

*Dimensions.* 322 mm long, 2 mm wide.

*Comments.* The reinvestigation of the cuticular features of the holotype allows us to confirm that it belongs to the genus *Pseudochordodes* as considered by Carvalho (1942).

**Key to the species of *Noteochordodes***

- 1. Areoles are arranged perpendicular to the longitudinal axis of the whole body. . . . . 2
  - Areoles of the mid-body are disorderly arranged . . . . . *N. achosmosus*
- 2. Areoles isolated with a tubercle in a lateral concavity. . . . . 3
  - Areoles isolated with a tubercle resting on one of their lateral sides. . . . . 4
- 3. Areoles conical, with smooth surface . . . . . *N. talensis*
  - Areoles elongated, narrow with flaking surface . . . . . *N. desantisi*
- 4. Areoles smooth or with a central depression and undulated borders. . . . . *N. cymatium*
  - Areoles smooth or with a central depression and smooth border. . . . .
  - . . . . . *N. saltae*

## Conclusions

From the three species described to date in the genus *Noteochordodes*, two could be confirmed. The reinvestigation of the holotype of [*N. dugesi*] allowed us to prove that the features of the cuticle are coincident with those of the genus *Pseudochordodes*. For this reason, the specimens assigned to [*N. dugesi*] have been transferred to a new species, *N. cymatium*. On the basis of the cuticular patterns *Neochordodes talensis* is included in *Noteochordodes*. Furthermore, another new species, *N. achosmosus* could be added to the genus. Therefore, the recently known diversity of *Noteochordodes* is of five species.

## Acknowledgements

We greatly appreciate the help of Lisa Levi (Museo Regionale di Scienze Naturali, Torino, Italy) and thank Cristina Damborenea (Museo de Ciencias Naturales, La Plata, Argentina) for the loan of and permission to investigate, museum specimens. Many thanks also to Patricia Sarmiento from the Scanning Electron Microscopy Service (Museo de Ciencias Naturales, La Plata, Argentina) for preparation of the material. Many thanks also to two anonymous reviewers for constructive comments on the manuscript.

## References

- Camerano L. 1897a. Gordii. Viaggio del Dott. Alfredo Borelli nel Chaco Boliviano et nella Repubblica Argentina. Bollettino dei Musei di Zoologia ed Anatomia Comparata della Reale Università di Torino 12:1–3.
- Camerano L. 1897b. Monografia dei Gordii. Memorie della Reale Accademia delle Scienze di Torino 47:339–419.
- Camerano L. 1898. Goroliens du Mexique. Bulletin de la Société Zoologique de France 23:73–76.
- Camerano L. 1915. Revisione dei Gordii. Memoire delle Reale Accademia delle Scienze di Torino 66:1–66.
- Carvalho JC. 1942. Uma nova espécie de Gordiaceo do Brasil e consideracoes sobre *Chordodes brasiliensis* Janda (Nematomorpha, Gordoidea). Boletim do Museu Nacional de Rio de Janeiro, Brasil 62:213–222.
- De Villalobos C, Hancock EG, Zanca F. 2004. Redescription and sexual dimorphism of *Chordodes balzani* Camerano, 1896 (Nematomorpha). Journal of Natural History 38:2305–2313.
- De Villalobos C, Miralles DB. 1997. Una nueva especie de *Chordodes* (Gordiaceo Nematomorpha) parasita de *Blaptica* sp. (Blaberidae, Blataria). Comunicaciones dei Musei de Ciencias y Tecnologia. Pontificia Universidade Católica, Porto Alegre, Brasil 10:45–51.
- De Villalobos C, Zanca F, Schmidt-Rhaesa A. 2005. New data on South American species of *Chordodes* (Nematomorpha). Arquivos do Museu Nacional, Rio de Janeiro 62:375–386.
- Miralles DB. 1975. Nuevo aporte al conocimiento de la Gordiofauna Argentina. Neotropica 21:99–103.
- Miralles DB, Camino N. 1983. Sobre la colección de Gordiaceos del Museo Argentino Bernardino Rivadavia. Neotropica 29:51–56.
- Miralles DB, De Villalobos C. 1993. Distribucion geografica de los Gordiaceos en la región neotropical. In: Castellanos ZA, editor. Fauna de agua dulce de la Republica Argentina. La Plata: Profadu (Conicet). p. 17–32.

- Miralles DB, De Villalobos C. 1996. Especies de *Neochordodes* de la Argentina (Gordiacea, Nematomorpha). *Iheringia Serie Zoología, Brasil* 81:145–150.
- Miralles DB, De Villalobos C. 2000. *Noteochordodes*, un nuevo género para la República Argentina (Nematomorpha, Gordiáceo). *Revista del Museo de La Plata* 14:279–283.
- Schmidt-Rhaesa A. 1997. Nematomorpha. In: Scwoerbel J, Zwick P, editors. *Süßwasserfauna Mitteleuropas*. Stuttgart: Gustav Fischer. p. 1–124.
- Schmidt-Rhaesa A. 2001. Problems and perspectives in the systematics of Nematomorpha. *Organisms, Diversity and Evolution* 1:161–163.
- Schmidt-Rhaesa A. 2002. Are the genera of Nematomorpha monophyletic taxa? *Zoologica Scripta* 31:185–200.
- Schmidt-Rhaesa A, Thomas F, Poulin R. 1998. Scanning electron microscopy and intraspecific variation in *Euchordodes nigromaculatus* from New Zealand. *Journal of Helminthology* 72:65–70.
- Zanca F, De Villalobos C. 2005. Scanning electron microscopy of *Chordodes moutoni* Camerano, 1895 (Gordiida, Nematomorpha). *Zootaxa* 1082:37–44.
- Zanca F, Schmidt-Rhaesa A. 2006. Reinvestigation and new evaluation of representatives from the genera *Semigordionus*, *Euchordodes*, *Pantachordodes*, *Dacochordodes* and *Spinochordodes* (Nematomorpha). *Mitteilungen aus dem Museum für Naturkunde in Berlin, Zoologische Reihe* 82:170–178.