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On the geographical distribution of the Neotropical and Andean species of *Schendylops* (Chilopoda: Geophilomorpha: Schendylidae)

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■ **ABSTRACT.** The geographical distribution of the 49 Neotropical and Andean species of *Schendylops* was analyzed. The majority of the species are Neotropical, being endemic to the Caribbean (six species), Amazonian (10 species), Parana (11 species), and Chacoan (seven species) subregions. Seven species are distributed in the Andean region: in the Paramo-Punan (six species) and Patagonian (one species) subregions. No generalized track was obtained, but connections between different subregions were found, being coincident with previous studies that recognised the Neotropical and Andean components within South America.

KEY WORDS. Chilopoda. *Schendylops*. Neotropical region. Andean region. Panbiogeography.

■ **RESUMEN. Distribución geográfica de las especies Neotropicales y Andinas de *Schendylops* (Chilopoda: Geophilomorpha: Schendylidae).** Se analizó la distribución geográfica de las 49 especies neotropicales y andinas de *Schendylops*. La mayoría de las especies son neotropicales, siendo endémicas de las subregiones Caribeña (seis especies), Amazónica (10 especies), Paranaense (11 especies) y Chaqueña (siete especies). Siete especies se distribuyen en la región Andina: en las subregiones Páramo-Puneña (seis especies) y Patagónica (una especie). No se obtuvo ningún trazo generalizado, aunque se encontraron conexiones entre diferentes subregiones, las cuales coinciden con estudios previos que reconocieron los componentes Neotropical y Andino en América del Sur.

PALABRAS CLAVE. Chilopoda. *Schendylops*. Región Neotropical. Región Andina. Panbiogeografía.

INTRODUCTIÓN

The amphiatlantic chilopod genus *Schendylops* Cook (Geophilomorpha: Schendylidae) is distributed in the Neotropical region, Africa, and Madagascar (Pereira *et al.*, 1997). It has been hypothesized that its age antedates the formation of the Atlantic ocean in the Mesozoic (Hoffman & Pereira, 1997). It comprises 61 known species, the majority of which (49) are ranged in the Neotropical and Andean regions. These species can be found in a great variety of habitats, from sea level up to about 4500 m in the Andes.

Our objective is to analyze the geographical distribution of the species of *Schendylops*, in order to determine distributional patterns.

MATERIAL AND METHODS

Data were taken from the literature (Meinert, 1870, 1886; Silvestri, 1895, 1897; Brölemann, 1902, 1904; Brölemann & Ribaut, 1911, 1912; Chamberlin, 1914, 1921, 1944, 1950, 1956,

Fig. 1. Geographical distribution of the species of *Schendylops* (references to numbers in the text).

1957; Attems, 1934; Verhoeff, 1938; Kraus, 1954, 1955, 1957; Turk, 1955; Crabill, 1960, 1972; Pereira & Coscarón, 1976; Pereira, 1981, 1983a-c, 1984, 1985, 1986, inéd.; Demange & Pereira, 1985; Pereira & Minelli, 1993, 1996; Pereira *et al.*, 1994, 1995, 1997). A complete list of the species analyzed, with their localities, is provided in the appendix.

Distributions of the species of *Schendylops* were mapped (Fig. 1) and superimposed to a biogeographic scheme of South America (Morrone, 1999); each number between square brackets in the text indicates the locality (or in some cases, a group of near localities) in the map. In addition, a track analysis was carried out, by connecting the separate localities of closely related species together with lines called individual tracks (see Morrone & Crisci, 1995).

RESULTS AND DISCUSSION

The majority of the species of *Schendylops* (36) are distributed in the Neotropical region (Fig. 1). Six species are endemic to three provinces of the Caribbean subregion: *S. andesicola* [6] and *S.*

dentifer [5] to the Cauca province; *S. colombianus* [4] to the Santa Marta province; and *S. minutus* [2], *S. paoletti* [3], and *S. virgingordae* [1] to the Coastal Venezuelan province. Ten species are endemic to two provinces of the Amazonian subregion: *S. amazonicus* [12], *S. bakeri* [12], *S. continuus* [12], *S. janauarius* [12], *S. marchantariae* [7, 12], and *S. oligopus* [8] to the Varzea province; and *S. labbanus* [8], *S. lesnei* [10], *S. tropicus* [9], and *S. verhoeffi* [11] to the Moist Guianan province. Eleven species are endemic to two provinces of the Parana subregion: *S. coscaroni* [18], *S. iguapensis* [17], *S. olivaceus* [15], *S. parahybae* [13], *S. perditus* [13], and *S. luederwaldi* [15] to the Atlantic province; and *S. demartini* [20], *S. demelloi* [17], *S. gounellei* [16], *S. longitarsis* [20], *S. paulistus* [19], and *S. sublaevis* [14] to the Forests province. Seven species are endemic to two provinces of the Chacoan subregion: *S. borelli* [22], *S. paraguayensis* [22], and *S. placii* [23] to the Chacoan province; and *S. anamariae* [25], *S. interfluvius* [25, 26], *S. madariagensis* [29], and *S. pampeanus* [27, 28, 30] to the Pampean province. *Schendylops elegantulus* [24, 28, 30] is distributed in both the Pampean and Chacoan provinces, whereas *S. mesopotamicus* [20, 25] is distributed both in the Forest province (Parana subregion) and Pampean province (Chacoan subregion).

Only seven South American species are distributed in the Andean region (Fig. 1): *S. edentatus* [31], *S. lomanus* [33], *S. pallidus* [34], *S. peruanus* [32], *S. potosius* [36], and S. *titicacaensis* [35] in the Paramo-Punan subregion; and *S. demangei* [37] in the Patagonian subregion.

The majority of the species analyzed are found in a single locality, however, it is possible to connect the localities of closely related species (Pereira, ined.) in order to delineate individual tracks, that may help elucidate former biotic connections between these areas. The individual tracks that correspond to the following species groups were found (Fig. 2): (1) *S. colombianus- S. continuus- S. labbanus* [4-8-12]; (2) *S. demelloi- S. parahybae- S. tropicus- S. coscaroni* [9-13-17-18]; (3) *S. verhoeffi- S. gounellei- S. borelli- S. madagariensis* [11-16-22-29]; (4) *S. dentifer- S. pallidus* [5-34]; and (5) *S. edentatus- S. potosius* [31-36]. Although no generalized track can be deduced from these individual tracks, they generally connect different Neotropical subregions between them, e.g., Caribbean-Amazonian (track 1), Amazonian-Parana (track 2), and Amazonian-Parana-Chacoan (track 3), or even Neotropical and Andean subregions between them, e.g., Caribbean-Paramo-Punan (track 4). These results basically coincide with some previous studies that recognised a Neotropical and Andean components within South America (Crisci *et al.*, 1991; Amorim & Tozoni, 1994; Morrone 1996a, b), with a pre-Cretaceous scenario for the origin of these patterns (Grehan, 1991).

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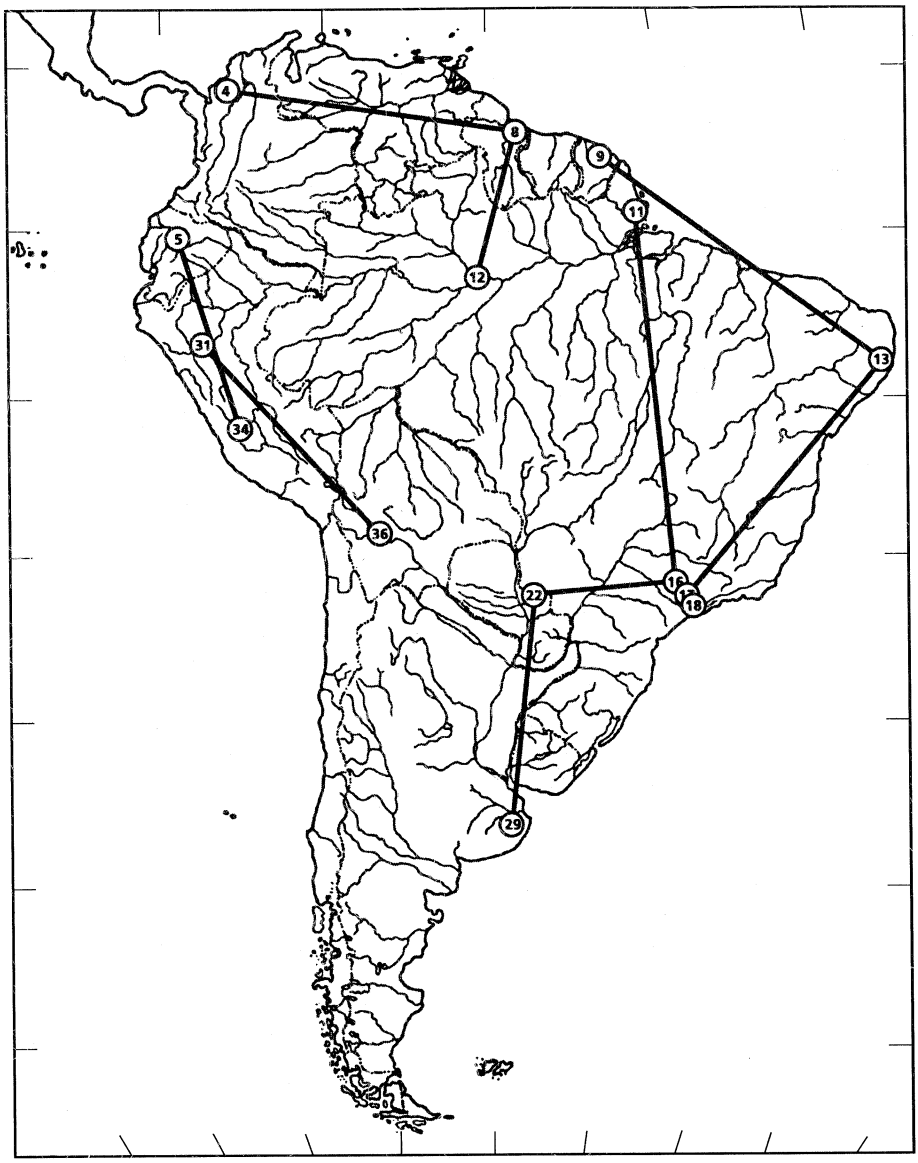

Fig. 2. Individual tracks corresponding to some species groups of *Schendylops* (references to numbers in the text).

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Appendix. Species analyzed, with the details of the localities where they were collected.

S. amazonicus (Pereira *et al.*, 1994). BRAZIL. Amazonas: lower course of Taruma Mirin river, about 20 Km upstream from Manaus.

S. anamariae (Pereira, 1981). ARGENTINA. Entre Ríos: Concordia.

S. andesicola (Chamberlin, 1957). ECUADOR. 30 miles S Alausi, Chimborazo, about 4000 m; Cotopaxi, 5 Km E Zumbahua, about 4000 m; Pichincha, 15 km E Pifo; Chimborazo, between Sibambe and Multitud.

S. bakeri (Chamberlin, 1914). BRAZIL. Amazonas: Manaus.

S. bolivianus (Silvestri, 1897). BOLIVIA. Caiza.

S. borellii (Silvestri, 1895). PARAGUAY. Río Apa.

S. brasilianus (Silvestri, 1897). BRAZIL. Without precise locality.

S. colombianus (Chamberlin, 1921). COLOMBIA. Fundación.

S. continuus (Pereira *et al.*, 1995). BRAZIL. Amazonas: reserve Fl. A. Ducke, near Manaus.

S. coscaroni (Pereira & Minelli, 1996). BRAZIL. São Paulo: Serra do Mar, Serra de Paranapiacaba, caminho do Mar, near monument "Pouso Paranapiacaba".

S. demangei (Pereira, 1981). ARGENTINA. Chubut: Puerto Lobos.

S. demartini (Pereira & Minelli, 1996). ARGENTINA. Misiones: Puerto Iguazú.

S. demelloi (Verhoeff, 1938). BRAZIL. São Paulo: Iguape.

S. dentifer (Chamberlin, 1957). ECUADOR. 30 miles N Latacunga, Cotopaxi, about 4000 m; Pichincha, northwestern slope of Cotopaxi; near Quito, Latacunga, Paramo, Rumiñahui volcano.

S. edentatus (Kraus, 1957). PERU. Near Chuquibamba, western slope of the Andes, about 3500 m.

S. elegantulus (Meinert, 1886). ARGENTINA. Chaco: Río de Oro; Buenos Aires: Florencio Varela, La Plata, Sierra de la Ventana.

S. fieldi (Chamberlin, 1944). ARGENTINA. Misiones: "Río Paranay", without more precise locality.

S. gounellei (Brölemann, 1902). BRAZIL. São Paulo: Alto da Serra, Fazenda Nova Nicaragua; Rio de Janeiro.

S. gracilis (Attems, 1934). SURINAME. Without more precise locality.

S. iguapensis (Verhoeff, 1938). BRAZIL. São Paulo: Iguape.

S. interfluvius (Pereira, 1984). ARGENTINA. Entre Ríos: Salto Grande, Gualeguaychú.

S. janauarius (Pereira *et al.*, 1995). BRAZIL. Amazonas: Lake Janauari, near Manaos.

S. labbanus (Chamberlin, 1921). BRITISH GUYANA. Dunoon.

S. lesnei (Brölemann & Ribaut, 1911). BRAZIL. Haut Carsevene.

S. lomanus (Chamberlin, 1957). PERU. 16 miles northwest Chancay, Loma Lachay.

S. longitarsis (Silvestri, 1895). PARAGUAY. "Paraguay Centrale", without precise locality. ARGENTINA. Misiones: Montecarlo, Apóstoles.

S. luederwaldi (Brölemann & Ribaut, 1911). BRAZIL. Rio de Janeiro: Campo Itatiaia.

S. madariagensis (Pereira, 1981). ARGENTINA. Buenos Aires: General Madariaga.

S. marchantariae (Pereira *et al.*, 1995). BRAZIL. Amazonas: Rio Solimoes, Ilha de Marchantaria; Ilha de Curari. PERU. Iquitos.

S. mesopotamicus (Pereira, 1981). ARGENTINA. Misiones: Puerto Iguazú, Parque Nacional Iguazú; Entre Ríos: Concordia.

S. minutus (Pereira & Minelli, 1993). VENEZUELA. Falcón: Parque Pittier, Rancho Grande.

S. oligopus (Pereira *et al.*, 1995). BRAZIL. Amazonas: Reserva Fl. A. Ducke, near Manaus.

S. olivaceus (Crabill, 1972). BRAZIL. Rio de Janeiro: Serra dos Orgaos, 1900-2100 m.

S. pallidus (Kraus, 1955). PERU. Near lake Torococha, La Viuda, altos Andes, 4200 m; near

La Viuda, altos Andes, 4500 m; Zárate, river San Bartolomé, tributary of river Limac, western sector of the Andes, 2800 m; lake Junin, 4400 m.

S. pampeanus (Pereira & Coscarón, 1976). ARGENTINA. Buenos Aires: Tandil, Cerro Cura Malal, La Plata, Berisso, Villa Elisa, Florencio Varela, Burzaco, Las Flores, Boulogne, Bella Vista, Moreno, Ing. Maschwitz.

S. paolettii (Pereira & Minelli, 1993). VENEZUELA. La Cristalina, near Bocono, 2500 m.

S. paraguayensis (Silvestri, 1895). PARAGUAY. Río Apa.

S. parahybae (Chamberlin, 1914). BRAZIL. Paraiba: Independencia.

S. paulistus (Brölemann, 1904). BRAZIL. São Paulo: Poço Grande.

S. perditus (Chamberlin, 1914). BRAZIL. Paraiba: Independencia.

S. peruanus (Turk, 1955). PERU. Huanuco, about 1900 m.

S. placii (Pereira & Minelli, 1996). ARGENTINA. Formosa: river Pilagá.

S. potosius (Chamberlin, 1955). BOLIVIA. Potosí.

S. sublaevis (Meinert, 1870). BRAZIL. Minas Geraes: Lagoa Santa.

S. titicacaensis (Kraus, 1954). PERU. Choquechacra: near Caracara; near lake Titicaca, *Quenoa* forests, 4050-4150 m.

S. tropicus (Brölemann & Ribaut, 1911). GUYANNE. Desembocadura del Makury.

S. varipictus (Chamberlin, 1950). GUADELOUPE. Basse-Terre: Matouba, Goyave. USA. Puerto Rico: Guilla de Guilarte.

S. verhoeffi (Brölemann & Ribaut, 1911). BRAZIL. Bas Carsevene.

S. virgingordae (Crabill, 1960). BRITISH VIRGIN ISLANDS. Virgin Gorda island. MARTINIQUE. Le Diamant. VENEZUELA. Falcón: Parque Nacional Morrocoy.

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