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Zootaxa 2548: 22–42 (2010)
www.mapress.com/zootaxa/
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Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

Oribatid mites (Acari: Oribatida) from *Austrocedrus chilensis* and *Nothofagus* forests of Northwestern Patagonia (Argentina)

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Abstract

Forest sites in Northwestern Argentinean Patagonia were surveyed to determine the oribatid mite fauna. A taxonomic inventory of oribatid mites was carried out in Northwestern Argentinean Patagonia to establish the taxonomic diversity, for increasing the knowledge of their distribution, detecting new species and assessing environmental effects on the oribatid mite community. Eleven sampling sites in nearly pure forests of *Austrocedrus chilensis*, *Nothofagus dombeyi*, *Nothofagus antarctica* were selected as these are among the most recurrent arboreal species found in this region. Samples of leaf litter, soil and pitfall traps contents were taken from each forest. Fifty-five oribatid species, belonging to 46 genera in 28 families, were found. Nine species are new records for Argentina and one for continental Argentina. Thirty-two species were recorded in *A. chilensis* forests, 35 in *N. dombeyi* forests and 20 in *N. antarctica* forests. Fifty species were found in leaf litter, 35 in soil and eight in pitfall traps. Fourteen species were recorded exclusively in leaf litter, one in soil and four in pitfall traps. A high level of endemism is confirmed as nearly 62 % of collected species have previously been found only in Southern Andes supporting the existence of an associated autochthonous oribatid fauna.

Key words: soil, leaf litter, pitfall trap, Oribatid mites, forest, Andes, Patagonia, Taxonomy

Introduction

The cold temperate forests in Andean North Patagonia (Argentina) occupy a thin strip of 75 km maximum width that spreads along the mountain range of the Andes from Neuquén up to Tierra del Fuego. Biodiversity in these temperate forests takes intermediate values compared to tropical forests of Argentina, however the number of endemic species is very high (Bertonatti & Corcuera 2000). The level of degradation of the Andean Patagonian forests is in general low, with exception of the transition zone with the steppe, where the forests of *Austrocedrus chilensis* have lost 95 % of his original range surface. At the other side of the mountain range (i.e. Chile) the *A. chilensis* forests are scarce due to ancient intense harvesting practices since colony times when even the wood was exported to Peru for building or furniture manufacturing purposes, intense wood exploitation until the end of XX century and contemporary illegal harvesting (Donoso Zegers 2006), consequently conservation strategies are required to protect the cold temperate forests including the recovery of the *A. chilensis* forests.

The impact of habitat loss and degradation on invertebrates is particularly important as they make up the bulk of biodiversity and play an integral role in many ecosystem processes (Groombridge & Jenkins 2000; Miller 1993). A good knowledge of the arthropod species inhabiting these forests is basic to monitor forest degradation and to plan adequate forest conservation measures (Hanski *et al.* 2007). For example, litter arthropods like ants (Nakamura *et al.* 2007) and mites (Culvik 2007) have been used as bio-indicators of the impacts of rainforest clearing. Particularly the oribatid mites inhabit the soil-litter system and are often the dominant arthropod group in highly organic soils of temperate forests (Norton & Behan-Pelletier 2009).

 Accepted by H. Schatz: 24 Jun. 2010; published: 26 Jul. 2010

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Furthermore in temperate forests oribatid mites are diverse and numerically dominant in leaf litter, in soils, in canopies, in many arboreal habitats including bark and trunks of trees, leaf domatia and stems, suspended soils and epiphytic cover including lichens (Noti *et al.* 2003; Lindo & Stevenson 2007). Therefore this taxon constitutes a promising group for monitoring habitat changes after forest degradation.

Based on the recent catalog of Subías (2004, 2009) the taxonomic studies of the oribatid fauna in Argentina are limited compared with studies in other parts of the world. The intensity of the investigations carried out in our region is not substantial considering the highest number of species is known from the Palearctic region even at the generic level (Schatz 2004). The most intensive studies were made mainly by Hammer (1958, 1962b) during her journeys to the Andean region of South America when she described more than 100 new species. Afterwards, Balogh and Csiszár (1963) described 26 new species found in Topal`s collection which was carried out near El Bolsón (Río Negro, Argentina). Apart from the above mentioned works and those of Niedbala (1984) and Baranek (1986) no other taxonomical works on oribatid mites were done in the Argentinean Northpatagonian region.

The aim of this research was to provide a taxonomic inventory of the soil and leaf litter oribatid mites of Northwestern Patagonian forests. Sampling was carried out at different seasons and at different locations of *Austrocedrus chilensis, Nothofagus antarctica, Nothofagus pumilio* and *Nothofagus dombeyi* forests in places scarcely or not sampled before in previous surveys (Hammer 1962b) for increasing the probability of detection of more species.

Material and methods

Mites where sampled from 11 natural forest sites (see map, figure 1). Detailed data are fully given in table 1. Two sites Traful (11) and Tronador (9) had two nearly equal dominating arboreal species. The geographic position of each sampling site was recorded using Global Positioning System (GPS) technology.

TABLE 1. Data for every site sampled, including height as meters above sea level (m.a.s.l.) and global positioning system latitude–longitude coordinates (GPS).

Site	Province	Location	GPS data	m.a.s.l.	Dominant tree species
1	Río Negro	Cerro Otto	41º08'34"S, 71º19'43"W	990	*A. chilensis*
2	Río Negro	Cerro LLao LLao	41°02'48"S, 71°33'10"W	987	*A. chilensis*
3	Río Negro	Parque LLao LLao	41°02'52"S, 71°32'56"W	888	*N. dombeyi*
4	Río Negro	Balcón Gutiérrez	41°10'42"S, 71°25'01"W	864	*N. dombeyi*
5	Río Negro	Cerro Padre Laguna	41°22'00"S, 71°31'05"O	913	*N. antarctica*
6	Río Negro	Arroyo Challhuaco	41°12'19"S, 71°19'04"O	1000	*N. antarctica*
7	Neuquén	Lago Huechulafquen	39°49'39"S, 71°37'44"W	938	*N. dombeyi*
8	Neuquén	Lago Totoral	40°40'48"S, 71°46'21"W	892	*N. dombeyi*
9	Río Negro	Meterological Station Tronador	41°12'19"S, 71°19'04"O	1000	*N. antarctica*
10	Río Negro	Pampa Linda	41°12'16"S, 71°49'11"W	961	*N. dombeyi* - *N. pumilio*
11	Neuquén	Lago Traful	40°37'52"S, 71°27'44"W	726	*N. dombeyi* - *A. chilensis*

Samples consisted of leaf litter, soil, and pitfall trap contents taken at 1 m minimum distance from trees. Most abundant accompanying flora was determined using the references available in the literature (Correa 1968-1998, Dimitri 1977). The *A. chilensis* forest chosen had nearly pure stands accompanied by isolated specimens of *Lomatia hirsuta, Maytenus boaria* and *Schinus patagonicus* with a shrub layer including *Berberis buxifolia, Maytenus chubutensis*, and *Gaultheria mucronata*, and a herbaceous layer including *Alstroemeria aurantiaca, Plantago lanceolata, Fragaria chiloensis, Ozmorhiza chilensis, Vicia nigricans, Eryngium paniculatum* and *Mutisia decurrens*. The *N. dombeyi* forests chosen had nearly pure stands

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accompanied by isolated specimens of *A. chilensis and N. pumilio*, with a shrub layer including *Chusquea culeou, Aristotelia chilensis, Ribes magellanicum, Berberis darwini, M. chubutensis* and *Azara microphyla* and a herbaceous layer including *Blechnum penna-marina, O. chilensis, A. aurantiaca, Taraxacum officinalis, V. nigricans* and *Chloea alpina*. The *N. antarctica* forests chosen had nearly pure stands accompanied by isolated specimens of *Austrocedrus chilensis*, with a shrub layer including *C. culeou, B. buxifolia, B. darwini, R. magellanicum, Mutisia spinosa, M. decurrens, V. nigricans* and a herbaceous layer including *B. penna-marina, O. chilensis, A. aurantiaca, T. officinalis* and *V. nigricans*.

Oribatid mites were sampled from 2005 to 2009. Plots of 36 m^2 were selected in sites at least 100 meters away from roads, tracks generated by visitors, forest exploitation or recognizable post fire sites. Soil borers (5 cm x 5 cm x 10 cm) were used to extract soil samples of 10 cm depth. Small shovels were used to collect leaf litter by sweeping the soil surface. In each site 36 samples of 250 cm^3 of soil and leaf litter were collected and mounted in Tullgren-Berlese funnels, built with a plastic grid of 2 mm, inside 350 cm^3 polypropylene containers, equipped with 15 watt bulbs and kept for seven days controlling the temperature under 30 ºC to prevent for violent sample dehydration, at the Laboratory of the Zoology Department of Centro Regional Universitario Bariloche (Universidad Nacional del Comahue). Bulbs were lit only during the first three days of the extraction process. Mites were collected in 75% alcohol. Nine pitfall traps per site, built with 450 plastic (9 cm diameter, 12 cm depth) and filled with diluted propylene glycol (40%) and a drop of soap, were set at 1 m minimum from each other. The contents of pitfall traps at each sampling plot were preserved in diluted ethanol (80%).

Oribatid mites were separated under a stereomicroscope with Pasteur pipettes and minute brushes. Thin micromanipulating needles were built with tungsten wire according to the method of Drebes (1974) to examine the specimens. Identification was carried out by first putting the mites in pure lactic acid. For some flat and translucent specimens whole-mounted preparations were made using Hoyer´s medium. Determinations were carried out using published taxonomic literature, mainly Balogh and Balogh (1988, 1990) as well as descriptions made by Balogh and Csiszár (1963), Hammer (1958, 1961, 1962a, 1962b), Mahunka (1980) and Baranek (1984, 1986). The classification system adopted was based on Subías (2004) except where more recent literature recommended different classifications (Norton & Behan-Pelletier 2009). In the list of species collected provided below, the term “cf.” refers to an uncertainty in the identification, because of slight differences between the specimens collected and a species described in the literature. The number of specimens examined, the type of substrate and the sampling date (month and year) of each mite species are indicated under “specimens examined”. The number of specimens examined is given in parentheses. In those cases where different stases were recognized, the number of specimens is accompanied by a letter “a” when referred to adults and “i” when immature (larvae or nymphs) are considered. Specimens stored in 2:3 alcohol 80 % and 1:3 lactic acid and Hoyer and gold covered whole mounted preparations are preserved in the collections of Universidad Nacional de Mar del Plata and Centro Regional Universitario Bariloche (Universidad Nacional del Comahue).

Results

A total of 2,403 specimens were identified to species level whenever possible. Fifty-five oribatid species belonging to 46 genera in 28 families were represented. Five genera are new records for the province of Río Negro, four for the province of Neuquén and two genera are new records for Argentina. Twenty already described species are new records for the province of Río Negro, four are new records for the province of Neuquén, nine are new records for Argentina, and one is a new species record for continental Argentina. We consider continental Argentina covering all territories of the country excluding all whose sovereignty is claimed by Argentina, i.e. Falkland Islands (former name: Islas Malvinas), the South Atlantic Argentine Islands, South Georgia and the South Sandwich Islands, South Shetland Islands, South Orkney Islands and the Argentinean Antarctic Sector. The genus *Paroppia* is a new record for Argentina. Including the results of this publication, excluding morphospecies, the number of described oribatid species known from Argentina is raised to 369. Four species have not been described previously and are therefore considered new species.

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Thirty-two species were recorded in *A. chilensis* forests, 35 in *N. dombeyi* forests and 20 in *N. antarctica* forests (table 2). Fourteen species were only recorded in *A. chilensis* forests, 13 in *N. dombeyi* forests, four in *N. antarctica forests* and two in mixed forests of either *N. dombeyi-N. pumilio* and *N. dombeyi-A. chilensis.* Fifty species were found in leaf litter, 35 in soil and eight in pitfall traps. Fourteen species were recorded exclusively in leaf litter, one in soil and four in pitfall traps.

TABLE 2. Specimen numbers of oribatid species collected in the eleven sites separated firstly by forest type and secondarily by sampling category. LL: leaf litter, S: soil, PT: pitfall trap. Data were pooled for each arboreal species. Nº: order number of species found arranged according to Subías (2009).

Nº	Species	A. chilensis			N. dombeyi			N. antarctica		
		LL	S	PT	LL	S	PT	LL	S	PT
1	*Eniochthonius minutissimus*	2	4		2	5		3		
2	*Sellnickochthonius elsosneadensis*							4		
3	*Liochthonius fimbriatissimus*				1			5		
4	*Cosmochthonius cf. semifoveolatus*	4	22		3			2		
5	*Trichthonius pulcherrimus*	25						1		
6	*Phthiracarus insignis*	3	2			4				
7	*Nothrus peruensis*	184	5		104	40				
8	*Camisia segnis*	4								
9	*Heminothrus biangulatus*				71		7			
10	*Crotonia flagellata*	2					5			
11	*Malaconothrus translamellatus*				1			4		
12	*Pheroliodes neuquinus*						7			
13	*Pheroliodes cf. minutus*	77	80							
14	*Licnodamaeus granulatus*	21	3							
15	*Jacotella ornata*	15	1							
16	*Anderemaeus magellanis*	37	7							
17	*Nodocepheus dentatus*	16	7		13	1		1		
18	*Cultroribula argentinensis*							5	25	
19	*Austrogneta multipilosa*				1	17			4	
20	*Anomaloppia dispariseta*				5	2			10	
21	*Austroppia cf. petrohuensis*				1	1				
22	*Brachioppiella pepitensis*	10	2							
23	*Brachioppiella periculosa*	2			21	24				
24	*Brassoppia peullaensis*				1	1				
25	*Discoppia tenuis*	40	10							
26	*Globoppia minor*	2			298	24		10	2	
27	*Lanceoppia hexapili*	34	1					8	1	
28	*Lanceoppia kovacsi*	98	8		16	1				
29	*Membranoppia breviclava*				20	1		4	1	
30	*Membranoppia argentinensis*	25	2							
31	*Microppia minus*		8							

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TABLE 2. (continued)

Nº	Species	A. chilensis			N. dombeyi			N. antarctica		
		LL	S	PT	LL	S	PT	LL	S	PT
32	*Neoamerioppia cf. chilensis*				12	1				
33	*Oppiella nova*		3		13	71		6	27	
34	*Oxyoppia suramericana*		3		30	7		2	5	
35	*Oxyoppia* n. sp..	2	5		5	37		2	24	
36	*Setoppia angustopili*			2	91	9	2			
37	*Paroppia* n. sp. *1*							1	1	
38	*Paroppia* n. sp. *2*				10	3				
39	*Suctobelbella* cf. *cornuta*	1			1	13				
40	*Suctobelbella* cf. *variabilis*	3			16	2				
41	*Pseudotocepheus* cf. *hauseri*				1					
42	*Pseudotocepheus* cf. *australis*				1					
43	*Tectocepheus velatus*	178	6		57	8		89	4	
44	*Cuspidozetes armatus*	1								
45	*Edwardzetes dentifer*						9			
46	*Furcobates hastatus*						2			
47	*Neotrichozetes spinulosa germainae*									1
48	*Jornadia* n. sp.	7								
49	*Paraphauloppia* cf. *australis*	8								
50	*Gerloubia bicuspidata*	2								
51	*Maculobates longiporosus*				24	2				2
52	*Totobates elegans*				25					
53	*Totobates pterygoides*				11					
54	*Tuxenia complicata*	3								
55	*Physobates spinipes*				2	1				

Species identified

Eniochthoniidae Grandjean

***Eniochthonius* Grandjean**

***Eniochthonius minutissimus* (Berlese, 1904)**

Specimens examined: Cerro Otto - under *A. chilensis*, soil XI-06 (2), I-07 (2), Leaf litter I-2008 (2), LLao LLao - under *N. dombeyi*, leaf litter XI-06 (2), soil XI-06 (5), Cerro P. Laguna - under *N. antarctica*, leaf litter, XI-06 (3).

Remarks: Originally described from Italy. Previously reported in Argentina [as *Eniochthonius minutissimus* Berlese] in El Bolsón (Balogh & Csiszár 1963) in mixed forest of *A. chilensis* and *Lomatia* sp., and in Chile in Puerto Montt and Peulla in mosses from forests (Hammer 1962a).

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Brachychthoniidae Thor

***Sellnickochthonius* Krivolutsky**

***Sellnickochthonius elsosneadensis* (Hammer, 1958)**

Specimens examined: Cerro P. Laguna leaf litter - under *N. antarctica*, XI-2006 (4).

Remarks: Semicosmopolitan distribution (Subías 2004). Originally described from Argentina. Previously reported in Argentina [as *Brachychochthonius elsosneadensis* Hammer] in Mendoza under *Juncus* (Hammer 1958), in Panama, Japan, China and Australia (Schatz 2006). **First record for the province of Río Negro.**

***Liochthonius* van der Hammen**

***Liochthonius (Liochthonius) fimbriatissimus* Hammer, 1962**

Specimens examined: LLao LLao - under *N. dombeyi*, leaf litter XI-2006 (1) and Cerro P. Laguna - under *N. antarctica*, XI-2006 (5).

Remarks: Originally described from Argentina. Previously reported from that country [as *Brachychthonius fimbriatus* Hammer, *Liochthonius fimbriatissimus* Hammer, *Liochthonius fimbriatus* Hammer] in the province of Mendoza (Hammer 1958), in the province of Santa Cruz (Hammer 1962b), in the province of Río Negro (Hammer 1962b, Balogh & Csiszár 1963) and in the province of Tierra del Fuego (Mahunka 1980).

Cosmochthoniidae Grandjean

***Cosmochthonius* Berlese**

***Cosmochthonius* cf. *semifoveolatus* Subías, 1982**

Specimens examined: Cerro Otto - under *A. chilensis*, soil XI-06 (3), III-2006 (1), Leaf litter XI-2006 (10), III-2007 (10), I-2009 (2), LLao LLao - under *N. dombeyi*, leaf litter XI-2006 (3) and Cerro P. Laguna - under *N. antarctica*, in leaf litter XI-2006 (2).

Remarks: *Cosmochthonius semifoveolatus* originally described from Spain. The specimens found share nearly the same morphological traits with *C. semifoveolatus* originally (Subías 1982) based on the revision of the genus carried out by Ayyildiz and Luxton (1990). First record for Argentina, if the identification is confirmed.

Trichthoniidae Lee

***Trichthonius* Hammer**

***Trichthonius pulcherrimus* (Hammer, 1958)**

Specimens examined: Cerro Otto - leaf litter under *A. chilensis*, XI-2006 (18), I-2009 (5), III-2009 (2), Cerro P. Laguna - leaf litter under *N. antarctica*, XI-2006 (1).

Remarks: Originally described from Argentina. Previously reported from that country [as *Cosmochthonius pulcherrimus* Hammer, *Trichthonius pulcherrimus* (Hammer)] in the province of Mendoza (Hammer 1958), in the province of Río Negro (Balogh & Csiszár 1963), Chile (Hammer 1962a), Bolivia (Hammer 1958), Peru (Hammer 1961) and Australia (Lee 1982).

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Phthiracaridae Perty

***Phthiracarus* Perty**

***Phthiracarus (Neophthiracarus) insignis* (Balogh & Csiszár, 1963)**

Specimens examined: Cerro Otto - under *A. chilensis*, leaf litter XI-2006 (3), soil XI-2006, III-2009 soil (2), LLao LLao - under N. dombeyi, soil XI-2006 (4).

Remarks: Originally described from Argentina. Previously reported from that country [as *Neophthiracarus insignis* Balogh & Csiszár] from leaf litter in *A. chilensis-Lomatia* forests (Balogh & Csiszár 1963) in the province of Río Negro.

Nothridae Berlese

***Nothrus* Koch**

***Nothrus peruensis* Hammer, 1961**

Specimens examined: Cerro Otto - under *A. chilensis*, leaf litter XI-2006 (117i, 30a), III-2007 (14a, 23i), soil XI-2006 (5i), LLao LLao - under *N. dombeyi*, leaf litter XI-2006 (27a, 77i), soil (3a, 19i), I-2008 (8a), I-2009 (10a).

Remarks: Originally described from Peru. Previously reported in Argentina from the province of Río Negro (Balogh & Csiszár 1963) and from the province of Tierra del Fuego (Baranek 1988) from lichens. In Chile it was recorded also on wet mosses and leaf litter from tall forests (Hammer 1962a).

Camisiidae Oudemans

***Camisia* Heyden**

***Camisia segnis* (Hermann, 1804)**

Specimens examined: Cerro Otto - under *A. chilensis*, leaf litter XI-2006 (1), III-2007 (1) I-2009 (3).

Remarks: This species is considered semicosmopolitan, living in the Holarctic, Oriental and Antarctic regions (Subías 2004). Originally described as *Notaspis segnis* (Hermann 1804). Previously reported from Argentina [as *Camisia segnis* (Hermann)] in the province of Mendoza (Hammer 1958) and in the province of Río Negro (Hammer 1962b; Balogh & Csiszár 1963).

***Heminothrus* Berlese**

First record for the province of Neuquén.

***Heminothrus (Platynothrus) biangulatus* (Hammer, 1962)**

Specimens examined: LLao LLao - leaf litter under *N. dombeyi*, XI -2006, (13a, 71i, III-2007 (51a), Lago Huechulafquen - under *N. dombeyi*, pitfall trap I-2005 (7).

Remarks: Originally described from Chile, from forests near Puerto Montt [as *Platynothrus biangulatus*]. Previously reported from Buenos Aires (Bischoff de Alzuet 1967) and Tierra del Fuego (Baranek 1988) as *Platynothrus biangulatus*. **First record for the provinces of Río Negro and Neuquén**.

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Crotoniidae Thorell

***Crotonia* Thorell**

First record for the province of Neuquén.

***Crotonia flagellata* (Balogh & Csiszár, 1963)**

Species examined: Cerro Otto - under *A. chilensis* leaf litter XI-2006 (2), Lago Traful - under *N. dombeyi-A. chilensis mixed forest*, pitfall trap III-2005 (5).

Remarks: Originally described from Argentina. Previously reported from that country [as *Acronothrus flagellatus* Balogh & Csiszár] in leaf litter of *Nothofagus pumilio* forest (Balogh & Csiszár 1963). **First record for the province of Neuquén**.

Malaconothridae Berlese

***Malaconothrus* Berlese**

***Malaconothrus (Cristonothrus) translamellatus* Hammer, 1958**

Specimens examined: Cerro P.Laguna - under *N. antarctica*, leaf litter XI-2006 (4), Llao Llao - under *N. dombeyi*, leaf litter (1).

Remarks: Originally described from Argentina and Bolivia. Previously reported from that country [as *Malaconothrus translamellatus* Hammer] from the provinces of Mendoza and Salta (Hammer 1958), from the provinces of Río Negro, Santa Cruz and Tierra del Fuego (Hammer 1962b), from Chile (Hammer 1962a, Covarrubias 2004), South Georgia Islands (Starý & Block 1995) and Falkland Islands (Starý & Block 1996).

Pheroliodidae Paschoal

***Pheroliodes* Grandjean**

***Pheroliodes neuquinus* Baranek, 1986**

Specimens examined: Llao Llao - under *N. Dombeyi*, pitfall trap I-2007 (7).

Remarks: Originally described from Argentina. Previously cited from that country in the province of Neuquén province on bark of *N. pumilio* and *Myrceugenia exucca* (Baranek 1986). **First record for the province of Río Negro.**

***Pheroliodes* cf. *minutus* Baranek, 1984**

Specimens examined: Cerro Otto - under *A. chilensis*, leaf litter III-2006 (64), II-2007 (8), III-2008 (5), soil III-2006 (75), I-2009 (5).

Remarks: *Pheroliodes minutus* originally described from Argentina. Previously reported from that country in the province of Buenos Aires (Baranek 1984). First record for the province of Río Negro if the identification is confirmed.

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Licnodamaeidae Grandjean

***Licnodamaeus* Grandjean**

***Licnodamaeus granulatus* Balogh & Csiszár, 1963**

Specimens examined: Cerro Otto - under *A. chilensis*, leaf litter IV-2007 (17), soil IV-2007 (3), leaf litter I-2008 (2), leaf litter I-2009 (2).

Remarks: Originally described from Argentina. Previously reported from that country in the province of Río Negro (Balogh & Csiszár 1963).

Gymnodamaeidae Grandjean

***Jacotella* Banks**

***Jacotella ornata* (Balogh & Csiszár, 1963)**

Specimens examined: Cerro Otto - under *A. chilensis*, leaf litter XI-2006 (1), soil XI-2006 (1), leaf litter (1) III-2006, (6), III-2007 (4), I-2008 (3).

Remarks: Originally described from Argentina. Previously reported from that country [as *Allodamaeus ornatus* Balogh & Csiszár] in the province of Río Negro (Balogh & Csiszár 1963).

Caleremaeidae Grandjean

***Anderemaeus* Hammer**

***Anderemaeus magellanis* Hammer, 1962**

Specimens examined: Cerro Otto - under *A. chilensis*, leaf litter XI-2006 (8), III-2007 (1), I-2008 (5), I-2009 (23), soil XI-2006 (7).

Remarks: Originally described from Chile. Previously reported from Argentina in the province of Tierra del Fuego (Baranek 1988). **First record for the province of Río Negro.**

Nodocepheidae Piffl

***Nodocepheus* Hammer**

***Nodocepheus dentatus* Hammer, 1958**

Specimens examined: Cerro Otto - under *A. chilensis*, leaf litter XI-2006 (16), XI-2006 soil (2), III-2007 (5), LLao LLao - under *N. dombeyi*, leaf litter XI-2006 (11), III-2007 (2), soil XI-2006 (1), Cerro P. Laguna - under *N. antarctica*, leaf litter XI-2006 (1).

Remarks: Originally described from Argentina. Previously reported from that country in the province of Mendoza (Hammer 1958), Río Negro (Hammer 1962b; Balogh & Csiszár 1963), Chubut (Balogh & Csiszár 1963), Falkland Islands (Balogh 1988) and Chile (Hammer 1962a).

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Astegistidae Balogh

***Cultroribula* Berlese**

***Cultroribula argentinensis* Balogh & Csiszár, 1963**

Specimens examined: Cerro P. Laguna - under *N. antarctica*, leaf litter XI-2006 (5), soil XI-2006 (25).

Remarks: Originally described from Argentina. Previously reported from that country in the province of Río Negro (Balogh & Csiszár 1963).

Autognetidae Grandjean

***Austrogneta* Balogh & Csiszár**

***Austrogneta multipilosa* Balogh & Csiszár, 1963**

Specimens examined: LLao LLao - under *N. dombeyi*, leaf litter XI-2006 (1), soil XI-2006 (17), Cerro P. Laguna - under *N. antarctica*, soil XI-2006 (4).

Remarks: Originally described from Argentina. Previously reported from that country in the province of Río Negro (Balogh & Csiszár 1963).

Oppiidae Sellnick

***Anomaloppia* (Hammer)**

***Anomaloppia dispariseta* (Hammer, 1958)**

Specimens examined: LLao LLao - under *N. dombeyi*, leaf litter XI-2006 (5), soil XI-2006 (2), Cerro P. Laguna - under *N. antarctica*, soil XI-2006 (10).

Remarks: Originally described from Argentina. Previously reported in Argentina [as *Oppia dispariseta* Hammer] in the province of Mendoza and in the Falkland Islands (Starý & Block 1996). **First record for the province of Río Negro.**

***Austroppia* Balogh**

***Austroppia* cf. *petrohuensis* Hammer, 1962**

Specimens examined: LLao LLao - under *N. dombeyi*, leaf litter XI-2006 (1), soil XI-2006 (1).

Remarks: *Austroppia petrohuensis* originally described from Chile. Previously reported from that country [as *Brachioppiella petrohuensis* Hammer] and from Argentina in the province of Río Negro (Hammer 1962a, 1962b).

***Brachioppiella* Hammer**

***Brachioppiella (Gressittoppia) pepitensis* Hammer, 1962**

Specimens examined: Cerro Otto - under *A. chilensis*, leaf litter XI-2006 (10), soil III-2007 (2).

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Remarks: Originally described from Chile. Previously reported from that country [as *Oppia pepitensis* Hammer] in Tierra del Fuego (Hammer 1962a) and a subspecies [as *Oppia pepitensis brevipectinata* Covarrubias] was described from South Shetland Islands (Covarrubias 1968). **First record for continental Argentina.**

***Brachioppiella (Brachioppiella) periculosa* Hammer, 1962**

Specimens examined: Cerro Otto - under *A. chilensis*, leaf litter IV-2007 (2), LLao LLao - under *N. dombeyi*, leaf litter XI-2006 (21), soil (24).

Remarks: Originally described from Chile. Previously reported from that country (Hammer 1962a). Previously reported from Argentina in the province of Río Negro (Hammer 1962b, Balogh & Csiszár 1963).

***Brassoppia* Balogh**

First record of the genus for Argentina.

***Brassoppia (Plaesioppia) peullaensis* Hammer, 1962**

Specimens examined: LLao LLao - under *N. dombeyi*, leaf litter XI-2006 (1), soil XI-2006 (1).

Remarks: Originally described from Chile. Previously reported from Chile [as *Brachioppiella peullaensis* Hammer] in Peulla (Hammer 1962a). **First record for Argentina.**

***Discoppia* Balogh**

***Discoppia (Cylindroppia) tenuis* (Hammer, 1958)**

Specimens examined: Cerro Otto - under *A. chilensis*, leaf litter XI-2006 (40), XI-2006 soil (10).

Remarks: Originally described from Argentina. Previously reported from that country [as *Oppia tenuis* Hammer] in the provinces of Mendoza and Salta (Hammer 1958). **First record for Río Negro province.**

***Globoppia* Hammer**

***Globoppia minor* Hammer, 1962**

Specimens examined: Cerro Otto - under *A. chilensis*, leaf litter III-2007 (2), LLao LLao - under *N. dombeyi*, leaf litter XI-2006 (298), soil XI-2006 (24), Cerro P. Laguna - under *N. antarctica*, leaf litter XI-2006 (10), soil XI-2006 (2).

Remarks: Originally described from Chile. Previously reported in Argentina from the province of Río Negro (Balogh & Csiszár 1963) and the province of Tierra del fuego (Mahunka 1980).

***Lanceoppia* Hammer**

***Lanceoppia (Lanceoppia) hexapili* Hammer, 1962**

Specimens examined: Cerro Otto, leaf litter under *A. chilensis*, leaf litter XI-2006 (30), III-2007 (4), soil XI-2006 (1), Cerro P. Laguna under *N. antarctica* leaf litter XI-2006 (8), soil IV-2007 (1).

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Remarks: Originally described from Chile. Previously reported from that country (Hammer 1962a) in Tierra del fuego. **First record for Argentina.**

***Lanceoppia (Lanceoppia) kovacsi* (Balogh & Csiszár, 1963)**

Specimens examined: Cerro Otto - under *A. chilensis* leaf litter XI-2006 (98), soil XI-2006 (8), LLao LLao - under *N. dombeyi*, leaf litter XI-2006 (15), III-2007 (1), soil XI-2006 (1).

Remarks: Originally described from Argentina. Previously reported from that country [as *Oppia kovacsi* Balogh & Csiszár] from the province of Río Negro (Balogh & Csiszár 1963) in forests of *A. chilensis* and *Lomatia*.

***Membranoppia* Hammer**

***Membranoppia (Membranoppia) breviclava* (Hammer, 1958)**

Specimens examined: LLao LLao - under *N. dombeyi*, leaf litter XI-2006 (20), soil XI-2006 (1), Cerro P.Laguna - under *N. antarctica*, leaf litter XI-2006 (4), XI-2006 (1).

Remarks: Originally described from Argentina. Previously reported from that country [as *Oppia breviclava* Hammer] in the province of Mendoza (Hammer 1958) and in the province of Río Negro (Hammer 1962b).

***Membranoppia (Pravoppia) argentinensis* (Balogh & Csiszár, 1963)**

Specimens examined: Cerro Otto - under *A. chilensis*, leaf litter XI-2006 (25), soil XI-2006 (2).

Remarks: Originally described from Argentina. Previously reported from that country [as *Oppia argentinensis* Balogh & Csiszár] in the province of Río Negro (Balogh & Csiszár 1963).

***Microppia* Balogh**

First record for the province of Río Negro.

***Microppia minus* (Paoli, 1908)**

Specimens examined: Cerro Otto - under *A. chilensis*, soil XI-2006 (8).
Remarks: Originally described from Italy as *Dameosoma minus* Paoli.

Previously reported from Argentina [as *Oppia minutissima* Sellnick] in the province of Chubut (Balogh & Csiszár 1963). **First record for the province of Río Negro.**

***Neoamerioppia* Subías**

***Neoamerioppia* cf. *chilensis* (Hammer, 1962)**

Specimens examined: LLao LLao - under *N. dombeyi*, leaf litter, XI-2006 (12), soil XI-2006 (1).

Remarks: *Neoamerioppia chilensis* originally described from Chile. Previously reported from that country [as *Amerioppia chilensis* Hammer] in Puerto Montt. First record for Argentina if the identification is confirmed.

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***Oppiella* Jacot**

***Oppiella nova* (Oudemans, 1902)**

Specimens examined: Cerro Otto - under *A. chilensis*, soil XI-2006 (3), LLao LLao - under *N. dombeyi*, leaf litter XI-2006 (13), soil XI-2006 (71), Cerro P. Laguna - under *N. antarctica*, leaf litter XI-2006 (6), soil XI-2006 (27).

Remarks: Originally described from the Netherlands. Previously reported in Argentina [as *Oppiella nova* (Oudemans)] in the Río Negro province (Hammer 1962b, Balogh & Csiszár 1963) and in the province of Buenos Aires (Denegri & Bischoff de Alzuet 1992, Salazar Martínez *et al.* 2007).

***Oxyoppia* Balogh & Mahunka**

***Oxyoppia (Oxyoppiella) suramericana* Hammer, 1958**

Specimens examined: Cerro Otto - under *A. chilensis*, soil XI-2006 (3), LLao LLao - under *N. dombeyi*, leaf litter XI-2006 (30), soil XI-2006 (7), soil IV-2007 (3), Cerro P. Laguna under *N. antarctica* leaf litter XI-2006 (2), soil IV-2007 (5).

Remarks: Originally described from Argentina. Previously reported from that country [as *Oppia suramericana* Hammer] in the province of Mendoza (Hammer 1958), in the province of Salta (Hammer 1958), in the province of Río Negro (Balogh & Csiszár 1963), in the province of Santa Cruz (Hammer 1962b), in the province of Buenos Aires (Denegri & Bischoff de Alzuet 1992, Salazar Martínez *et al.* 2007).

***Oxyoppia (Oxyoppiella)* n. sp.**

Specimens examined: Cerro Otto - under *A. chilensis*, soil XI-2006 (4), leaf litter III-2007, (2), soil III-2007 (1), LLao LLao - under *N. dombeyi*, leaf litter XI-2006 (5), soil XI-2006 (37), Cerro P. Laguna under *N. antarctica* leaf litter XI-2006 (2), soil IV-2007 (24).

Remarks: The peculiar disposition of lamellar and translamellar lines and the smaller size differenciates this species of the other species in the genus.

***Setoppia* Balogh**

***Setoppia angustopili* (Hammer, 1962)**

Specimens examined: LLao LLao - under *N. dombeyi*, leaf litter XI-2006 (91), soil XI-2006 (9), Pampa Linda—under *N. dombeyi-A. chilensis* mixed forest, pitfall III-2005 (2).

Remarks: Originally described from Chile. Previously reported from Argentina [as *Lanceoppia angustopili* Hammer] but with unknown collecting site (Balogh & Csiszár 1963) although province of Río Negro or the province of Chubut include the suspected sites. **First record for the province of Río Negro.**

***Paroppia* Hammer**

First record for Argentina.

***Paroppia* n. sp. 1**

Specimens examined: Cerro P. Laguna under *N. antarctica* leaf litter XI-2006 (1), soil XI-2006 (1). 270 µm.

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Remarks: Genus originally described from New Zealand with *P. lebruni* Hammer as type species. There are only four recognized species for the genus *Paroppia* Hammer. The shape of sensillus (geniculated, with four distal parallel lines of ciliae) is very different in *P. lebruni* Hammer.

***Paroppia* n. sp. 2**

Specimens examined: LLao LLao - under *N. dombeyi*, leaf litter XI-2006 (10), soil XI-2006 (3). 300 µm.

Remarks: With geniculated and fusiform sensillus.

Suctobelbidae Jacot

***Suctobelbella* Jacot**

First record for the province of Río Negro.

***Suctobelbella* (*Ussuribata*) cf. *cornuta* Hammer, 1962**

Specimens examined: LLao LLao - under *N. dombeyi*, leaf litter XI-2006 (1), soil XI-2006 (13), Cerro Otto - under *A. chilensis*, leaf litter XI-2006 (1).

Remarks: *Suctobelbella cornuta* originally described from Chile. Previously reported from that country [as *Suctobelba cornuta* Hammer] in Puerto Montt (Hammer 1962a). First record for Argentina if the identification is confirmed.

***Suctobelbella (Suctobelbella)* cf. *variabilis* Hammer, 1962**

Specimens examined: LLao LLao - under *N. dombeyi*, leaf litter XI-2006 (16), soil XI-2006 (2). Cerro Otto - under *A. chilensis*, leaf litter XI-2006 (3).

Remarks: *Suctobelbella variabilis* originally described from Chile. Previously reported from that country [as *Suctobelba variabilis* Hammer] in Puerto Montt, Petrohué and Peulla (Hammer 1962a). First record for Argentina if the identification is confirmed.

Tetracondylidae Aoki

***Pseudotocepheus* Balogh**

First record for the province of Río Negro.

***Pseudotocepheus* cf. *hauseri* (Mahunka, 1980)**

Specimens examined: LLao LLao - under *N. dombeyi*, leaf litter XI-2006 (1).

Remarks: *Pseudotocepheus hauseri* originally described from Argentina. Previously reported [as *Nesotocepheus hauseri* Mahunka] from the province of Tierra del Fuego (Mahunka 1980). First record for the province of Río Negro if the identification is confirmed.

***Pseudotocepheus* cf. *australis* (Mahunka, 1980)**

Specimens examined: LLao LLao - under *N. dombeyi*, leaf litter XI-2006 (1).

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Remarks: *Pseudotocepheus hauseri* originally described from Argentina. Previously reported [as *Nesotocepheus australis* Mahunka] from the province of Tierra del Fuego (Mahunka 1980). First record for the province of Río Negro if the identification is confirmed.

Tectocepheidae Grandjean

***Tectocepheus* Berlese**

***Tectocepheus velatus* (Michael, 1880)**

Specimens examined: Cerro Otto - under *A. chilensis*, leaf litter XI-2006 (121i, 32a), III-2007 (7i ,18a), soil XI-2006 (2a), III-2007 (3i ,1a), LLao LLao - under *N. dombeyi*, leaf litter XI-2006 (13a, 6i), III-2007 (17a, 14i), soil XI-2006 (2a,6i), Balcón Gutiérrez - under *N. dombeyi*, leaf litter III-2008 (7a), Cerro P. Laguna - under *N. antarctica*, leaf litter XI-2006 (48a,38i), III-2007 (1a,2i), soil (1a,3i) XI-2006.

Distribution: Originally described from England. Previously reported from the Falkland Islands (Starý & Block 1996). Although the genus *Tectocepheus* was recorded in Argentina no assignment to species or subspecies was given (Hammer 1958; Hammer 1962b; Baranek 1988; Salazar Martínez *et al.* 2007) until recently when *T. minor* was recorded in the province of Buenos Aires (Fredes & Martínez 2008) and *T. velatus* in the province of Misiones (Martinez *et al.* 2009). **First record for the province of Rio Negro.**

Oribatellidae Jacot

***Cuspidozetes* Hammer**

***Cuspidozetes armatus* Hammer, 1962**

Specimens examined: Cerro Otto - under *A. chilensis*, leaf litter IV-2007 (1).

Remarks: Originally described from Argentina. Previously reported in the province of Río Negro (Hammer 1962b, Balogh & Csiszár 1963).

Ceratozetidae Jacot

***Edwardzetes* Berlese**

***Edwardzetes dentifer* Hammer, 1962**

Specimens examined: LLao LLao - under *N. dombeyi*, pitfall trap I-2006 (9).

Remarks: Originally described from Chile. Previously reported from Argentina in the province of Río Negro (Hammer 1962b, Balogh & Csiszár 1963), in the province of Santa Cruz (Hammer 1962b), in the province of Tierra del Fuego (Baranek 1988) and in the Falkland Islands (Starý & Block 1996).

***Furcobates* Sellnick**

First record for the province of Neuquén.

***Furcobates (Furcobates)* cf. *hastatus* Kramer, 1898**

Specimens examined: Lago el Totoral (Nq)—under *N. dombeyi*, pitfall trap III-2005 (2).

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Remarks: *Furcobates hastatus* originally described from Tierra del Fuego**.** Previously recorded from Argentina [as *Furcobates hastata* (Kramer 1898)] in the province of Tierra del Fuego (Kramer 1898), in the province of Río Negro and the province of Santa Cruz (Balogh & Csiszár 1963). Previously recorded from Chile [as *Oribates longicornutus* Berlese] in Pitrufquén (Berlese & Leonardi 1901). First record for the province of Neuquén if the identification is confirmed.

Neotrichozetidae Balogh

***Neotrichozetes* Travé**

***Neotrichozetes spinulosus germaineae* Travé, 1961**

Specimens examined: Near Meteorological Station on Tronador road—under *N. antarctica* pitfall trap, XI-2005 (1).

Remarks: Originally described from Argentina. Previously reported from that country in the province of Río Negro (Travé 1961; Hammer 1962b; Balogh & Csiszár 1963).

Oribatulidae Thor

***Jornadia* Wallwork & Weems**

First record for the province of Río Negro.

***Jornadia* n. sp.**

Specimens examined: Cerro Otto - under *A. chilensis*, leaf litter XI-2006 (7).

Remarks: Only three species are included in this genus. One of them was previously reported for Argentina [as *Oribatula dactyloscopica* Balogh & Mahunka] in the provinces of Cordoba (Balogh & Mahunka 1968) and Buenos Aires (Denegri & Bischoff de Alzuet 1992). Seven specimens were found only in leaf litter from *A. chilensis*. The specimens do not exhibit the fingerprint pattern which characterizes *J. dactyloscopica*.

***Paraphauloppia* Hammer**

***Paraphauloppia* cf. *australis* (Hammer, 1962)**

Specimens examined: Cerro Otto - under *A. chilensis*, leaf litter XI-2006 (7), IV-2007 (1).

Remarks: *Paraphauloppia australis* originally described from Chile. Previously reported from that country [as *Eporibatula australis* Hammer] in Puerto Montt and Punta Arenas (Hammer 1962a). Previously reported from Argentina in the province of Tierra del Fuego (Baranek 1988). Also reported from Falkland Islands (Starý 1995). First record for the province of Río Negro if the identification is confirmed.

Parapirnodidae Aoki & Ohkubo

***Gerloubia* Coetzer**

***Gerloubia bicuspidata* (Hammer, 1958)**
Specimens examined: Cerro Otto - under *A. chilensis*, leaf litter XI-2006 (2).

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Remarks: Originally described from Argentina. Previously reported [as *Eporibatula bicuspidata* Hammer] in the province of Mendoza (Hammer 1958) and in the province of Río Negro (Balogh & Csiszár 1963).

Liebstadiidae Balogh & Balogh

***Maculobates* Hammer**

First record for the province of Neuquén.

***Maculobates longiporosus* Hammer, 1962**

Specimens examined: LLao LLao - under *N. dombeyi*, leaf litter XI-2006 (24), soil XI-2006 (2), Lago el Totoral(Nq), under *N. antarctica* - pitfall trap III-2005 (2).

Remarks: Originally described from Chile (Hammer 1962a). Previously reported from that country in Punta Arenas and Puerto Montt (Hammer 1962a) and from Argentina in the province of Santa Cruz (Hammer 1962b) and from the province of Río Negro (Balogh & Csiszár 1963). **First record for the province of Neuquén.**

Protoribatidae Balogh & Balogh

***Totobates* Hammer**

***Totobates elegans* (Hammer, 1958)**

Specimens examined: LLao LLao - under *N. dombeyi*, leaf litter XI-2006 (5), IV-2007 (20).

Remarks: Originally described from Argentina. Previously reported [as *Protoribates elegans* Hammer] from the province of Mendoza (Hammer 1958). **First record for the province of Río Negro.**

***Totobates pterygoides* Hammer, 1962**

Specimens examined: LLao LLao - under *N. dombeyi*, leaf litter XI-2006 (11).

Remarks: Originally described from Argentina. Previously reported from that country in the province of Río Negro (Hammer 1962b) in Puerto Blest.

***Tuxenia* Hammer**

***Tuxenia complicata* Hammer, 1958**.

Specimens examined: Cerro Otto - under *A. chilensis*, leaf litter XI-2006 (3)

Remarks: Originally described from Argentina. Previously reported from that country in the provinces of Mendoza and Salta (Hammer 1958) and the province of Río Negro (Balogh & Csiszár 1963).

Tegoribatidae Grandjean

***Physobates* Hammer**

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***Physobates spinipes* Hammer, 1962**

Specimens examined: LLao LLao - under *N. dombeyi*, leaf litter XI-2006 (2) soil XI-2006 (1).

Remarks: Originally described from Chile. Previously reported from that country from Petrohué (Hammer 1962a) and Nahuelbuta (Covarrubias 1967), from Argentina in the province of Río Negro (Balogh & Csiszár 1963).

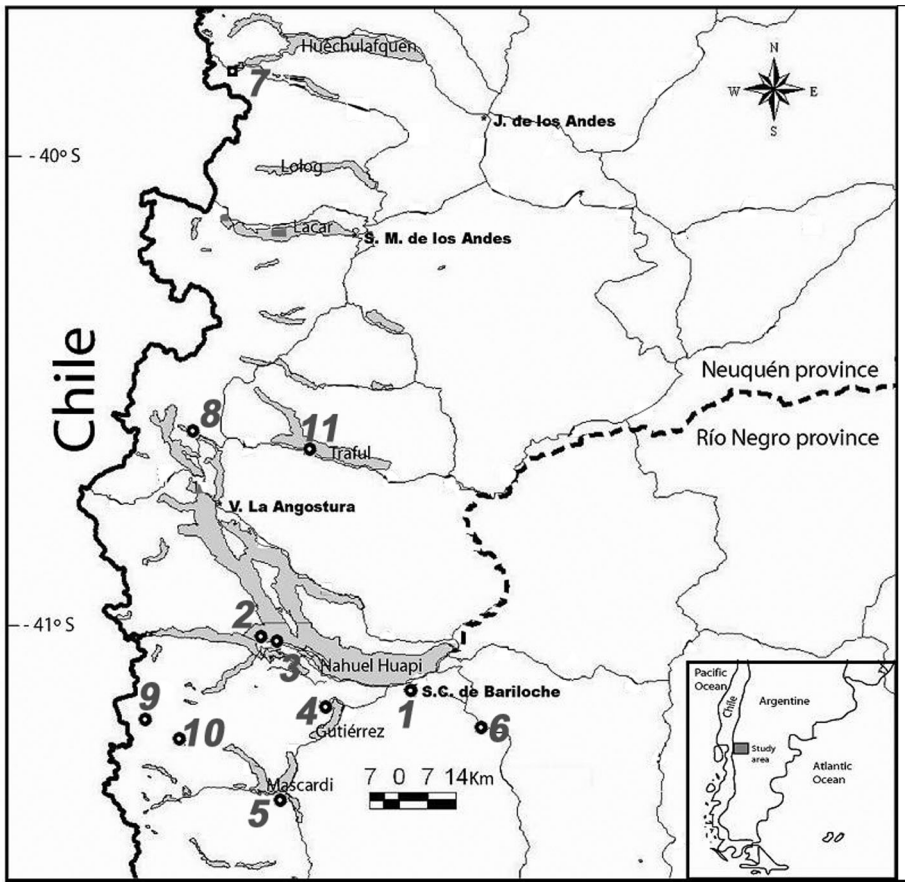

FIGURE 1. Map of Argentinean Northwestern Patagonian region with the location of the eleven sampled sites. Numbers correspond to the list in table 1.

Discussion

Almost 62 % of species collected were only found in Southern Andean regions showing a high level of endemism. This percentage does not include *Edwardzetes dentifer, Paraphauloppia australis, Anomaloppia dispariseta, Brachioppiella pepitensis* and *Totobates elegans* which have also been found in the Falkland Islands, in the South Shetland Islands and in the Antarctica. Their distribution is probably due to the ancient land communication connecting Subantarctic Islands, Antarctica and South America. *Gerloubia bicuspidata* has not been included in the above percentage because its distribution includes California in the USA although this information is uncertain (Subías 2009 online version). Nearly all of the species collected in this study have been previously found in the Austral Andes Mountains excepting *Cosmochthonius semifoveolatus, Pheroliodes minutus* and *Paroppia* species. This high level of endemism is in agreement with the current knowledge on the world distribution trend of oribatid mites in which the vast majority of all oribatid species (almost 90 %) are restricted to one zoogeographical region (Schatz 2004) and with present accepted affirmation that Neotropical high Andes (over 1000 m) are considered one of the Gondwanan refugia for oribatid faunas (Marshall & Pugh 1996). The level of endemism at the genus level was however lower

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considering only two of the genera found in this survey are exclusive from Southern Andes Mountains (*Tuxenia* and *Cuspidozetes)*. The genus *Paroppia* has been recorded also in Africa, Hawaii and New Zealand. Based on its rather disjunct distribution, it probably represents an ancient gondwanic group of Oppiidae.

Twenty seven species found in this survey were already known for Chile which was predictably expected due to the proximity of the sampling sites to the Chile–Argentina border. Ten species were also known from New Zealand, supporting the ancient connection by land. *Pseudotocepheus* and *Nodocepheus* are among the genera which are widely distributed in the southern hemisphere and are common to New Zealand, Australia, South America and Africa. Four cosmopolitan species were found: *Eniochthonius minutissimus*, *Oppiella nova*, *Microppia minus* and *Tectocepheus velatus* and three semiscosmopolitan species: *Sellnickochthonius elsosneadensis*, *Liochthonius fimbriatissimus* and *Camisia segnis*.

A great proportion of specimens found in soil belong to species which have monodactyl claws as those belonging to the Oppiidae. This is probably related to the edaphic habitats sampled as oribatid species with tridactyl claws have been shown to be in greater proportion in arboreal habitats as tree trunks and tree bark while oribatids with monodactyl claws are commonly better represented in forest floor (Karasawa & Hijii 2004, 2008). Although tridactylic species occur also in forest floor heterodactylity has been shown to be more frequently related to edaphic species rather than to arboreal (Karasawa & Hijii 2004, 2008) which agrees with the observation that the common tridactylic species found in this survey *Pheroliodes minutus* and *Nothrus peruensis* exhibit heterodactylic tridactyl claws together with other less frequent oribatids as *Pheroliodes neuquinus*, *Licnodamaeus granulatus*, *Anderemaeus magellanis*, *Cuspidozetes armatus* and *Physobates spinipes.*

Body size of the species found in pitfall traps is greater than those found in edaphic substrates; this is related to a greater surface–activity (Walter & Proctor 2001). Accordingly, body sizes of species found in soil were smaller than those found in leaf litter which generally show greater mobility in a more fluctuating environment (Kang *et al.* 2001). The specimens examined include about 70 % of the species actually sampled in this study. The remaining specimens sampled in soil and leaf litter have not been incorporated to this inventory because these are larvae and nymphs or specimens which could not been assigned to a genus. Specimens inhabiting tree trunks, barks, epiphytes and suspended soils which have also been extracted, remain for future analysis which certainly will render new records and new species of this puzzling diverse microarthropod group.

Acknowledgments

To Dr Paula Sackmann (Laboratorio Ecotono of the CRUB-UNCo), Dr Laura Lorenzo, Dr María Inés Messuti and Dr Guernot Vobis (Laboratorio de Botánica of the CRUB-UNCo) for kindly providing clearing and fixative reagents and glass material. To Lic. Alejandra Ruffini, the chief of CRUB laboratories, for making available the digital optical microscopes. To Dr René Covarrubias (Instituto de Entomología. Universidad Metropolitana de Ciencias de la Educación, Santiago, Chile) for providing information on Chilean Oribatida. To the Centro Regional Universitario Bariloche of the Universidad Nacional del Comahue for allowing us to develop this project. To Dr H. Schatz (Institut für Zoologie/Ökologie, Leopold-Franzens-Universität, Innsbruck, Austria) as two anonymous referees for reviewing the manuscript.

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