

Distribution of the species of Berosini (Coleoptera: Hydrophilidae) in South America

Distribución de las especies de Berosini (Coleoptera: Hydrophilidae) en América del Sur

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Abstract: The tribe Berosini (Coleoptera: Hydrophilidae) is represented in South America by the genera *Berosus* Leach, *Hemiosus* Sharp and *Derallus* Sharp. Distributional data from new material and from previous publications are given and a classification of the type of distribution is proposed. Few species are strictly Neotropical. Most species are associated with one or more of the main river systems (Paraguay-Paraná-Plata, Amazonas, Orinoco, São Francisco and Desaguadero-Colorado-Negro), with latitudinal influence in the Paraná-Plata. Species of *Berosus* and *Derallus* are mostly distributed along the rivers, those of *Hemiosus* are located on sandy or (rarely) gravelly substrates, with influence of the origin of sediments (Andean, Brasília shield, etc.).

Key words: Aquatic beetles. Neotropical fauna.

Resumen: La tribu Berosini (Coleoptera: Hydrophilidae) está representada en América del Sur por los géneros *Berosus* Leach, *Hemiosus* Sharp y *Derallus* Sharp. Se presentan datos de material nuevo y de publicaciones precedentes y se propone una clasificación de los tipos de distribuciones. Pocas especies son estrictamente neotropicales. La mayoría de ellas están asociadas con una o más de las grandes cuencas fluviales (Paraguay-Paraná-Plata, Amazonas, Orinoco, São Francisco y Desaguadero-Colorado-Negro), con influencia latitudinal en el Paraná-Plata. Las especies de *Berosus* y *Derallus* se distribuyen principalmente a lo largo de los ríos, las de *Hemiosus* se localizan sobre sustratos arenosos o (raramente) de grava, con influencia del origen de los sedimentos (andinos, macizo de Brasília, etc.).

Palabras clave: Coleópteros acuáticos. Fauna neotropical.

Introduction

The Berosini are a tribe of Hydrophilidae (Coleoptera) characterized by a long, narrow scutellum and by the presence of swimming hairs on meso- and metatibiae. Three genera are found in South America: the exclusively American (almost exclusively Neotropical) *Hemiosus* Sharp and *Derallus* Sharp and the worldwide *Berosus* Leach. The species of *Hemiosus* are usually found in water bodies with sandy or gravelly substrate (Oliva 1994). The species of *Derallus* collected from Argentina are found in pools and ponds. The species of *Berosus* appear in different types of habitats: vegetated, stable ambients, flood pools and, in the case of pioneer species, swimming pools and cattle troughs. Adult Berosini can leave the water and fly in search of new habitats (Oliva 2007; Oliva and Short 2012). This makes river valleys a natural dispersal path. The beetles are often found in marginal puddles or rock pools (Denton and Oliva 1999; Oliva and Short 2012). Adults do not appear affected by water characteristics, but the aquatic larvae may be more sensitive. Also, the egg-cases are attached to algae or rocks (Archalgelsky 2002), so substrates might be selected selection as egg-case support.

Precedent work and difficulties. It may be remarked that within one genus, some species show restricted distribution and others an extended one. This paper attempts to correlate available distributional data with the geography of South America. Preliminary approximations (Oliva *et al.* 2002;

Oliva 2007) suffered from lack of records for Colombia, Venezuela and the Guianas. More information was provided by Queney (2006), Oliva and Short (2012) and examination of collections. Oliva (2007) considered a Guiana coastal and a Brazilian coastal distribution. It is now evident that species with these distributions belong into the Orinoco and São Francisco basins respectively (see following section). Species assigned to a new distribution since Oliva (2007) are preceded by an asterisk (*).

River basins. South America is traversed by three large river basins, the Orinoco, the Amazonas and the Paraguay-Paraná-Plata, plus two smaller ones, the São Francisco (Fig. 1A: SF) and the Colorado-Negro. The mouths of all the rivers may be considered connected through coastal plains. The Amazonas and the Orinoco are connected through the Casiquiare. The Paraguay-Paraná-Plata system comprises the Paraguay, Pilcomayo and Bermejo with all their affluents, the Paraná with its affluents, including the Paranaíba in Brazil and the Salado and Carcarañá in Argentina, the Uruguay with its affluents and the Río de la Plata. The affluents of the Paranaíba connect the Paraná-Plata with the Amazonas and with the São Francisco. The latter is separated from the Amazonas by the highlands Chapada do Araripe, probably not a barrier to dispersal of aquatic beetles. The Colorado and the Negro run W to E along the northern limit of the Argentinian Patagonia and correspond to a corridor through the Andes chain (Fig. 1A). The river Desaguadero continues

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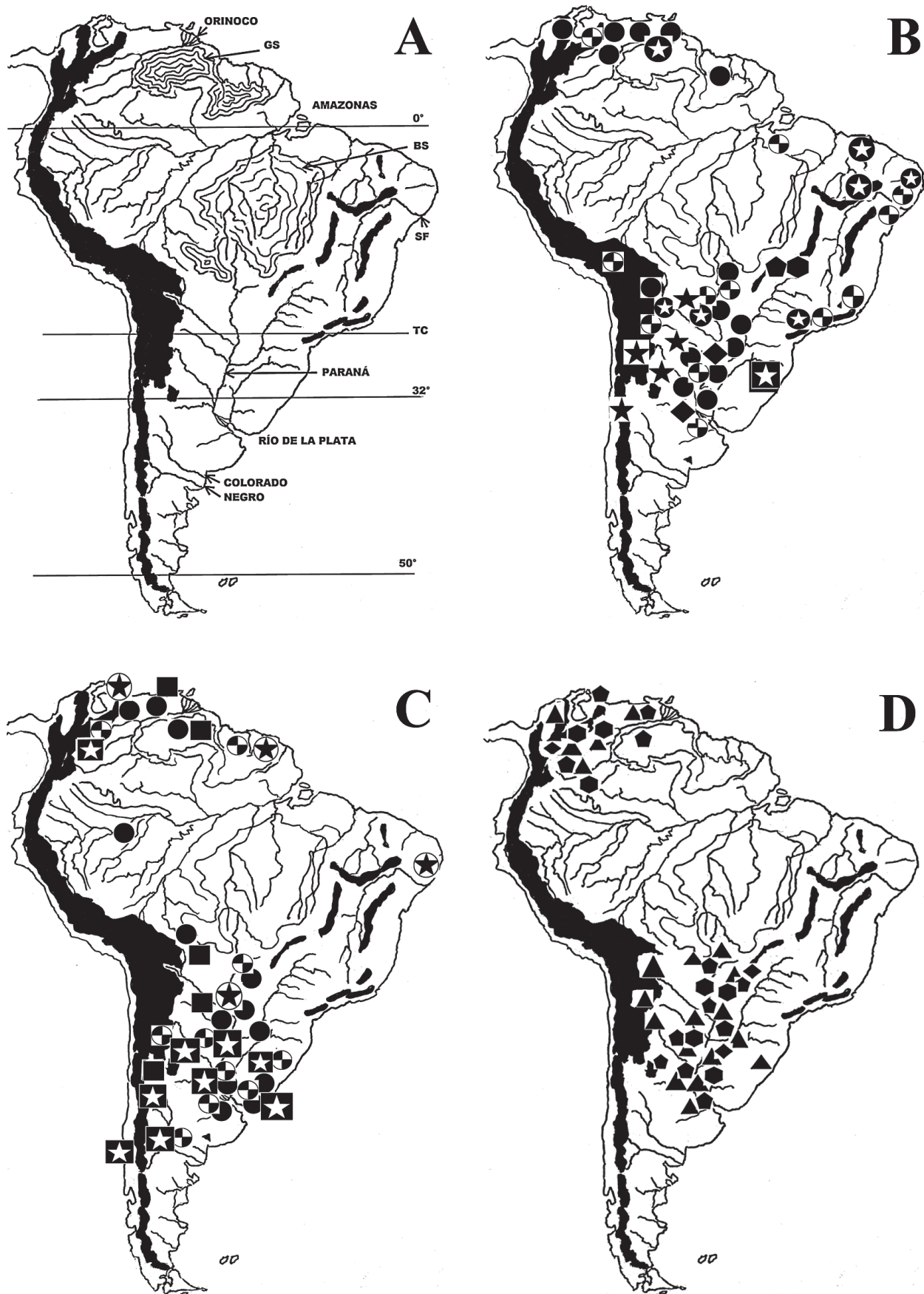


Figure 1. A. South America, main river basins. B. Neotropical (A1) and special (F) distributions. C. South American (A2). D. South American (A2), continued.

this system towards the NW. In brief, there is no real barrier between river systems and physical exclusion can hardly be invoked to explain distribution..

Geographic factors. Climatic. Of 50 species of *Berosini* recorded for Argentina, only two have been found S of the river Colorado; the remainder fall into two groups. One reaching the delta of the Paraná, the other never found S of parallel 32 S.

Orographic. Only the high mountains in the Andes (Fig. 1A: solid black) are a real barrier. However, the type of sediment depends on the location: sub-Andean valleys or Guyana and Brazil shields (Fig. 1A: GS, BS). Particle size depends on the distance from the source. Some species of *Berosini* are known to occur in water bodies with substrate of a determined particle size.

The present paper attempts to define and classify the types of distribution of the species of *Berosini*. The hypothesis has been that the species are distributed mainly by a combination of latitude and selection of substrate (including particle size), with species tolerant to these variables having very wide distributions which include two or more of the large river basins, as there are no real physical barriers between the latter.

Materials and methods

This paper is based on examination of collections and on the revision of precedent papers. A large lot of specimens was kindly loaned by the Naturhistorisches Museum Wien (NMW). Material from the Michigan State University (MSU) was examined during a visit to Kansas University in 2009.

All the material was dry-pinned. It was examined under a stereoscopic microscope. To dissect out male genitalia, the specimens were relaxed in boiling water. The genitalia were placed in microvials with glycerol, with the cork transfixed by the pin which supported the specimen.

Results

Types of distribution

A: Species found in the Orinoco, Amazonas and Paraná systems.

A1: Neotropical proper (extending to Central America). Fig. 1B.

Berosus truncatipennis Castelnau, 1840. Argentina: Corrientes, Chaco, Entre Ríos, Santa Fe; Bolivia: Santa Cruz; Brazil: Mato Grosso do Sul; Guyana; Paraguay: Alto Paraná, Cordillera, Itapúa; Venezuela: Anzoátegui, Apure, Aragua, Delta Amacuro, Falcón, Guárico, Sucre, Zulia. Black circle.

Derallus angustus Sharp, 1882. Argentina: B. Aires, Corrientes, Chaco, Salta, S. Fe; Bol.: Chaparé; Brazil: Alagoas, Amazonas, Ceará, Espírito Santo, M. G. do S, Pará, Pernambuco, R. Janeiro, R. G. do S; Paraguay: Concepción; Venezuela: Portuguesa. Type locality: Guatemala. Black and white quartered circle.

D. altus (LeConte, 1855). Argentina: Salta; Brazil: Ceará, Pernambuco, Piauí, R. Janeiro; Paraguay: Concepción; Venezuela: Orinoco. Type locality: US: Louisiana. Black star in white circle.

All frequent in temporary ambients. Short and Torres (2006) give *D. ambitus* Orchymont and *D. terraenovae* Oliva for

Panamá, but so far I have not handled material from Central America.

A2: South American. The southern limit of Punta Lara on the Río de la Plata, although *B. geayi* Orchymont, *B. holdhausi* Knisch, *B. pluripunctatus* Mouchamps and *B. zimmermanni* Knisch have not appeared S of 32°S. Figs. 1C, 1D.

**Berosus erraticus* Mouchamps, 1921. Argentina: B. Aires, E. Ríos, Formosa, Misiones; Bolivia: S. Cruz; Brazil: Amazonas; Paraguay: Central, S. Pedro; Uruguay: Lavalleya, Maldonado; Venezuela: Anzoátegui, Bolívar, Guárico. Stable, vegetated ambients. Black circle.

**B. festivus* Berg, 1885. Argentina: B. Aires, Chaco, E. Ríos, Río Negro, Tucumán, Salta. Brazil: Mato Grosso do S, Rio Grande do S; Guyana; Uruguay: Maldonado, Minas; Venezuela: Barinas. Black and white quartered circle.

**B. geayi* Orchymont, 1937. Brazil: Pernambuco; French Guiana; Paraguay: Central; Venezuela: Falcón. Black star in white circle.

**B. holdhausi* Knisch, 1921. Argentina: Formosa, La Rioja, Salta; Bolivia: S. Cruz, Tarija; Brazil: M. Grosso do S; Paraguay: Alto Paraguay, Boquerón, Presidente Hayes; Venezuela: Anzoátegui, Bolívar. Black square.

**B. pallipes* Brullé, 1841. Argentina: B. Aires, Catamarca, Chaco, Córdoba, Corrientes, E. Ríos, Jujuy, La Rioja, Mendoza, R. Negro, Salta, S. Fe, S. Estero; Brazil: M. Grosso do S, Rio Grande do S; Chile: Talca; Uruguay: Maldonado; Venezuela: Barinas. Pioneer species. White star in black square.

Fig. 1D.

B. patruelis Berg, 1885. Argentina: B. Aires, Chaco, Corrientes, E. Ríos, Formosa, Misiones, Salta, S. Fe, S. Estero; Bolivia: S. Cruz. Brazil: M. Grosso do S, R. Grande do S; Colombia: Meta; Paraguay: Alto Paraguay, Central, Concepción, Guairá, Misiones, S. Pedro; Venezuela: Anzoátegui, Apure, Aragua, Barinas, Cojedes, Falcón, Guárico, Trujillo, Zulia. Pioneer species. Black triangle.

**B. pluripunctatus* Mouchamps, 1963. Argentina: Corrientes; Brazil: M. Grosso do S; Venezuela: Barinas. Black diamond.

**B. reticulatus* Knisch, 1921. Argentina: B. Aires, Córdoba, Chaco, E. Ríos, Misiones, Salta, S. Fe, S. Estero; Brazil: M. G. do S; Paraguay: Alto Paraguay, Canindeyú, Central, Concepción, Guairá, Itapúa, Paraguari; Venezuela: Anzoátegui, Barinas, Bolívar, Falcón, Guárico. Black pentagon.

**B. zimmermanni* Knisch, 1921. Argentina: Chaco, Corrientes, E. Ríos, Formosa; Brazil: M. Grosso do S; Colombia: Meta; Paraguay: A. Paraguay, Boquerón, Central, Cordillera; Venezuela: Apure, Portuguesa, Táchira. Black hexagon.

B: Species associated with a single river system.

B1: Orinoco. Flatlands of Colombia (Arauca, Boyacá, Meta, Vichada), the Guianas, Venezuela (Apure, Amazonas, Anzoátegui, Delta Amacuro, Guárico, Monagas, Sucre). Fig. 2A.

Berosus apure Oliva 2002. Ven: Apure, Guárico. Black circle.

**B. aragua* Oliva and Short, 2012. Venezuela: Anzoátegui, Aragua, Guárico. Black and white quartered circle.

**B. asymmetricus* Oliva and Short, 2012. Venezuela: Amazonas, Bolívar. Black star in white circle.

**B. capanaparo* Oliva and Short, 2012. Venezuela: Apure. White star in black circle.

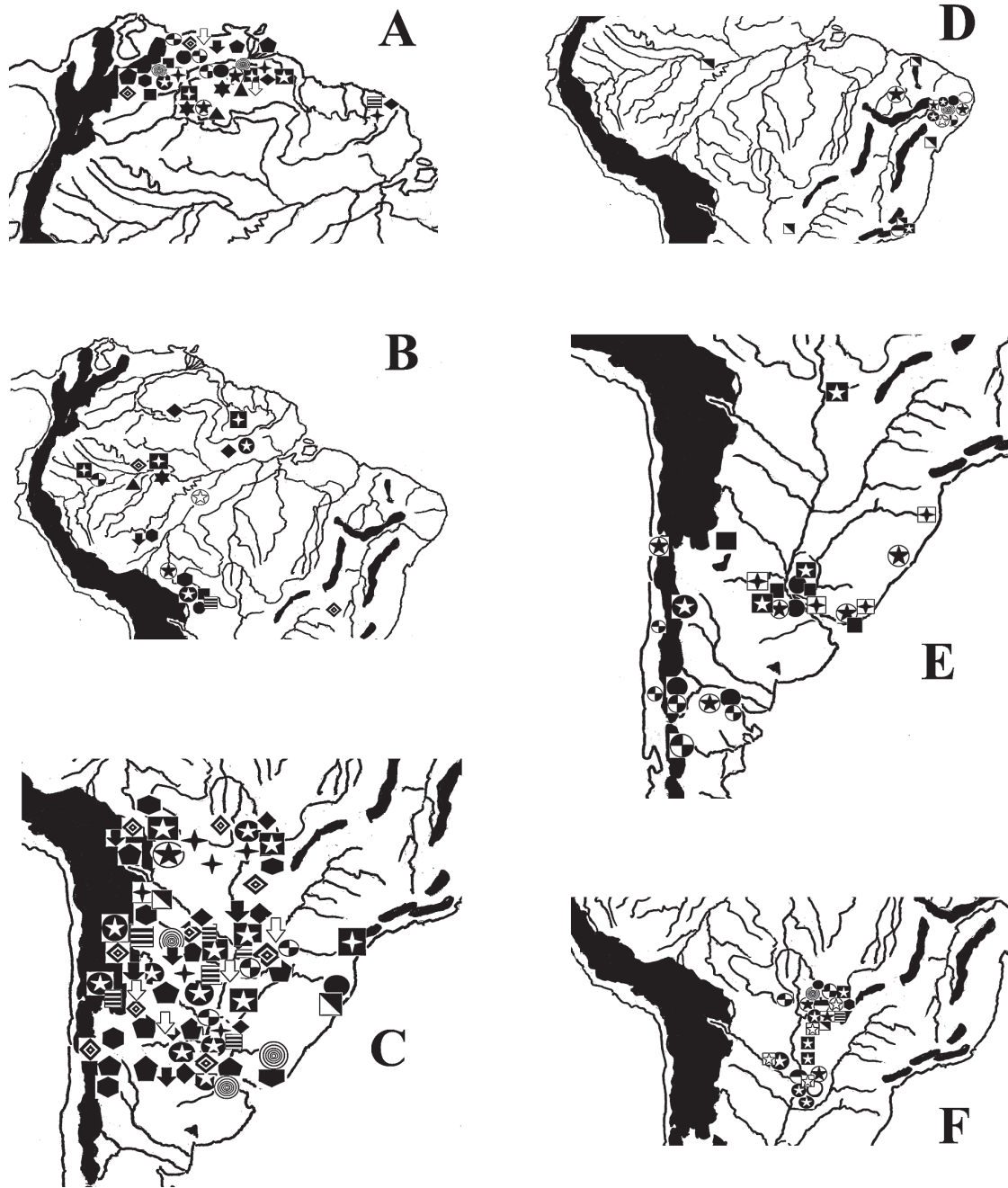


Figure 2. A. Orinoco (B1). B. Amazonas (B2). C. Paraguay-Paraná-Plata (B3). D. São Francisco (B4). E. Desaguadero-Colorado-Negro (B5) and Pampean (E) distributions. F. Pantanal (B6).

**B. castaneus* Oliva and Short, 2012. Venezuela: Bolívar. White star in black square.

**B. corozo* Oliva and Short, 2012. Venezuela: Apure, Guárico. Black square.

**B. duquefi* Queney, 2006. French Guiana. Striped square.

**B. ebeninus* Oliva and Short, 2012. Venezuela: Apure, Bolívar. Concentric circles.

**B. garciai* Oliva and Short, 2012. Venezuela: Amazonas, Bolívar: White four-pointed star in black square.

**B. guyanensis* Queney, 2006. French Guiana; Venezuela: Bolívar. Black four-pointed star.

**B. humeralis* Oliva and Short, 2012. Venezuela: Amaz., Bolívar (Guiana shield). Black six-pointed star.

**B. jolyi* Oliva and Short, 2012. Venezuela: Anzoátegui. Black arrow.

**B. llanensis* Oliva and Short, 2012. Venezuela: Apure. Black hexagon.

**B. megaphallus* Oliva and Short, 2012. Venezuela: Apure, Barinas, D. Amacuro, Monagas. Black pentagon.

**B. olivae* Queney, 2006. French Guiana; Venezuela: Bolívar; marsh. Black diamond.

**B. ornaticollis* Oliva and Short, 2012. Venezuela: Amaz., Bolívar (Guiana Shield). Black triangle.

**B. repertus* Oliva and Short, 2012. Venezuela: Apure, Barinas, Guárico. Black and white diamond.

**B. tramidrum* Oliva and Short, 2012. Venezuela: Bolívar, Guárico. White arrow.

B2: Amazonas. Bolivia (Beni, Chapare, Roboré, Santa Cruz), Brazil (Acre, Amazonia, Pará, Rondonia, Tohantins), Colombia (Amazonas, Caquetá, Guaviare, Vaupés); Paraguay (Boquerón), Perú (Madre de Dios); Venezuela (Amazonas, Bolívar). Fig. 2B.

Berosus arcanus Knisch, 1924. Bolivia: Santa Cruz: Black circle.

B. batesi Oliva 1992. Brazil: Amazonas. Circle quartered black and white.

**B. dentifer* Mouchamps, 1963. Bolivia: Cochabamba; Perú: Madre de Dios. Black hexagon.

B. forsteri Mouchamps 1963. Bolivia: Beni. Black star in white circle.

B. freyi Mouchamps, 1960. Bolivia: S. Cruz: Brazil: Pará. White star in black circle.

**B. gynopalpis* Mouchamps, 1963. Bolivia: S. Cruz. Black square.

B. hamatus Knisch, 1924. Brazil: Amazonas, Pará; Perú: Loreto. White four-pointed star in black square.

**B. inflatipes* Oliva, 1992. Bolivia: S. Cruz. Striped square.

B. inpa Oliva, 1992. Brazil: Amazonas. Black six-pointed star.

**Hemiosus costalis* Oliva, 1994. Brazil: Amazonas. White star in white circle.

**H. tarsalis* Oliva and Short, 2010. Perú: M. de Dios. Black arrow.

Derallus brachyphallus Oliva, 1983. Brazil: Amazonas, Minas Gerais. Black and white diamond.

D. pectoralis Oliva, 1983. Brazil: Pará; Venezuela: Amazonas. Black diamond.

D. perpunctatus Oliva 1983. Brazil: Amazonas. Black triangle.

B3: Paraguay-Paraná-Plata. Paraguay (excepting Boquerón), most of the Chaco-Pampean plain in Argentina (Buenos Aires, Chaco, Corrientes, Entre Ríos, Formosa, Misiones, Santiago del Estero, Santa Fe; marginally Catamarca, Córdoba, Jujuy, La Rioja, Mendoza, Salta, San Luis, San Juan, Tucumán) and practically all Uruguay. It spreads into Bolivia (Chuquisaca, Tarija) and Brazil (Mato Grosso do Sul, Paraná, Rio Grande do Sul, Santa Catharina). Fig. 2C.

**B. asphaltinus* Knisch, 1922. Bolivia: S. Cruz; Brazil: S. Catharina. Diagonal black and white square.

**Berosus auspicalis* Orchymont, 1940. Brazil: S. Catharina. Black circle.

**B. borellii* Knisch, 1925. Bolivia: Chaco. Black star in white circle.

**B. coelacanthus* Oliva, 1989. Argentina: B. Aires, Catamarca, Chaco, E. Ríos Jujuy, Salta, S. Fe, S. Estero; Brazil: M. Grosso do S: White star in black circle.

B. masculinus Knisch, 1921. Argentina: Corrientes, Formosa; Bolivia: S. Cruz; Brazil: M. Grosso do S; Paraguay: Concepción. White star in black square.

**B. megillus* Orchymont, 1940. Brazil: S. Paulo. White four-point star in black square.

B. nervulus Mouchamps, 1963. Arg: Chaco, E. Ríos, Salta; Bolivia: S. Cruz; Brazil: M. G. do S; Paraguay: A. Paraguay. Black four-point star in white square.

**B. paraguayanus* Knisch, 1924. Catamarca, Chaco, E. Ríos, Formosa, Salta, S. Estero; Paraguay: Central. Striped square.

**B. pedregalensis* Jensen-Haarup, 1910. Argentina: B. Aires, Catamarca, Chaco, Córdoba, Corrientes, E. Ríos, Formosa, Mendoza, Misiones, S. Luis, S. Fe; Bolivia: Tarija. Pioneer species. Black pentagon.

**B. rufulus* Knisch, 1924. Argentina: B. Aires, Córdoba, Chaco, Formosa, Mendoza, Misiones, Salta, S. Fe, S. Estero; Bolivia: S. Cruz; Paraguay: Alto Paraguay, Central, Concepción, Cordillera, Guairá, S. Pedro. Black and white diamond.

**B. speciosus* Knisch, 1921. Argentina: B. Aires, E. Ríos, Formosa, S. Fe; Brazil: M. Grosso do S; Paraguay: Central, Cordillera, Guairá, Misiones. Black diamond.

**B. stenocoptus* Jensen-Haarup 1910. Arg: B. Aires, Chaco, Córdoba, E. Ríos, Formosa, La Rioja, Salta, S. Fe, S. Estero; Bolivia: Tarija; Paraguay: Alto Paraguay, Central, Concepción, Presidente Hayes, S. Pedro. Pioneer species. White arrow.

**B. unguidentatus* Oliva, 1989. Argentina: S. Fe; Paraguay: Itapúa, Misiones. Black and white quartered square.

**B. ussingi* Jensen-Haarup, 1910. Argentina: B. Aires, Catamarca, Córdoba, E. Ríos, Jujuy, Mendoza, Misiones, Salta; Bolivia: Beni; Paraguay: Canindeyú, Central, Guairá, Itapúa, Misiones, Paraguari; Uruguay: Lavalleja. Black hexagon.

**Derallus argentinensis* Bruch, 1915. B. Aires, Chaco; Uruguay: Maldonado. Concentric circles.

**D. paranensis* Oliva, 1981. Argentina: B. Aires, Chaco, E. Ríos, Formosa, Salta, Tucumán; Bolivia: S. Cruz; Paraguay: Caaguazú, Concepción, Itapúa. Black arrow.

B4: San Francisco. Brazil (Alagoas, Pernambuco; probably Bahia, Ceará, Maranhao, Paraíba, Piauí, Rio Grande do Norte, Sergipe). Coastal plain and mountain chain included. Fig. 2D.

B. firmius Orchymont, 1940. Brazil: Pernambuco. White circle.

B. margaritinus Oliva, 1999. Brazil: R. Janeiro. Black and white circle.

B. navatus Orchymont 1949. Brazil: Pernambuco; Piauí. Black star in white circle.

B. spectatus Orchymont 1940. Brazil: Pernambuco: rio S. Francisco. Black-and-white quartered circle.

Hemiosus morlestus Orchymont, 1940. Brazil: Pernambuco (Psammophilic?). Concentric circles.

H. mornarius Orchymont, 1940. Brazil: Pernambuco. Black circle.

H. mornax Orchymont, 1940. Brazil: Alagoas (Psamm.?). White star on white circle.

H. mulvianus Orchymont, 1940. Brazil: Alagoas, Pernambuco (Psamm.?). White star in black circle.

H. varidius Orchymont, 1940. Brazil: Pernambuco (Psamm.?). Black star in white square.

H. variegatus (Boheman, 1858): Brazil (no locality). White star in black square.

Amazonian species extending to the S. Francisco area: *Derallus anicatus* Orchymont, 1940. Brazil: Amazonas,

Bahia, Ceará, M. Grosso do Sul, R. Janeiro: Diagonal black and white square.

B5: Desaguadero-Colorado-Negro, Argentina (La Pampa, Mendoza, Neuquén, Río Negro, San Juan). Some species extend further eastwards and westwards. Fig. 2E.

B. alternans Brullé, 1841. B. Aires, E. Ríos, Neuquén, R. Negro. Black circle.

B. bruchianus Knisch, 1924. Argentina: B. Aires, R. Negro; Brazil: R. Grande do S; Chile: Valparaíso; Uruguay: Canelones, Maldonado. Black star in white circle.

B. dehiscens Jensen-Haarup, 1910. Mendoza. White star in black circle.

**Hemiosus dejeani* (Solier, 1849) (Argentina: Neuquén, R. Negro; Chile: Araucania, Concepción, Illapel, Quillota, Santiago). Black and white quartered circle.

**B. obscurifrons* Knisch, 1921 (Argentina: B. Aires, E. Ríos, S. Fe; Brazil: S. Catharina; Uruguay: Canelones, Maldonado). Black four-point star in white square.

B6: Pantanal. Species recorded only from the lowlands of the Paraguay, most of them described from Corumbá, in what is now Mato Grosso do Sul, Brazil. Some species assigned here by Oliva (2007) were found as far N as Venezuela. Fig. 2F.

Berosus cognitor Mouchamps, 1963. Paraguay: Guairá. White circle.

B. egregius Knisch, 1921. Brazil: M. Grosso do S; Paraguay: Caaguazú. Black star in white circle.

B. fratellus Knisch, 1921. Brazil: M. Grosso do S; Paraguay: Central. Black and white halved circle.

B. hispidulus Oliva, 1992. M. Grosso do S. Concentric circles.

B. insignis Knisch, 1921. Brazil: M. Grosso do S; Paraguay: Alto Paraguay. Black and white quartered circle.

B. nigrinus Knisch, 1921. M. Grosso do S: White star in white circle.

B. nitidissimus Oliva, 1989. M. Grosso do S. Black circle.

B. palposus Knisch, 1921. Brazil: M. Grosso do S; Paraguay: Guairá, Misiones, Paraguari, P. Hayes. White star in black circle.

B. rectangulus Mouchamps, 1960. Brazil: M. Grosso do S: Black star on white square.

**B. singularis* Knisch, 1921. Brazil: M. Grosso do S: Black-and-white diagonal square.

B. sticticus Boheman 1859. Brazil: M. Grosso do S; Paraguay: Canindeyú, Paraguari: White star in white square.

B. subtilis Knisch, 1921 (Brazil: M. Grosso do S; Paraguay: Central, Concepción, S. Pedro): White star in black square.

B. uniformis Knisch, 1921 Brazil: M. Grosso do S: Striped square.

B. vilipendus Mouchamps 1963 Brazil: M. Grosso do S. Black hexagon.

C: Species associated with two of the large systems.

C1: Orinoco-Amazonas. Fig. 3A.

**B. ambogynus* Mouchamps, 1963. Bolivia: Tarija; Brazil: Amazonas, Pará; Venezuela: Amazonas, Apure, Bolívar, Guárico. White circle.

**B. brevibasis* Oliva, 1989. Brazil: M. Grosso do S; Venezuela: Apure, Bolívar, Guárico: Black star in white circle.

**B. consobrinus* Knisch, 1921. Brazil: M. G. do S; Colombia (N). Paraguay: Boquerón; Venezuela: Bolívar. Black and white quartered circle.

**B. elegans* Knisch, 1921. (Brazil: M. Grosso do S; Venezuela: Bolívar, Guárico): Concentric circles.

**B. ghanicus* Orchymont, 1941. Brazil: Espirito Santo; Colombia: Meta; Guyana; Venezuela: Bolívar. White star in white circle.

**B. ruffinus* Orchymont, 1946. Bolivia: Beni; Venezuela: Bolívar. Black diamond.

**B. marquardtii* Knisch, 1921. Brazil: M. Grosso do S; Venezuela: Apure: Black and white halved circle.

**B. wintersteineri* Knisch, 1921. Brazil: M. Grosso do S; Venezuela: Guárico. White star in black circle.

**D. subglobosus* Oliva, 1983. Brazil: Amazonas; Venezuela: Apure. Striped square.

**Derallus terraenovae* Oliva, 1983. Brazil: Amazonas, M. Grosso do S, M. Gerais; Venezuela: Guárico. Black square.

C2: Amazonas-Paraná. Fig. 3B.

**B. corumbanus* Knisch, 1921. Argentina: Corrientes; Bolivia: Beni; Brazil: Mato Grosso do Sul; Paraguay: San Pedro. Black circle.

**B. decolor* Knisch, 1924. Argentina: B. Aires, Chaco, Córdoba, Corrientes, E. Ríos, Formosa, Jujuy, Misiones, Salta, S. Luis, S. Fe, S. Estero; Bolivia: S. Cruz, Tarija; Brazil: Amazonas, M. Grosso do S; Paraguay: Alto Paraguay, Boquerón, Concepción, Itapúa. Pioneer species. White star on black circle.

**B. minimus* Knisch, 1921. Argentina: B. Aires, Catamarca, Chaco, Corrientes, E. Ríos, Formosa, Misiones, S. Estero, Salta, Tucumán; Brazil: Amaz., M. Grosso do S; Paraguay: Central, Cordillera, Guairá, Itapúa, Misiones. Pioneer species. Black and white quartered circle.

**B. sinigus* Oliva, 1989. Argentina: B. Aires, Córdoba, Chaco; Brazil: Pará. Concentric circles.

**Derallus ambitus* Orchymont, 1940. Argentina: Corrientes, E. Ríos, Formosa; Brazil: Ceará, Pernambuco, R. Janeiro; Ecuador: Napo; Uruguay: Pando; Venezuela: Zulia. Black star in white circle.

**D. argutus* Orchymont, 1940. Argentina: Chaco; Bolivia: S. Cruz; Brazil: Pernambuco, M. Grosso do S; Paraguay: Presidente Hayes; Venezuela: Amazonas. Four-pointed black star in white square.

**D. intermedius* Oliva, 1995. Bolivia: S. Cruz; Brazil: M. Gerais; Guyana; Venezuela: Amazonas. White four-pointed star in black square.

Paraná-San Francisco: *B. latipalpus* Spangler, 1967. Brazil: M. Grosso do S, Piauí. L in white circle.

D: Species associated with special substrates.

D1: Extended sub-Andean. Fig. 3C.

Berosus auriceps Boheman, 1859. Argentina: Córdoba; Uruguay: S. Carlos; Brazil: S. Paulo, Minas Gerais; Paraguay: Amambay, Central, Cordillera, Guairá, Paraguari. Black circle.

B. chalconcephalus Germain, 1865. Argentina: B. Aires, Chubut, E. Ríos, Neuquén, R. Negro, Salta, S. Cruz; Bolivia: Oruro; Chile: Ñuble; Valparaíso; Uruguay: Canelones. White star in black circle.

Hemiosus bruchi Knisch, 1924. Argentina: Catamarca, Córdoba, Chaco, Salta; Paraguay: S. Pedro. Often on gravel substrate. Black star in white circle.

H. multimaculatus Jensen-Haarup, 1910. Argentina: Catamarca, Córdoba, Jujuy, La Rioja, Mendoza, Salta, S. Luis, Tucumán; Bolivia: Tarija; Chile: Tarapacá. Black-and-white quartered circle.

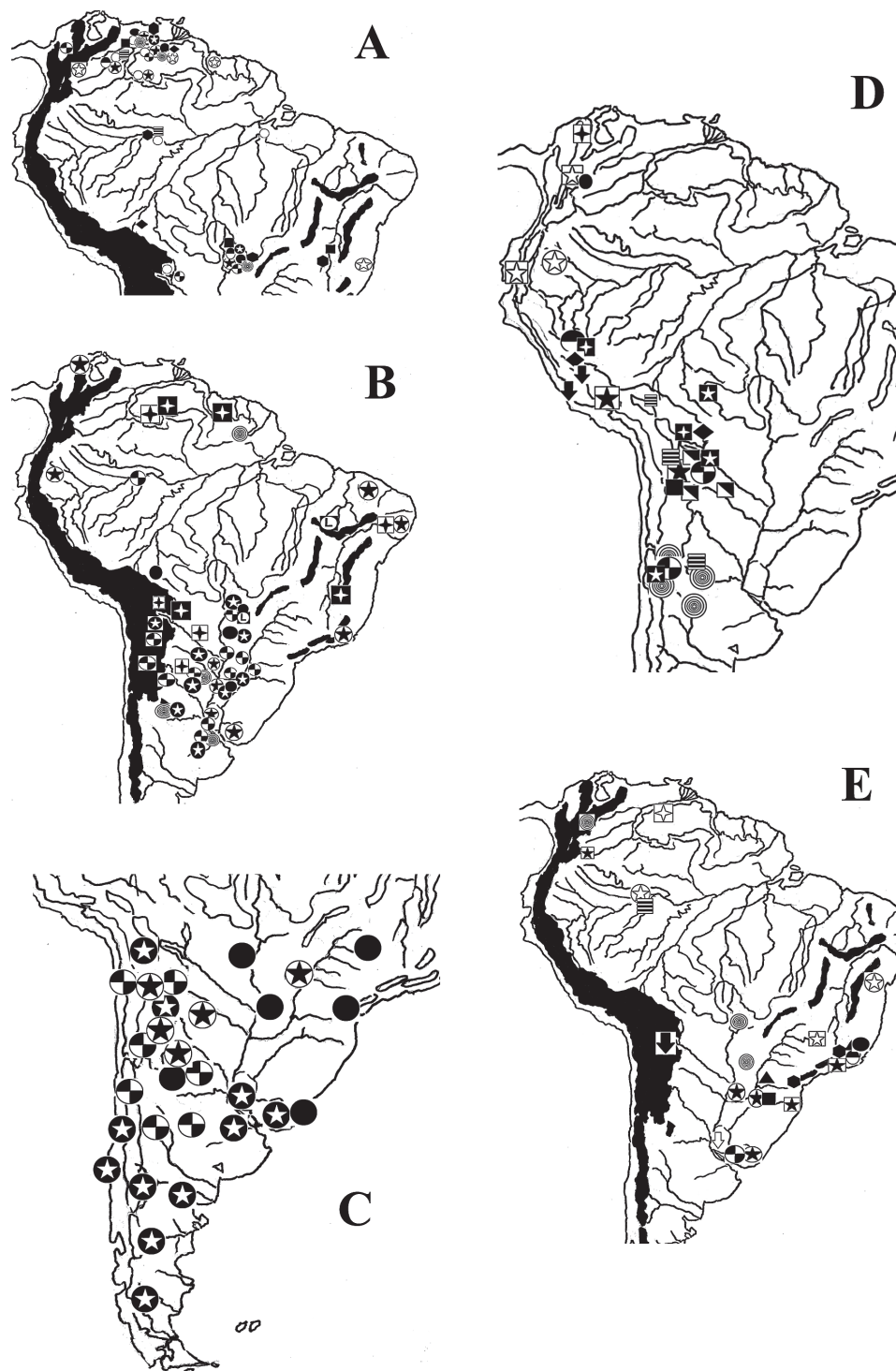


Figure 3. A. Orinoco-Amazonas (C1). B. Amazonas-Paraná (C2). C. Extended sub-Andean (D1). D. Restricted sub-Andean (D2). E. Psammophilic (D3).

D2: Restricted sub-Andean. Fig. 3D.

Berosus aulus Orchymont, 1941. Argentina: Córdoba, La Rioja, S. Juan, S. Luis. Concentric circles.

**B. domitus* Spangler, 1966. Perú: Huánuco. Black and white halved circle.

B. cornicinus Knisch, 1921. Argentina: Córdoba, Salta; Brazil ?. Striped square.

B. festai Knisch, 1925. Ecuador: Oriente. White star in white circle.

**B. ghanicoides* Orchymont, 1941. Argentina: Salta; Perú: Ayacucho. Black star on white square.

**B. multicarinatus* Oliva, 1989. Formosa, Salta, Tucumán. Black and white diagonal square.

**B. subandinus* Oliva, 1989. Argentina: La Rioja, Salta. Black and white quartered circle.

B. tartagalensis Oliva, 1995. Argentina: Salta. Black square.

B. toxacanthus Oliva, 1989. Argentina: La Rioja, Salta; Paraguay: Alto Paraguay. White star in black square.

**Hemiosus aequatorialis* Oliva, 1994. Perú: Tumbes; Venezuela: Táchira. White star in white square.
 **H. bacchusi* Oliva, 1994. Venezuela: Táchira. Black circle.
 **H. funditus* Spangler, 1966. Bolivia: Tarija; Perú: Huánuco. White four-pointed star in black square.
 **H. hapalus* Spangler, 1966. Bolivia: Tarija; Perú: Huánuco. Black diamond in white square.
H. hartmanni Mouchamps, 1957. Perú: Arequipa, Cuzco. Black arrow.
 **H. maculatus* Sharp, 1882. Venezuela: Zulía. Black four-pointed star in white square.
 **H. schindleri* Mouchamps, 1963. Bolivia: Cochabamba. Striped square.

D3: Psammophilic. Associated with fine sand. Most *Hemiosus* have this type of distribution. A similar selection might occur in some *Berosus*, but this has not been verified. Fig. 3E.
Hemiosus apicalis Oliva, 1994. Argentina: Misiones; Paraguay: Misiones; Uruguay: Lavalleja. Black star in white circle.
H. ater Clarkson and Ferreira, 2009. Brazil: R. Janeiro. Black and white halved circle.
 **H. cognatus* (Knisch, 1921). Brazil: M. G. do S; Paraguay: S. Pedro; Venezuela: Táchira. Concentric circles.
H. dimorphus Orchymont, 1940. Brazil: R. Janeiro. Black circle.
H. fitkauai Oliva, 1984. Brazil: Amazonas, Bahia. White star in white circle.
H. grades Clarkson and Ferreira, 2009. Brazil: R. Janeiro. Black star in white square.
H. interimus Mouchamps, 1963. Bolivia: S. Cruz. Black arrow.
H. irinus Oliva, 1994. Argentina: Misiones. Black square.
H. laevicollis Oliva, 1994. Venezuela: Bolívar. White four-pointed star in white square.
H. monstrosus Oliva, 1994. Brazil: Amazonas. Striped square.
H. moreirai Orchymont, 1921. Brazil: R. Janeiro, Sao Paulo. Black hexagon.
H. punctipennis Oliva, 1994. Uruguay: Artigas. Black and white quartered circle.
H. regalis Knisch, 1922. Brazil: S. Catharina; Colombia: Meta. Black star in white square.
H. santosi Clarkson and Ferreira, 2009. Brazil: M. Gerais. White star in white square.
H. sculptipennis Oliva, 1994. Argentina: E. Ríos. White arrow.
H. tenembaumi Orchymont, 1937. Brazil: Paraná. Black triangle.

E: Pampean species: Pampean plain (Argentina: Buenos Aires; Brazil: Mato Grosso do Sul, Santa Catharina; Uruguay: coastal departments). They may extend to the Argentinian provinces of Entre Ríos (along the Paraná) and Santa Fe and even Córdoba (probably along the Carcarañá). Fig. 2E.
B. adustus Knisch, 1922. Argentina: B. Aires, Córdoba, E. Ríos; Uruguay: Maldonado. Black square.
 **B. ethmonotus* Oliva, 1989. Argentina: B. Aires, E. Ríos; Brazil: M. G. do S): White star in black square.
 **B. obscurifrons* Knisch, 1921. Argentina: B. Aires, E. Ríos, S. Fe; Brazil: S. Catharina; Uruguay: Canelones, Maldonado). Black four-point star in white square.

F: Special distributions. Fig. 1B.

**B. avernus* Oliva, 1992. Brazil: S. Catharina; thermal springs. White star in black square.

B. coptogonus Jensen-Haarup, 1910. Argentina: Córdoba, Chaco, La Rioja, Mendoza, Salta, S. Estero; Paraguay: Presidente Hayes. Psammophilic? Black star in white square.
 **B. degallieri* Queney, 2010. Brazil: DF; high-altitude cerrado. Black hexagon.
 **B. phallicus* Oliva, 1989. Argentina: B. Aires, Chaco, S. Fe; Paraguay: Misiones. Psammop.? Black diamond.
 **B. spiniger* Queney, 2010. Brazil: DF; high-altitude cerrado. Black pentagon.

New localities

1- Michigan State University

Berosus asphaltinus Knisch 1922: "Bolivia/Santa Cruz district/nr. Buena Vista, Hotel Flora y Fauna, 22-26-Oct-2002/Morris and Wauper colls". Type locality: Brazil: Nova Teutonia.

Berosus dentifer Mouchamps, 1963: "PERU: Madre de Dios. Tambopata/Res. Zone: Tambopata Res. Centr./on Rio Tambopata: 622' elev./C. R. Bartlett: (3-7).X.2004/13°08.305'S; 69°502'W." A single male. Type locality: Bolivia: Chaparé: Rio Chipiriri.

Berosus hamatus Knisch, 1924: "Perú/Loreto, Pucallpa/Yarinacocha/29 July 1962/ W.T. Van Velzen" "Michigan State Univ./A.J. Cook Arthrop/Research Collection". A single male (dissected genitalia in glass vial), six females. Type locality: Brazil: Pará. Also recorded from Brazil: Amaz.: Lake Catuá; Villa Nova; Paraná da Terra Nova; Igarapé Catuá; São Paulo de Olivença: r. Solimões (Oliva, 1989). A species with remarkable sexual dimorphism, including entire (not bispinuous) elytral apices in males.

Berosus nervulus Mouchamps, 1963: "Bolivia/Santa Cruz district/nr. Buena Vista. Hotel Flora y Fauna, 22-26-Oct-2002/Morris and Wauper colls".

2- Berosini of the Vienna Museum (Naturhistorisches Museum Wien)

Berosus consobrinus Knisch, 1921: N Colombia.

B. geayi Orchymont, 1937: Paraguay: Agropil (*sic*).

B. ghanicus Orchymont, 1941: Colombia: Meta: Vista Hermosa.

B. latipalpus Spangler, 1967. Brazil: Piauí: Parnagua.

B. navatus Orchymont, 1949. Brazil: Piauí: Parnagua.

B. paraguayanus Knisch, 1924. Argentina: Catamarca: Punta Balasto.

B. patruelis Berg, 1887. Colombia: Meta. N Colombia without loc.

B. truncatipennis Castelnau 1840. Brazil: Piauí: Parnagua. Kolombien – Villa Hermosa – Meta – 6/3/1997

B. zimmermanni Knisch, 1921. Colombia: Meta: Vista Hermosa.

Hemiosus regalis Knisch. Colombia: Meta

Discussion

Species marked with an asterisk are additions or changes since Oliva (2007). There are three reasons for these changes: species newly described since 2007, new geographical records since 2007 or new definition of the types of distribution.

Most distributions can be associated with one or more of the main river basins; there is no evidence of a special fauna of the Guiana coastal plain or of correlation with former distribution of the Brazilian Mata Atlantica (Oliva 2007). As expected, species of *Derallus* and *Berosus* appear

along the rivers, often in marginal pools and flood marshes, while most species of *Hemiosus* are restricted to small areas of fine sand; a few species associated with gravel have wider distributions. Only three species, tolerant of new or altered habitats, have a Neotropical distribution. Latitude influence shows in species from the Paraná-Plata or from all three larger systems; some reach the delta of the Paraná, others are not recorded S of parallel 32° S. The Amazonas and the São Francisco are different only for species of *Hemiosus*, which cluster around Pernambuco with a few species on the upper Amazonas (Figs. 2B, 2D, 3E). Coastal Brazilian distribution in Oliva (2007) corresponds to the São Francisco basin. The affluents of the Negro, Neuquén and Limay traverse the Andes providing a corridor for such species as *H. dejeani*. The Colorado and Desaguadero with their affluents extend NW. The Desaguadero is now dammed to avoid salinization of the Colorado, but originally it was permanent, and the system penetrated, through the Atuel-Chadileufú and the Salado, in the present province of Mendoza (Criado Roque and Ibáñez 1979). The remarkably restricted distribution of *B. dehiscens* Jensen-Haarup (recorded only from Mendoza) might be a relictual distribution along the upper reaches of Desaguadero, now dry.

Species with extended sub-Andean distribution may extend into plains. (Fig. 3C). The extreme case is *B. chalconcephalus* Germain, which in Argentina reaches Santa Cruz to the S (Souza 2004) and Entre Ríos to the E, extending W into Chile and N to Oruro in Bolivia. This species should not be placed in the Pampean distribution (Oliva 2007). On the other hand, *H. bruchi* and *H. multimaculatus* tolerate gravel substrates instead of the sandy ones preferred by other species of *Hemiosus*. The latter genus accounts for most of the Restricted sub-Andean distribution. In Venezuela one might contrast *Hemiosus laevicollis* (Bolívar: Guyana shield sediment) and *H. bacchusi* (Táchira: Andean sediment). Psammophilic species are associated with fine sand; this is the case of the *Hemiosus* of eastern Argentina. The only species found in Entre Ríos was *H. sculptipennis*, from several localities between the quartz 100% and 50% isopleths (Etchichury and Tofalo, 2004). Another species, *H. apicalis*, was described from Misiones province and from the department of Lavalleja (Uruguay), both localities with quartz sand. The species was not found in NW Uruguay, where one might expect it; instead, *H. punctipennis* was described from this locality alone, and may be associated with a special type of sediment: there is a basaltic flow over the area. This pattern explains the presence of many species of *Hemiosus* with small distributions.

Acknowledgements

I thank Dr. A. E. Z. Short and the University of Kansas for a kind invitation to examine material. I thank the Museum of Natural History of Vienna (Naturhistorisches Museum Wien) for the loan of Neotropical Berosini. This paper was written as part of the author's duties as career researcher of CONICET (Consejo Nacional de Investigaciones Científicas y Tecnológicas, Argentina).

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Received: 13-May-2013 • Accepted: 11-Nov-2014

Suggested citation:

OLIVA, A. 2014. Distribution of the species of Berosini (Coleoptera: Hydrophilidae) in South America. Revista Colombiana de Entomología 40 (2): 272-280. Julio-Diciembre 2014. ISSN 0120-0488.