

## New Records of Cladocera (Crustacea: Anomopoda) from Laguna Navío Quebrado, La Guajira Department, Colombia

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**ABSTRACT** - Zooplankton plays key roles in structuring interactions in aquatic communities but often remain undescribed in many water systems. This paper reports seventeen species of the Cladocera (Crustacea: Branchiopoda) from Laguna de Navío Quebrado, all of them new records for La Guajira Department, Colombia. The Cladocera assemblages include mostly the Neotropical taxa associated with vegetation. This paper also serves as the first compilation of the data on the Cladocera of this region and includes brief remarks, descriptions and illustrations of some species with additional notes on their distribution.

Key words: Cladocera, Colombia, distribution, Neotropics, species composition, taxonomy.

### INTRODUCTION

Cladocerans are aquatic branchiopod microcrustaceans that show a considerable range in size (0.2 – 6 mm, and even 1.8 cm in case of the genus *Leptododa* Lilljeborg, 1861). They inhabit pelagic, littoral and benthic zone, and most of them prefer freshwater bodies. At present, 620 species of Cladocera are recognized as valid in the world fauna (Forró *et al.*, 2008). They belong to four orders: Anomopoda, Ctenopoda, Onychopoda, and Haplophoda (Frey, 1987).

In the Americas, México, Belize, Guatemala, Cuba, Venezuela, Brazil, and Argentina represent the countries with most studied cladoceran fauna (Elmoor-Loureiro, 1997; Paggi, 2004; Elias-Gutiérrez *et al.*, 2006; Zoppy and López, 2008; Elias-Gutiérrez *et al.*, 2008; Elias-Gutiérrez and Varela, 2009). In Colombia, the knowledge about freshwater cladocerans still remains inadequate, although a few old publications are well-known: Stingelin (1913) reported 23 species from Colombia Mountains; Pearse (1915) recorded five species in the material collected by the Walker Expedition to Santa Marta and Brehm (1956) found nine species in Barranquilla Department.

The interest to the cladoceran studies in Colombia is increased during last decade. Barón-Rodríguez and Díaz (2007) reported on the occurrence of *Ephemeroporus tridentatus* Bergamin, 1939 in Ciénaga de Paredes (Santander). Aranguren-Riaño *et al.* (2010) described a new species of Cladocera, *Euryercus norandinus* Aranguren, Monroy & Gaviria, 2010 from Lago de Tota (Santander). The same taxon was described one month later by Bekker *et al.* (2010) from Lake Regadera as *E. dumonti* (Bekker, Kotov & Elmoor-Loureiro, 2010), and could be regarded as a junior synonym of the former. The Ciénaga Grande de Santa Marta, located in Magdalena Department is now the water system with the most studied Cladocera fauna in Colombia (Fuentes-Reinés and Elmoor-Loureiro, 2011; Fuentes-Reinés *et al.*, 2012; Fuentes-Reinés and Zoppi de Roa, 2013).

Other territories from Colombia still poorly studied. Up to now, no single adequate study of the Cladocera of La Guajira Department (the northernmost extremity of Colombia) has been compiled. This study is aimed to investigate the cladoceran fauna of Laguna Navío Quebrado, provide descriptions

and appropriate illustrations of some remarkable taxa, and improve our knowledge on the distribution of some cladoceran species in Colombia.

## MATERIAL AND METHODS

I studied 108 samples collected of the North coast of Laguna Navío Quebrado, adjacent to Camarón river, Guajira Department (11° 25'N and 73° 5'W). The samples were taken monthly, from April to December 2012, in the littoral zone (covered by macrophytes) and pelagic zones in regions of oyster banks. Water salinity ranged from 0 to 28 PSU. Water samples were collected using a bucket of 25 L in both vegetation areas and open water, then filtered through a plankton net (45 µm), and the filtered contents preserved in 70% ethanol. Samples were sorted under a dissecting stereomicroscope Urano 40X. Specimens were placed to glycerol drops on slides, studied *in toto* and then some of them were dissected for study of fine morphological details. Dissected specimens and appendages were mounted in glycerine and sealed with Canada balsam. The mounted specimens and their body parts

were photographed using a Kodak Easy Share C140 digital camera adapted to a compound microscope Olympus CX22.

The specimens were measured in lateral position, from head to the posterior part of the valve. Identifications were made according to the papers of Elmoor-Loureiro (1997), Sinev (2001), Sinev and Hollwedel (2002), Van Damme *et al.* (2011) and Elías-Gutiérrez *et al.* (2008).

Specimens were deposited at the Museo de Colecciones Biológicas de la Universidad del Atlántico - Colombia (UARC). The following abbreviation are used in the text: IDL (inner distal lobe of limb I), ODL (outer distal lobe of limb I); PP (postpore distance), IP (interpore distance).

## RESULTS

Seventeen species reported here include new records for La Guajira department. They belong to five families and 14 genera (Tab. 1). The family Chydoridae exhibited the highest species richness (12), followed by Macrothricidae (2), Daphnidae, Moinidae, Ilyocryptidae (a single species in each).

**Table 1.** Species of Cladocera from Laguna Navío Quebrado and its distribution. Geographic category: NT (Neotropical), C (Cosmopolita), NA (Nearctic) and TR (Tropicopólita). Departments: At (Atlántico), An (Antioquia), Co (Córdoba), Ch (Chocó), Cu (Cundinamarca), H (Huila), Sa (Santander), S (Sucre), Mg (Magdalena).

Order	Family	Species	Distribution in Colombia	World distribution	References to Colombia
	Daphnidae	<i>Ceriodaphnia cornuta</i> Sars, 1885	At, H, Co, Ch, Sa, Mg	C	Camargo, 1994; Herrera and Guillot, 1999; Barón-Rodríguez <i>et al.</i> , 2006; Álvarez, 2010; Fuentes <i>et al.</i> , 2012
	Moinidae	<i>Moinodaphnia macleayi</i> (King, 1853)	Sa, Co, Mg	C	Pearse, 1915; Barón-Rodríguez <i>et al.</i> , 2006; Álvarez, 2010; Fuentes-Reinés <i>et al.</i> , 2012
	Ilyocryptidae	<i>Ilyocryptus spinifer</i> Herrick, 1882	An, Cu Sa, Mg	C	Gaviria, 2001; Barón-Rodríguez <i>et al.</i> , 2006; Fuentes-Reinés <i>et al.</i> , 2012
	Macrothricidae	<i>Macrothrix elegans</i> Sars, 1901	Co, Mg	NT	Álvarez, 2010; Fuentes <i>et al.</i> , 2012
		<i>Macrothrix spinosa</i> (King, 1853)	Co, Mg	C	Álvarez, 2010; Fuentes-Reinés <i>et al.</i> , 2012
			Aloninae		
		<i>Alona glabra</i> Sars, 1901	Mg, Cu	NT	Stingelin, 1913; Fuentes-Reinés <i>et al.</i> , 2012
Anomopoda		<i>Karualona muelleri</i> (Richard, 1897)	Mg, Co	NT	Pearse, 1915; Álvarez, 2010; Fuentes-Reinés <i>et al.</i> , 2012
		<i>Oxyurella ciliata</i> (Bergamin, 1939)	Co, Mg	NT	Álvarez, 2010; Fuentes-Reinés <i>et al.</i> , 2012
		<i>Leberis davidi</i> (Richard, 1895)	Co, Mg	NT	Álvarez, 2010; Fuentes-Reinés <i>et al.</i> , 2012
		<i>Euryalona orientalis</i> (Daday, 1898)	Mg	TR	Pearse, 1915; Fuentes-Reinés <i>et al.</i> , 2012
		<i>Nicsmirmovius fitzpatricki</i> (Chien, 1970)	Mg	NT	Fuentes-Reinés and Zoppy, 2013
	Chydoridae	<i>Anthalona verrucosa</i> (Sars, 1901)	Co, Mg	NT	Álvarez, 2010; Fuentes-Reinés <i>et al.</i> , 2012
		<i>Notoalona sculpta</i> (Sars, 1901)	At, Mg	NT	Brehm, 1956; Fuentes-Reinés <i>et al.</i> , 2012
			Chydorinae		
		<i>Chydorus nitidulus</i> (Sars, 1901)	At, Co, Mg	NT	Stingelin, 1913; Álvarez, 2010; Fuentes-Reinés <i>et al.</i> , 2012
		<i>Chydorus eurynotus</i> (Sars, 1901)	Co, Mg	TR	Álvarez, 2010; Fuentes-Reinés <i>et al.</i> , 2012
		<i>Chydorus pubescens</i> (Sars, 1901)	Co, Mg	TR	Álvarez, 2010; Fuentes-Reinés <i>et al.</i> , 2012
		<i>Dunbevedia odontoplax</i> Sars, 1901	Cu, Mg	NT	Stingelin, 1913; Fuentes-Reinés <i>et al.</i> , 2012

Within the family Chydoridae, only the genus *Chydorus* Leach, 1816 was represented by three species, followed by *Macrothrix* Baird, 1843 (2 species). Each of the remaining genera was represented by a single species. A brief remarks, descriptions and illustrations about the more frequent and abundant species are given below.

Family Daphniidae Straus, 1820

Genus *Ceriodaphnia* Dana, 1853

***Ceriodaphnia cornuta*** Sars, 1885

Syn: Fuentes-Reinés *et al.*, 2012:128, fig. 7; FADA 2013:14.

*Material examined:* 5 adult females, catalog number: UARC124M.

*Remarks:* It was found within the macrophytes during April-May. This species was formally described from Australia (Sars, 1885) and then found everywhere in tropics. But in reality this is a large group of taxa, specific in different continents (Elias-Gutiérrez *et al.*, 2008; Sharma and Kotov, 2013). It is a polymorphic species (Zaret, 1969), and very common in freshwaters of tropics and subtropics (Villalobo and González, 2006).

Genus *Moinodaphnia* Herrick, 1887

***Moinodaphnia macleayi*** (King, 1853)

Syn: Goulden, 1968:84, fig. 46. Fuentes-Reinés *et al.*, 2012: 136, fig. 15; FADA 2013:42.

*Material examined:* 10 adult females, catalog number: UARC128M.

*Remarks:* This species was found within macrophytes in September. It is a mesobenthic species that inhabit small lakes, swamp and pools (Goulden, 1968). The genus is regarded as monotypical, and needs to be revised worldwide (Smirnov, 1976).

Family Ilyocryptidae Smirnov, 1976 *sensu*

Smirnov, 1992

Genus *Ilyocryptus* Sars, 1862

***Ilyocryptus spinifer*** Herrick, 1882

Syn: Kotov and Stifter, 2006:139, figs. 69-70; Fuentes-Reinés *et al.*, 2012:134, fig 13.

*Material examined:* 8 adult females, catalog

number: UARC115M.

*Remarks:* This species was described from USA (Herrick, 1882). It is a benthic organism (Sousa and Elmoor-Loureiro, 2008) and was found within macrophytes in April, September and October. Among Ilyocryptidae, *I. spinifer* is the most frequently reported from Colombia (Stingelin, 1913; Gaviria, 2001; Barón-Rodríguez *et al.*, 2006). This species is considered dominant among ilyocryptids from the subtropical and tropical waters (Kotov and Dumont, 2000).

Family Macrothricidae Norman et Brady, 1867

Genus *Macrothrix* Baird, 1843

***Macrothrix elegans*** Sars, 1901

Syn: Kotov *et al.*, 2004:62, figs. 1-123.

*Material examined:* 4 adult females, catalog number: UARC125M.

*Remarks:* It was found among the macrophytes in June. This is the most common Neotropical species of *Macrothrix* (Kotov *et al.*, 2004). Earlier it was considered a junior synonym of *Macrothrix triserialis* Brady 1886 (Smirnov, 1976). Nevertheless, Dumont *et al.*, 2002 demonstrated that it is a valid species. *Macrothrix elegans* Sars, 1901 was confused with *M. superaculeata*, however, separation of the two latter species was confirmed by Kotov *et al.* (2004).

***Macrothrix spinosa*** (King, 1853)

Syn: Smirnov, 1992: 29, figs. 60-93. Fuentes-Reinés *et al.*, 2012:130, fig. 10.

*Material examined:* 2 adult females, catalog number: UARC129M.

*Remarks:* This species was the least abundant within the *Macrothrix* genus and was found in October. It is valid species described from Australia (King, 1853), very common in tropics (Smirnov, 1976) and needs to be revised worldwide.

Family Chydoridae Dybowski et Grochowski, 1894 emend. Frey 1967

Genus *Karualona* Dumont et Silva-Briano, 2000

***Karualona muelleri*** (Richard, 1897)

Syn: Fuentes-Reinés *et al.*, 2012:149, fig. 28; Van Damme and Dumont, 2010: 767, fig. 7.

*Material examined:* 10 adult female, catalog number: UARC118M.

*Remarks:* This species was common within macrophytes from April to May. It was initially described as *Alona mülleri* Richard, 1897 from Lunache, Chile (Richard, 1897) and allocated to genus *Karualona* Dumont and Silva-Briano, 2000 by Sinev and Hollwedel (2005). The first report of this species for Colombia was as *Allonella karua* by Pearse (1915). It is a common Neotropical taxon.

Genus *Oxyurella* Dybowski et Grochowski, 1894  
***Oxyurella ciliata*** Bergamin, 1939  
Syn: Smirnov (1974):605.

*Material examined:* 3 adult females, catalog number: UARC119M.

*Remarks:* It was one of the species less abundant and collected only in October. It is a valid species (Smirnov, 1971) described from Brazil (Bergamin, 1939).

Genus *Leberis* Smirnov, 1989  
***Leberis davidi*** (Richard, 1895)  
Syn: Sinev *et al.*, 2005:193, figs. 60-150. Fuentes-Reinés *et al.*, 2012:149, fig. 29.

*Material examined:* 15 adult females, catalog number: UARC120M.

*Remarks:* It was a common species in many samples, collected in April, May, June, July and November. The species was described from Haiti as *Alona davidi* by Richard (1895) and then transferred to the genus *Leberis* (Sinev *et al.*, 2005). It is a Neotropical taxon (Kotov and Ferrari, 2010).

Genus *Euryalona* Sars, 1901  
***Euryalona orientalis*** (Daday, 1898)  
Syn: Fuentes-Reinés *et al.*, 2012:146, fig. 25.

*Material examined:* 5 adult females, catalog number: UARC116M.

*Remarks:* It was found within macrophytes in December and reported for the first time in Colombia as *Euryalona occidentalis* by Pearse (1915). This species is very common in the subtropics and tropics. *E. orientalis* could be a species complex and needs to be revised worldwide (Kotov *et al.*, 2013; Van Damme and Maiphae, 2013).

Genus *Notoalona* Rajapaksa et Fernando, 1987  
***Notoalona sculpta*** (Sars, 1901)  
Syn: Fuentes-Reinés *et al.*, 2012:146, fig. 26.

*Material examined:* 15 adult females, catalog number: UARC126M.

*Remarks:* It was rare within macrophyte and found only in July. *N. sculpta* was described from Brazil (Sars, 1901) as *Alonella* and then translocated to *Notoalona* (Rajapaksa and Fernando, 1987). This is a Neotropical species, which needs to be re-studied again after a significant increasing of level of morphological analysis during last two decades.

Genus *Chydorus* Leach, 1816  
***Chydorus nitidulus*** (Sars, 1901)  
Syn: Smirnov, 1996:132, figs. 548-550; FADA 2013:16-17.

*Material examined:* 2 adult females, catalog number: UARC122M.

*Remarks:* This species was the least abundant within the family Chydoridae and was found within macrophytes in September. Neotropical species described from Brazil (Sars, 1901).

***Chydorus eurynotus*** (Sars, 1901)  
Syn: FADA 2013:16; Fuentes-Reinés *et al.*, 2012:149, fig. 30.

*Material examined:* 4 adult females, catalog number: UARC130M.

*Remarks:* It was scarce within macrophytes and found only in September. This species was described from Brazil (Sars, 1901), but found worldwide in tropical and subtropical regions (Smirnov, 1971, 1996). This species group needs to be revised worldwide.

***Chydorus pubescens*** (Sars, 1901)

*Material examined:* 2 adult females, catalog number: UARC132M.

*Remarks:* It was scarce within macrophytes and found only in July. Valid species described from Brazil (Sars, 1901), then similar populations were found in other tropical regions. According to Kotov *et al.* (2013), this species needs to be revised worldwide. Probably *C. pubescens* is exclusively Neotropical species.

Genus *Dunhevedia* King, 1853

***Dunhevedia odontoplax*** Sars, 1901

*Material examined:* 4 adult females, catalog number: UARC123M.

*Remarks:* Valid Neotropical species described from Colombia (Stingelin, 1913). It was found within macrophytes in October and December.

Genus *Anthalona* Van Damme, Sinev et Dumont, 2011

***Anthalona verrucosa*** (Sars, 1901)  
(Fig. 1A-F)

Syn: Van Damme *et al.* 2011:41, figs. 20-23.

*Material examined:* 25 adult females, catalog number: UARC121M.

*Anthalona verrucosa* is characterized by an ovoid body and an especially small size, 0.25-0.28 mm (Fig. 1A). Head shield with a well developed, but obtuse rostrum (Fig. 1B), two head pores (Fig. 1C), quadrangular labrum with a small denticle in anterior part (Fig. 1D); short and wide postabdomen with well-developed lateral fascicles of setae and short marginal denticles (Fig. 1E). Antennal formula for setae 0-0-3/1-3-3; The IDL of limb I with two setae bearing well-developed denticles, and the ODL with a single large seta, IDL with two hooked setae (Fig. 1F).

*Remarks:* It was one of the most common species associated to macrophytes, collected from June-December. *Anthalona verrucosa* was described from São Paulo, Brazil (Sars, 1901) as *Alona*, and have been reported in South

America, Africa and Eurasia (Smirnov, 1971; Alonso, 1996). However the true *verrucosa* is likely limited to Neotropics (Van Damme *et al.*, 2011). This is the first documented record with illustrations confirming its presence in Colombia. Earlier it was simply reported for Bolivar department (Álvarez, 2010).

Genus *Alona* Baird, 1843

***Alona glabra*** Sars, 1901  
(Fig. 2A-F)

Syn: Kotov *et al.*, 2010:33.

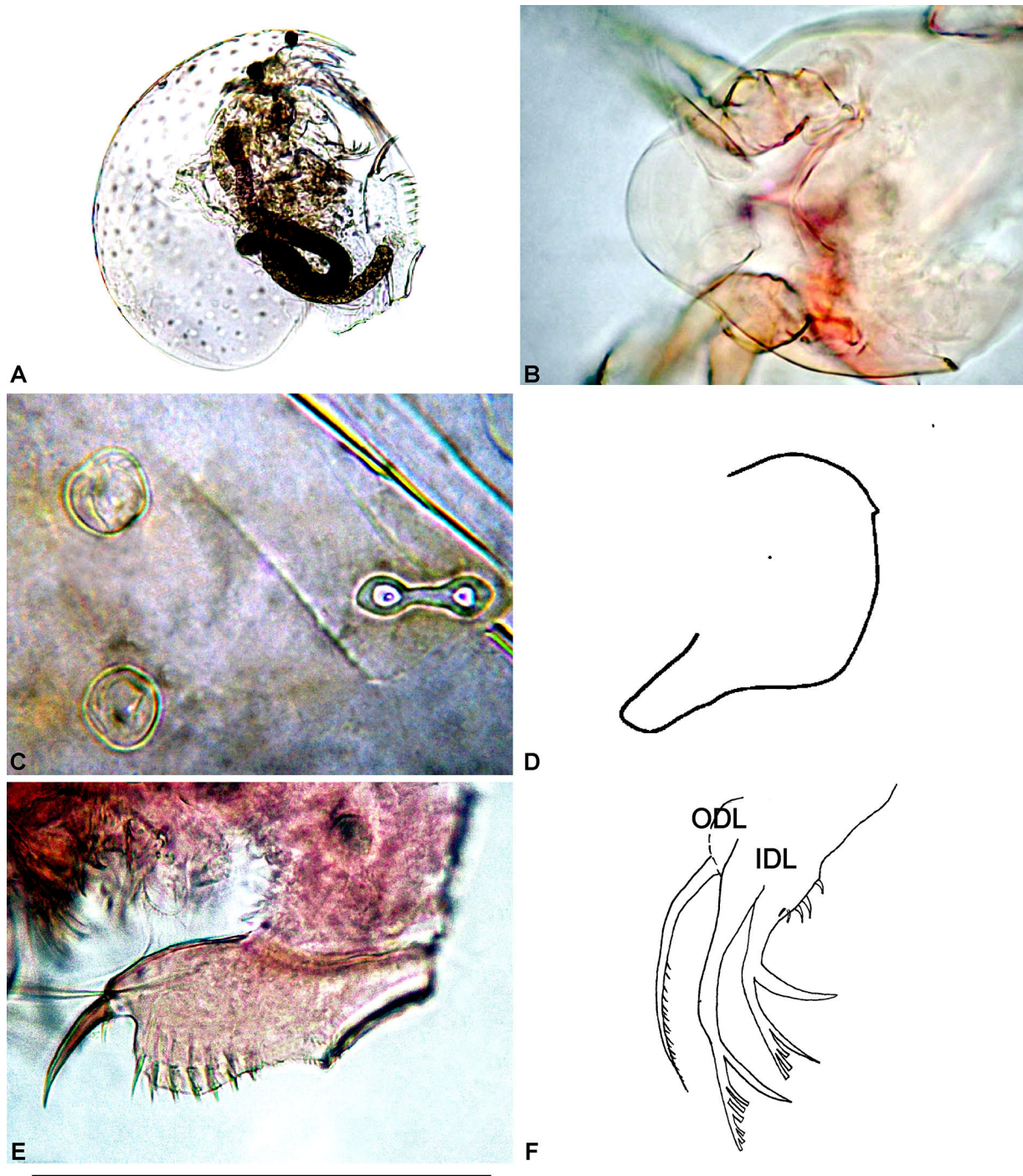
*Material examined:* 30 adult females and 20 adult males, catalog number: UARC117M.

The body of *A. glabra* is ovoid, size ranging from 0.38-0.42 mm (Fig. 2A); the taxon is different from closest *Alona cambouei* in three interconnected head pores (Fig. 2B) and from *Alona pulchella* in small PP/IP ratio. In this case, the postabdomen is short, with small distal denticles decreasing in size proximally (Fig. 2D).

Male. Habitus similar to female (not illustrated), body range length 0.28-0.29 mm; postabdomen short, round-quadrangular, postabdominal claw shorter than in female and possessing a basal spine a little longer than in female, about 0.45 the length claw (Fig. 2E). Trunk limb 1 with a U-shaped copulatory hook, IDL with two plumose and a single smooth male setae (Fig. 2F).

*Variability:* A single female had only two head pores connected, but with an obscure connection between pores 2 and 3, instead of three pores with a well-developed connection (Fig. 2C).

*Remarks:* It was the most common species associated with macrophyte roots, collected from April, May, June, October and November. In Colombia, it has been reported from Ciénaga Grande de Santa Marta and Andean region (Stingelin, 1913; Fuentes-Reinés *et al.*, 2012). The male has only been described by Sinev (2001). In this research, the male was found in great proportions during the rainy season (October and November).



**Figure 1.** *Anthalona verrucosa*. Female. A. Habitus; B. Head shield; C. Head pores; D. Labrum. E. Postabdomen; F. IDL of limb I. Scale bars = 50  $\mu$ m

Genus *Nicsmirnovius* Chiambeng et Dumont, 1999

*Nicsmirnovius fitzpatricki* (Chien, 1970)

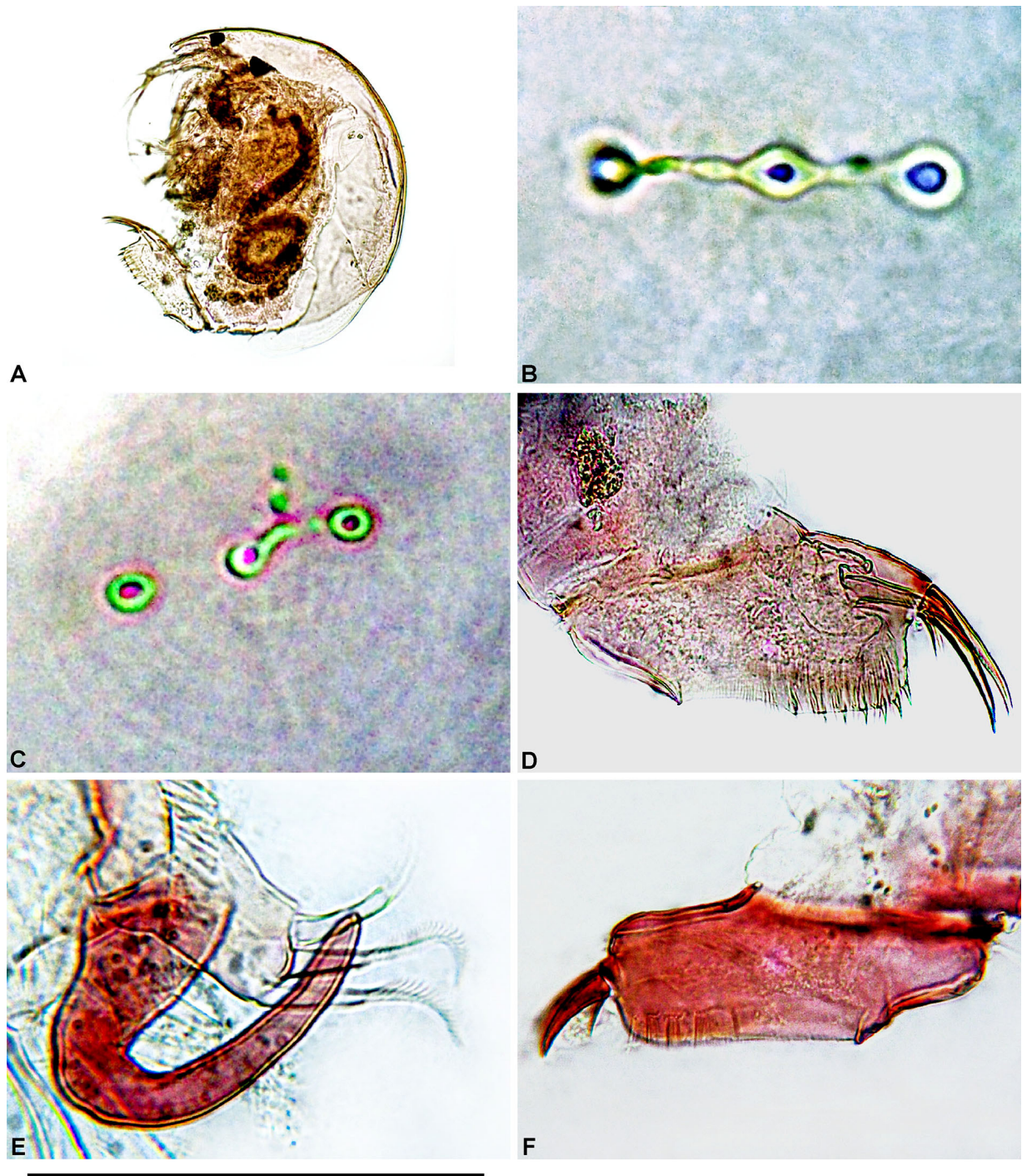
(Fig. 3A-E)

Syn: Van Damme *et al.*, 2003:42.

*Material examined:* 20 adult female from Laguna Navío Quebrado, northern Colombia, catalog number: UARC131M.

Body length 0.31-0.39 mm (Fig. 3A). It

is characterized by three head pores with narrow connection and two lateral pores with *Cosmarium*-shaped structure located in the posterior part of the main head pores (Fig. 3B), a relatively large labral keel and a depression near apex (Fig. 3C). First antenna tubular, reducing in thickness at the distal part, with a long setule on it (Fig. 3D), IDL and ODL of limb I with 3 and 1 setae respectively (Fig.

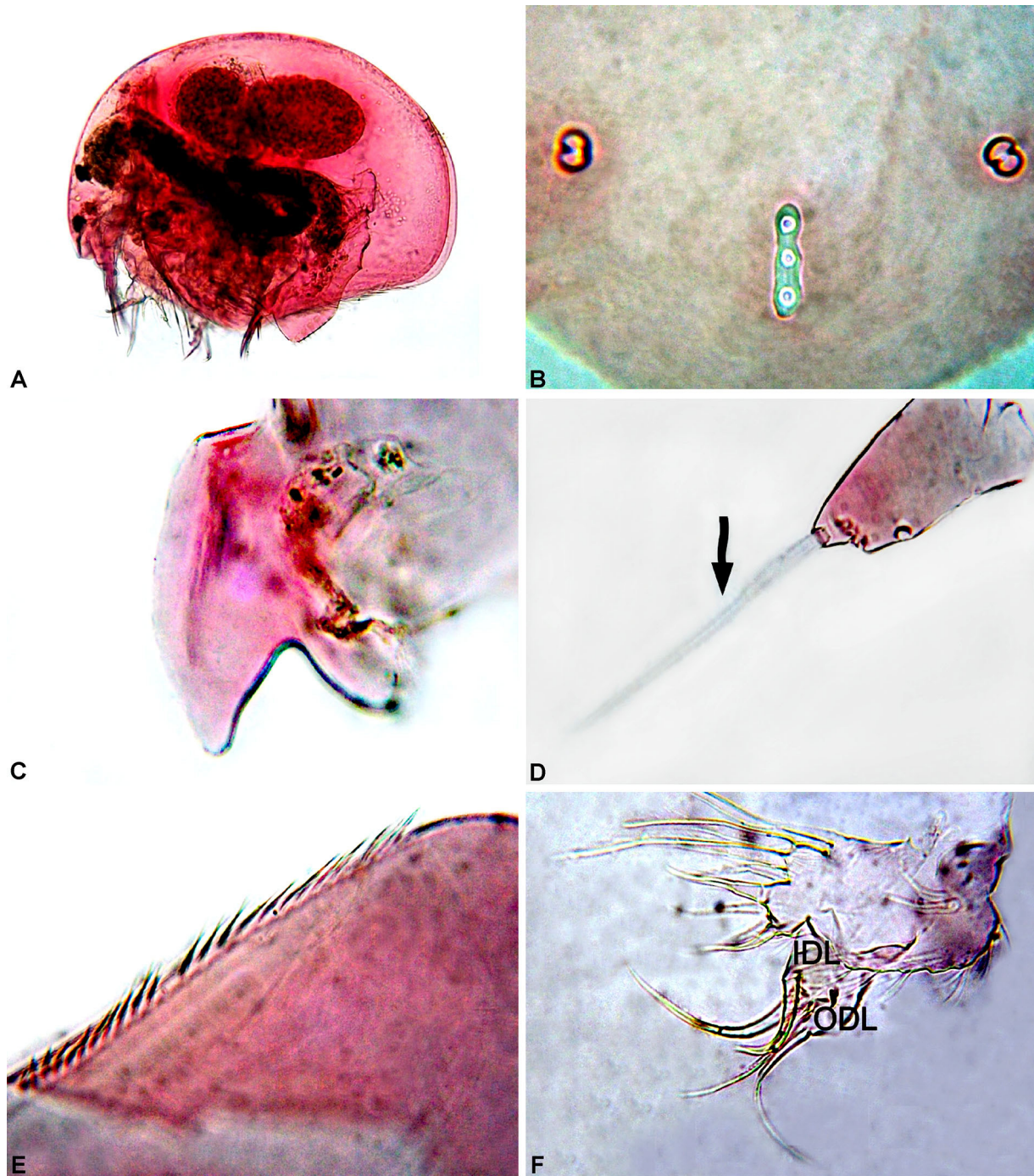


**Figure 2.** *Alona glabra*. A. Habitus. B-C. Main head pores; D. Postabdomen. Male. E. IDL of limb 1. F. Postabdomen. Scale bars = 50  $\mu$ m.

3E), valve without reticulations, short setae on posterior-ventral valve portion (Fig. 3F), postabdomen quadrangular, with eight-nine denticles at the distal part, and lateral fascicles, its length is 2.3 times the width (Fig. 4A-D), postabdominal claw very long, its length 42% of postabdomen length, a basal spine beginning 7  $\mu$ m from the base of postabdominal claw, base of claw with a pecten of six fine setules (Fig. 4E).

*Variability:* Two female were observed to possess the basis of postabdominal claw very reduced (Fig. 4B).

*Remarks:* It was found within macrophyte during rainy season (October and November). *Nicsmirnovius fitzpatricki* was described as *Alonella fitzpatricki* from the Pearl River U.S.A by Chien (1970). For years later it was reassigned to *Alona eximia* by Frey (1974) and

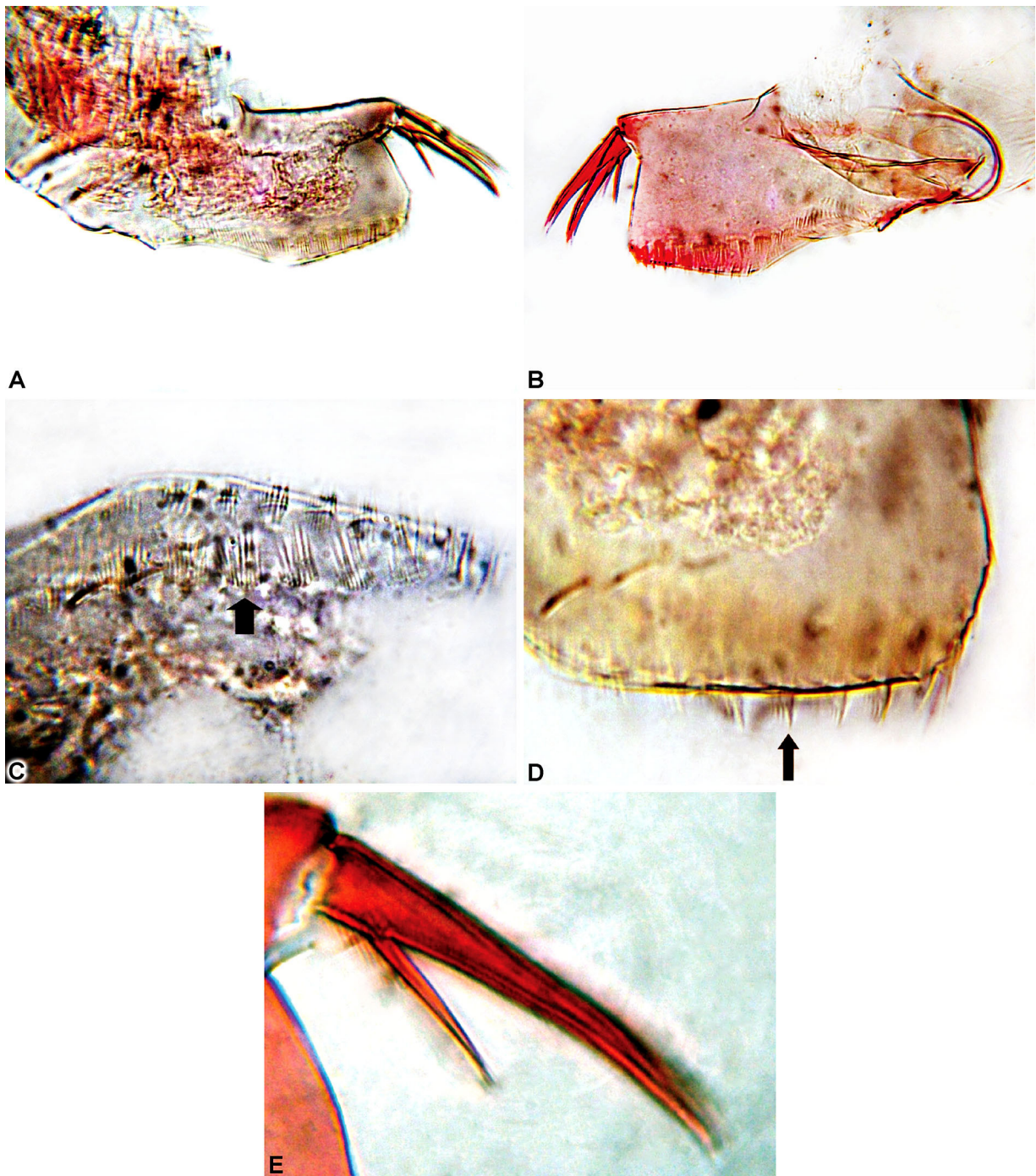


**Figure 3.** *Nicsmirnovius fitzpatricki*. Female. A. Habitus. B. Head pores. C. Labrum. D. First antenna (the Arrow points at the long setule). E. Valve setae near posteroventral corner. F. IDL and ODL of limb I. Scale bars = 50  $\mu$ m.

finally placed in the genus *Nicsmirnovius* (Van Damme *et al.*, 2003). *Nicsmirnovius fitzpatricki* has been reported from Puerto Rico, México (Van de Velde *et al.*, 1978), Argentina (Paggi, 1979), Venezuela (Zoppi de Roa and López, 2008), Brasil (Vila dos Santos *et al.*, 2011) and Colombia (Fuentes-Reinés and Zoppi de

Roa, 2013). Examined specimens beared the diagnostic features of *N. fitzpatricki* described by Van Damme *et al.* (2003) and Fuentes-Reinés and Zoppi de Roa (2013). This is the second record to Colombia, with one previously reported from Magdalena department (Fuentes-Reinés and Zoppi de Roa, 2013).





**Figure 4.** *Nicsmirnovius fitzpatricki*. A-B. Postabdomen (The arrow points at the basis of postabdominal claw). C. Lateral fascicles of postabdomen. D. Denticles at the distal part of postabdomen. E. Postabdominal claw. Scale bars = 50  $\mu$ m.

## DISCUSSION

This study led to the finding of 17 cladoceran taxa in only a small portion of Laguna Navío Quebrado. Three most common cladocerans of the lagoon (*Alona glabra*, *Nicsmirnovius incredibilis*, *Antholona verrucosa*) are littoral animals. The occurrence of these species

along with *Macrothrix elegans*, *Alona glabra*, *Karualona muelleri*, *Oxyurella ciliata*, *Leberis davidi*, *Nicsmirnovius fitzpatricki*, *Antholona verrucosa*, *Notoalona sculpta*, and *Chydorus nitidulus*, indicate a very typical Neotropical species assemblage. Fuentes-Reinés *et al.* (2012) reported the similar situation in Ciénaga

Grande de Santa Marta. From 92 species of cladocerans reported from Colombia (Fuentes-Reinés *et al.*, 2013), 18.47% are found in the Guajira department to date, but I believe this number will be significantly increased. Several taxa that could be common in the north region of Colombia are still lacking.

It remains highly probable that species such as *Moina micrura*, *Moina minuta*, *Sarsilatona serricauda* and *Ephemeroporus hybridus* could be found in the Guajira department, because they occur in other close localities (Magdalena and Córdoba department, Maracaibo state) (Carruyo-Noguera *et al.*, 2008; Fuentes-Reinés *et al.*, 2012, 2013). The absence of these taxa in my study could be partly explained by the scarcity of the macrophytes in the studied water body. The high salinity (28 PSU) in the limnetic region could limit the presence of some cladoceran species in this zone. The majority of freshwater cladocerans are phytophylous, and just macrophytes seem to support a greater variety of microhabitats, inhabited by a large number of species (Elmoor-Loureiro, 2007).

The species richness in Laguna Navío Quebrado (17) is low as compared with the Ciénaga Grande de Santa Marta (45) and Ciénaga de Ayapel (20 species and 9 morphotypes) (Villabona-González *et al.*, 2011; Fuentes-Reinés *et al.*, 2012). The absence of macrophytes in Navío Quebrado might explain its relatively low species diversity. Among the species identified, *Alona glabra*, *Leberis davidi*, and *Antholona verrucosa* were recorded almost throughout all the sampling period. In contrast, *Chydorus nitidulus*, *C. eurynotus*, *C. pubescens*, *Macrothrix elegans*, *M. spinosa*, *Euryalona orientalis*, *Notoalona sculpta* and *Oxyurella ciliata*, were rare in the lagoon.

*Antholona verrucosa*, *A. glabra* and *N. fitzpatricki* could be easily confused with other American species. The former is similar to *A. brandorffi* in the shape of antenna I; two main head pores with narrow connections, both species have tuberculated valves. Nevertheless *A. verrucosa* differs from *A. brandorffi* in the rostrum shape (its posterior margin narrow and

elongated in *A. verrucosa* while in *A. brandorffi* the posterior margin is broadly rounded). The most obvious differences between these two species concern: (1) the morphology of IDL of limb I (two setae are supplied with long denticles in *A. verrucosa*, while in *A. brandorffi* they are shorter); (2) labrum (with a small denticle in *A. verrucosa* and without denticle in *A. brandorffi*); and (3) distal denticles of postabdomen (shorter in *A. brandorffi* than in *A. verrucosa*).

*Alona glabra* could be confused with *A. cambouei* and *A. pulchella*, but only *A. glabra* is found in South America (Sinev, 2001). In the Neotropical region *N. fitzpatricki* Chien Shing-ming, 1970 can be confused with *Nicsmirnovius incredibilis* (Smirnov, 1984), but they can be separated by: (1) labral keel (elongated in *N. fitzpatricki* and rounded in *N. incredibilis*); (2) IDL seta of limb I (as long as IDL seta in *N. fitzpatricki* while in *N. incredibilis* is longer); (3) postabdomen (with single distal angle in *N. fitzpatricki* while in *N. incredibilis* with a doubled angle); (4) postanal portion of the postabdomen (with clusters of long setules in *N. incredibilis* vs. robust denticles in *N. fitzpatricki*); and (5) postadominal claw (with basal spine very long in *N. fitzpatricki* while short in *N. incredibilis*). In *Nicsmirnovius fitzpatricki* from Colombia the postabdomen is compact as in the Argentinian specimens. According to Van Damme *et al.* (2003), American populations of the genus still need to be revised.

The studies of Colombian cladocerans need to be continued. Only accurate determinations according to recent level of taxonomic analysis could lead to adequate understanding of their biodiversity. Before a strong improvement of our knowledge on faunistic composition of the Neotropical cladocerans, subsequent analysis of their biogeography, ecological preferences etc. seem to be pre-mature.

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