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Chironomid (Chironomidae: Diptera) checklist from Nahuel Huapi National Park, Patagonia, Argentina

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Lista de los quironómidos (Chironomidae: Diptera) del Parque Nacional Nahuel Huapi, Patagonia, Argentina

RESUMEN. Este trabajo presenta el primer catálogo de taxones modernos y subfósiles de la familia Chironomidae (Insecta: Diptera) del Parque Nacional Nahuel Huapi en Patagonia, Argentina. La fauna catalogada contiene 104 especies en 48 géneros y 6 subfamilias para la fauna moderna y 52 morfotipos en 36 géneros y 4 subfamilias para la fauna subfósil.

PALABRAS CLAVE. Chironomidae. Diversidad. Fauna moderna. Fauna subfósil. Hemisferio Sur.

ABSTRACT. This paper presents the first inventory of modern and sub-fossil taxa of the Family Chironomidae (Insecta: Diptera) from Nahuel Huapi National Park in Patagonia, Argentina. The catalogued fauna contains 104 species in 48 genera and 6 sub-families for modern fauna and 52 morphotypes in 36 genera and 4 subfamilies for sub-fossil fauna.

KEYWORDS. Chironomidae. Diversity. Modern fauna. Sub-fossil fauna. Southern Hemisphere.

INTRODUCTION

The Family Chironomidae (Insecta: Diptera: Nematocera), colloquially known as non-biting midges, are probably the most abundant insects found in freshwater systems (Cranston, 1995). The distribution of chironomids is driven by environmental conditions, especially temperature, and a considerable number of species are stenotopic (i.e. living in a narrow range of particular environmental conditions). Chironomids respond rapidly to environmental change and the sensitivity of chironomids to different environmental variables such as dissolved oxygen, nutrients and organic content of sediments, pH and salinity, has led to their use as indicators of lake quality and environmental change in ecological and paleoecological studies (Walker, 2001).

In southern South America, studies on Chironomidae began with Edwards (1931), who was the first to recognize the possibility of a circum-Antarctic chironomid faunal connection. In Patagonia, the region of Argentina and Chile that extends from 39° S to 55° S, the most significant early contributions to knowledge on chironomid taxonomy and biogeography were made by

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Brundin (1956, 1958, 1966). Since Brundin's studies, other researchers have investigated this remote area of the world (e.g. Cranston, 2000a, 2000b; Cranston & Edwards, 1999; Gonser & Spies, 1997; García & Añón Suarez, 2007; Paggi, 1979, 1984, 1986a, 1986b, 1987; Paggi, 2007; Paggi & Añón Suárez, 2000; Prat *et al.*, 2004; Reiss, 1972; Sæther, 1990; Sæther & Andersen, 2003) making remarkable contributions to furthering the knowledge of taxonomy and distribution of Southern Hemisphere chironomids. However, the number of species currently documented is still considered conservative and many taxa remain undescribed (Cranston, 1995).

For the Austral region, there are only three identification keys available for chironomids covering part of the Australian and New Zealand faunas (Freeman, 1959, 1961; Cranston, 1996; 2000c). Similar keys have yet to be published for Patagonia.

Study area

Nahuel Huapi National Park covers an area of 710,000 ha. It was the first national park created in Argentina and was donated by Dr. Francisco P. Moreno in 1903. It is located in the north-western part of Rio Negro Province between 40°8′ and 41°35′ S to 71°2′ and 71°57′ W (Fig. 1). Within the National Park, on a W-E transect of not more than 100 km, annual precipitation declines from 3000 mm (Puerto Blest) to 200 mm (Limay river). This moisture regime supports three types of vegetation units: Alto-Andean Steppe, Andino-Patagonian Forest and Patagonian Steppe (Correa, 1998) in one of the most extreme ecological gradients of the world.

In this study we provide the first inventory of Chironomidae taxa for the Nahuel Huapi National Park, one of the most important centres of species diversity and richness not only in the Southern Hemisphere, but also in the world (Orme *et al.*, 2005). We also include a list of taxa identified from sub-fossil chironomid head capsules collected from lake sediments located in the National Park. This work will contribute to the knowledge of the taxonomy and distribution of one of the most abundant aquatic insect groups in the world, and which are in need of further investigation in southern South America.

MATERIAL AND METHODS

Taxonomic identifications based on newly collected material were made with reference to specimens from collections and literature at the Natural History Museum, London, UK and Museo de La Plata, Argentina. The new material was collected during 2006/2007, together with other freshwater invertebrates as part of a Darwin Initiative programme currently in progress in the Nahuel Huapi National Park.

Sub-fossil chironomids are often abundant in a wide range of Quaternary deposits. They are of special interest in paleolimnology because their strongly sclerotised larval head capsules preserve well in sediments, enabling their identification to generic and species-group level. The material shown in this study was collected from lake sediment cores obtained in the Nahuel Huapi National Park area (Ariztegui *et al.*, 1997; Bianchi *et al.*, 1997, 2000; Corley & Massaferro, 1998; Massaferro & Corley, 1998; Massaferro *et al.*, 2004) and identified following Cranston (2000) and photographical material.

RESULTS

Chironomid taxa are listed systematically by tribe and in alphabetical order by genus and species. Letters L, P, M and F refer to larvae, pupae, adult male and adult female specimens respectively. The list is based on material collected in Nahuel Huapi National Park during 2006-2007 as part of the Darwin Initiative project, and also from material previously described in the literature of and collected from Nahuel Huapi National Park.

Modern fauna

Sub-family Tanypodinae
Tribe Pentaneurini
Ablabesmyia infumata Edwards, 1931 M

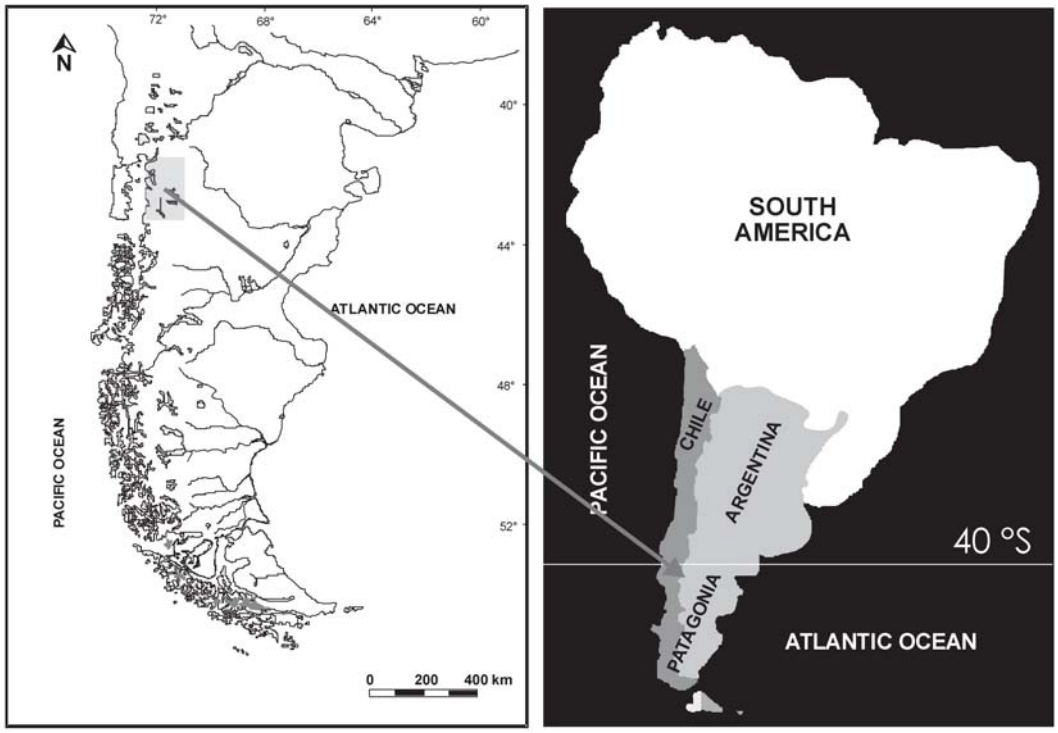

Fig. 1. Geographical location of the Nahuel Huapi National Park.

Ablabesmyia punctulata (Philippi, 1865) M
Ablabesmyia reissi Paggi & Añón-Suárez, 2000 L-P-M-F
Ablabesmyia sp. 1 L
Ablabesmyia sp. 2 M
Alotanypus sp. 1, L
Labrundinia separata (Edwards, 1931), M-F
Labrundinia sp. 1, L
Larsia pallescens Edwards, 1931 M-F
Pentaneura cinerea (Philippi, 1865) F
Pentaneura sp. 1, L

Tribe Macropelopini
Apsectrotanypus sp., L-P-M

Tribe Tanypodini
Tanypus sp., L

Sub-family Podonominae
Parochlus ayseni Brundin, 1966 M-F
Parochlus crassicornis Brundin, 1966 P-M
Parochlus cristatus Brundin, 1966 M
Parochlus duseni Brundin, 1966 M-F
Parochlus fascipennis Brundin, 1966 F
Parochlus montivagus Brundin, 1966 P-M-F
Parochlus nigrinus nigrinus (Edwards, 1931) M-F
Parochlus patagonicus Brundin, 1966 P
Parochlus squamipalpis (Edwards, 1931) F
Parochlus trigonocerus Brundin, 1966 P-M
Parochlus tubulicornis Brundin, 1966 P-M-F
Podochlus robsoni Brundin, 1966 P-M
Podochlus sp. «Ñireco» Brundin, 1966 P
Podochlus tenuicornis Brundin, 1966 P-M
Podonomopsis brevipalpis Brundin, 1966 P-M-F
Podonomopsis mutica (Edwards, 1931) M
Podonomus albinervis Edwards, 1931 P-M-F-L
Podonomus besti Brundin, 1966 P-M-F
Podonomus decarthrus Edwards, 1931 M-F
Podonomus inermis Brundin, 1966 P-M-F
Podonomus montanus Brundin, 1966 P-M-F
Podonomus nudipennis Edwards, 1931 M
Podonomus rivulorum Brundin, 1966 P-M-F
Podonomus sp. «Rigi II» Brundin, 1966 P
Rheochlus insignis Brundin, 1966 M

Sub-family Aphroteniinae
Paraphrotenia excellens Brundin, 1966 P-M-F

Sub-family Diamesinae
Heptagyia annulipes Philippi, 1865 M-F

Limaya longitarsis Brundin, 1966 L-P-A
Mapucheptagyia brundini Willassen, 1995 M
Paraheptagyia nitescens (Edwards, 1931) M
Paraheptagyia semiplumata (Edwards, 1931) M-F
Reissmesa antiqua (Brundin, 1966) P-M-F

Sub-family Orthocladiinae
Austrocladius hamulatus (Edwards, 1931) M-F
Austrocladius heterogeneous (Edwards, 1931) M-F
Austrocladius hirtinervis (Edwards, 1931) M-F
Austrocladius obliquus (Edwards, 1931) M-F
Austrocladius sp., L
Botryocladius edwardsi Cranston & Edward, 1999 P-M
Botryocladius glacialis Cranston & Edward, 1999 P
Botryocladius mapuche Cranston & Edward, 1999 P
Botryocladius tronador Cranston & Edward, 1999 P
Bryophaenocladius emarginatus (Edwards, 1931) F
Thienemanniella sp., L
Cricotopus/Paratrichocladius sp. 1, L
Cricotopus/Paratrichocladius sp. 2, L
Diplocladius calonotus (Edwards, 1931) M-F
Diplocladius flavozonatus (Edwards, 1931) M-F
Diplocladius pulchripennis (Edwards, 1931) M-F
Diplocladius sp., L
Edwardsidia candicans (Edwards, 1931) M
Edwardsidia phylligra (Edwards, 1931) M
Eukiefferiella sp., L
Limnophyes brachyarthra (Edwards, 1931) M-F
Limnophyes collaris (Edwards, 1931) M-F
Limnophyes griseatus (Edwards, 1931) M
Limnophyes subnudicollis (Edwards, 1931) M
Limnophyes sp. 1, L
Limnophyes sp. 2, M
Parakiefferiella sp., L
Parapsectrocladius acuminatus (Edwards, 1931) L-P-M-F
Parapsectrocladius escondido Cranston & Añón-Suárez, 2000 L-P-M-F
Parapsectrocladius longistilus Cranston, 2000 P-M-F
Parapsectrocladius sp. 1, L
Paratrichocladius sp. 1, M
Paratrichocladius sp. 2, M
Physoneura costalis (Edwards, 1931)
Physoneura minuscula (Edwards, 1931) M
Physoneura nigroflava (Edwards, 1931) M
Pseudosmittia fortispinata (Edwards, 1931) M
Pseudosmittia sp. 1?, M
Rhinocladius culicinus Edwards, 1931 F
Rhinocladius longirostris Edwards, 1931 M-F
Thienemanniella sp., L
Orthocladiinae sp. 1, M
Orthocladiinae (*Diplocladius*?) sp. 2, L
Orthocladiinae sp. 3, L
Orthocladiinae (*Smittia*?) sp. 4, L

Sub-family Chironominae
Tribe Chironomini
Apedilum sp., L-M
Chironomus sp., L
Pagastiella sp., M
Parachironomus supparilis (Edwards, 1931) L-P-M-F
Parachironomus vistosus Paggi, 1979 M
Phaenopsectra flavipes species group sp., L
Phaenopsectra obediens species group sp., L
Polypedilum quinquesetosus (Edwards, 1931) M-F
Polypedilum sp., L

Tribe Pseudochironomini
Riethia melanoides (Edwards, 1931) M-F
Riethia sp., L

Tribe Tanytarsini
Caladomyia tuberculata (Reiss 1972)
Camposimyia echinata (Reiss, 1972) M
Nimbocera patagonica Reiss, 1972 L-P-M
Paratanytarsus sp., L
Rheotanytarsus globosus Reiss, 1972 P-M
Rheotanytarsus sp., L
Tanytarsus clivosus Reiss, 1972 P-M
Tanytarsus fastigatus Reiss, 1972 P-M
Tanytarsus hamatus Reiss, 1972 M
Tanytarsus sp. 1, L
Tanytarsus sp. 2, L
Tanytarsus sp. 3, L

Sub-fossil fauna

Sub-family Tanypodinae
Ablabesmyia sp., L
Apsectrotanypus sp., L
Macropelopia sp., L
Labrundinia sp., L
Djalmabatista sp., L

Sub-family Podonominae

Parochlus sp., L
Podonomus sp., L

Sub-family Orthocladiinae
Corynoneura sp., L
Cricotopus, L
Eukiefferiella, L
Gymnometriocnemus, L
Limnophyes/Paralimnophyes, L
Nanocladius, L
Orthocladiinae sp.1 (*Paramectriocnemus*?), L
Orthocladiinae sp.2 (*Mesosmittia*?), L
Orthocladiinae sp.3 (*Cricotopus*?), L
Orthocladiinae sp.4 (wood miner), L
Orthocladiinae sp.11 (*Symbiocladius*?), L
Orthocladiinae sp.13, L
Orthocladiinae sp.14, L
Orthocladiinae sp.15 (*Paraphaenocladius*?), L
Orthocladiinae sp.16 (*Bryophaenocladius*?), L
Parakiefferiella morphotype *triquetra*, L
Parakiefferiella sp., L
Parapsectrocladius sp., L
Parasmittia sp. L
Psectrocladius sp., L
Pseudosmittia sp., L
Smittia sp., L

Sub-family Chironominae
Tribe Chironomini
Chironomus sp., L
Cryptotendipes sp., L
Dicrotendipes sp., L
Glyptotendipes sp., L
Harrisius sp., L
Microtendipes sp., L
Parachironomus sp., L
Paracladopelma sp., L
Phaenopsectra sp., L
Polypedilum sp., L
Stelechomyia sp., L
Xenochironomus sp., L
Zavreliella marmorata?, L

Tribe Pseudochironomini
Riethia sp., L

Tribe Tanytarsini
Lauternboniella sp. ?, L
Paratanytarsus sp. ?, L
Tanytarsus sp. 1A, L
Tanytarsus sp. 1B, L
Tanytarsus sp. 1C, L
Tanytarsus sp. B, L
Tanytarsus sp. C, L
Tanytarsus sp. D, L

DISCUSSION

Figures 2 and 3 show the current knowledge of the distribution of modern and sub-fossil chironomid taxa amongst chironomid sub-families in Patagonia. Pioneering work by Brundin (1966) estimated the proportions of species amongst the chironomid sub-families in Andean-Patagonian flowing waters as follows: Podonominae 38%, Diamesinae plus Orthocladiinae 42%, leaving the remaining 20% among Tanypodinae, Aphroteniinae and Chironominae. Later, Ashe et al. (1987) compiled a taxonomic list of chironomid species from the same region showing the following percentages: Chilenomyiinae 0.2%, Podonominae 38%, Aphroteniinae 1.3%, Diamesinae 4.8%, Orthocladiinae 37.2%, giving uncertain values to the sub-families Chironominae, Tanypodinae and Prodiamesinae.

Our results are generally in good agreement with Brundin's and Ashe's works, except for Podonominae which show a lower percentage (25%) compared to the previous data (38%). Podonominae are cold-stenothermous species found in high altitude streams and ponds, in general located above the tree line, over 1000 m. These environments are sometimes difficult to sample and the lower number of species could be related to the lack of collection sites above 1000 m in our work. Regarding Chironominae, there are also differences compared with the previous works. In Brundin's study Chironominae, Tanypodinae and Aphroteniinae are grouped together amounting to 20% of the total chironomid fauna, whereas our data show 19% of species in Chironominae and 11% of species in Tanypodinae. Due to the fact that both sub-families are predominantly inhabitants of lentic environments, the highest percentages found in our data may be related to the

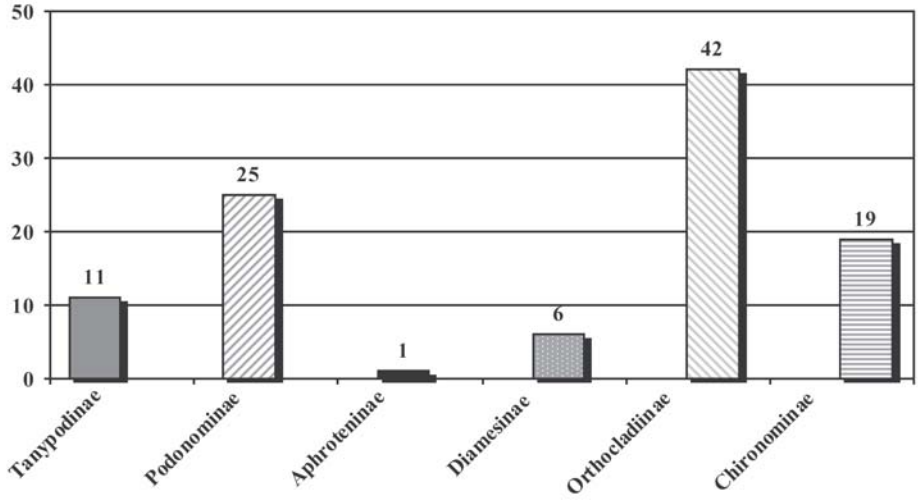

Fig. 2. Chironomid taxa, grouped by sub-families, collected in Nahuel Huapi National Park.

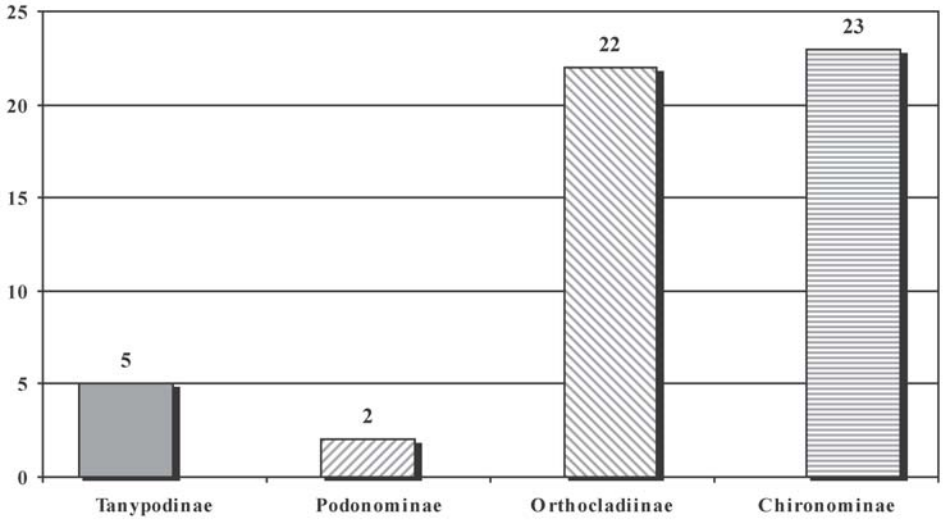

Fig. 3. Sub-fossil chironomid taxa, grouped by sub-families, collected from lake sediment samples from Nahuel Huapi National Park.

sampling effort, implying that more lakes than streams were chosen for sampling.

Massaferro & Brooks (2002) and Massaferro & Moreno (in press) identified sub-fossil larval chironomid head capsules from Patagonia in sediments dated from 15,000 years BP to the present. Most of the identifications were to genus level or as species morphotypes because chironomid larval head capsules preserved in lake sediments often do not preserve sufficient diagnostic characters for species-level identifications. Fossil material was compared to the modern fauna to reduce the uncertainty of identifying fossil material.

Although knowledge of the chironomid fauna from the Andean-Patagonian region has greatly improved, further work is needed to extend the knowledge of chironomid assemblage structure and distribution in Patagonia, especially dealing with taxonomic and ecological aspects of midges. Additional taxonomic work will improve the knowledge of the biodiversity of the southern South American entomological fauna and unravel identification issues dealing with the fossil

fauna. Studies of the ecological requirements of the chironomid fauna are also important to improve the understanding of chironomid species tolerance and optima which will enhance their application as tools for biomonitoring and restoration practices in aquatic environments.

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