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Scientific Note

New records of *Seira dowlingi* (Wray, 1953) (Collembola, Entomobryidae, Seirinae) for New World

Nikolas G. Cipola[1], Nerivânia N. Godeiro[2], Bruno C. Bellini[2]

[1]Laboratório de Sistemática e Ecologia de Invertebrados do Solo, Instituto Nacional de Pesquisas da Amazônia – INPA, CPEN. Avenida André Araújo, 2936, Aleixo, CEP 69067-375, Manaus, AM, Brazil. [2]Department of Entomology, College of Plant Protection, Nanjing Agricultural University, Nanjing, China. [3]Laboratório de Collembola, Departamento de Botânica e Zoologia, Centro de Biociências, Universidade Federal do Rio Grande do Norte (UFRN). Rodovia BR-101, Lagoa Nova, Campus Universitário, 59064-741, Natal, RN, Brazil.

Corresponding author: nikolasgc@gmail.com

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Abstract. *Seira dowlingi* (Wray, 1953) is recorded for the first time in Peru and Brazil from five states, including Fernando de Noronha archipelago plus a new record from United States. These new records support that *S. dowlingi* has a wide distribution in Neotropical Region, and expanded to 34 the number of species of *Seira* Lubbock, 1870 found in Brazil. In addition, our revision excluded the record of *Seira domestica* (Nicolet, 1842) for Brazil.

Keywords: Distribution, Entomobryoidea, Seirini, Springtails.

Seira dowlingi (Wray, 1953) was firstly described as *Drepanocyrtus dowlingi* Wray, 1953 based on specimens exclusively from the type locality, Dominican Republic (Wray 1953). Posteriorly *Seira caheni* Jacquemart, 1976 was described from Galapagos and synonymized with *S. dowlingi* by Christiansen & Bellinger (2000). Currently *S. dowlingi* is one of the most widespread species in Central America, with additional records from Cuba, Panama and Puerto Rico (Mari-Mutt 1986, Mari-Mutt & Bellinger 1990, Christiansen & Bellinger 2000, Bellinger et al. 2019) plus a recent record in North America, Illinois state, United States (Katz et al. 2015). However, different biomes of Neotropical Region have not yet been properly sampled and consequently the *Seira* Lubbock, 1870 fauna is unknown in the different phytogeographical domains (Christiansen & Bellinger 2000). Thus, herein new records of *S. dowlingi* are provided from Brazil, Peru and United States.

Specimens preserved in ethanol were cleared with Nesbitt's solution and mounted on glass slides in Hoyer's medium following Cipola et al. (2018a). Specimens in ethanol gel were photographed using a stereomicroscope (M165C) attached to a DFC420 digital camera with a dome as shown in Kawada & Buffington (2016). Photographs were digitally corrected using Application Suite V3.4.1. Distribution map was made using software of Shorthouse (2010). The examined material is deposited at the Invertebrate Collection of National Institute for Amazon Research (INPA), National Museum of Rio de Janeiro (MNRJ), Reference Collection of Soil Fauna, Paraíba State University (CRFS-UEPB), Collembola Collection of Biosciences Center of Federal University of Rio Grande do Norte (CC/UFRN), Brazil, and University of Arizona Insect Collection (UAIC), United States.

Seira dowlingi (Wray, 1953)

Figs. 1, 2.

Drepanocyrtus dowlingi Wray, 1953: 5, figs 2O-S, Puerto Libertado, Republica Dominicana (orig. descr.).

Examined material. 3 females in slides and 10 specimens in ethanol (UAIC): USA, **Arizona**, *Graham*, Piñaleno Mountains, Ash Creek near Cluff Ranch Wildlife, Area 16 km SW Pima, 32°46'00"N, 109°52'00"W, 1370 m, 10-16.vii.2015, malaise in small hillside gully, MB Irwiin leg. 1 female in slide (INPA): PERU, **Madre de Dios**, *Inambari*, Santa Rita Alta, 12°55'S, 70°14'W, mining area in Amazon Forest, 293 m, 03.xi.2018, Berlese-Tullgren funnels, EA Villalobos leg. 22 females in slides and 48 specimens in ethanol (INPA): BRAZIL, **Amazonas**, *Manaus*, in an apartment of "Aleixo" neighborhood, 03°05'29"S, 59°59'22"W, urban area, 85 m, 01-06.vii.2012, entomological aspirator, NG Cipola leg. 1 male and 1 female in slides (INPA): *idem*, in an apartment of "Tocantins" neighborhood, 03°05'39"S, 60°02'04"W, urban area, 30 m, 06.iii.2013, manual, FGL Oliveira leg. 1 female in slide (INPA): *idem*, in an apartment of "Petrópolis" neighborhood, 03°05'53"'S, 59°59'16"'W, urban area, 92 m, 03.xi.2013, manual, T Mahlmann leg. 1 male in slide and 3 specimens in ethanol (INPA): *idem*, INPA, entrance of campus II, 03°05'42"S, 59°59'23"W, urban area, 98 m, 03.xi.2013, manual, NG Cipola & GL Monte leg. 3 females in slides (INPA): "Raifran" farm, "Brasileirinho" road, Km 7, 03°02'08"S, 59°52'16"W, Amazon forest, 34 m, 29.viii.2013, manual, LB Leal leg. 1 female in slide (INPA): *idem*, Reserva Ducke, Sede, 02°55'48"S, 59°58'31"W, Amazon forest, 76 m, 08-11.iii.2005, entomological umbrella, BM Oliveira leg. 1 male in slide (INPA): *idem*, 29.iv.2013, entomological aspirator, NG Cipola leg. 1 female in slide (INPA): *Benjamin Constant*, Hotel "Cabanas", 04°23'37"S, 70°01'59"W, Amazon forest, 77 m, 01-03.ix.2013, pitfall-trap, V Linardi leg. 2 females and juvenile in slides (INPA): *Tabatinga*: Hotel "Takana", 04°13'50"S, 69°55'54"W, urban area, 80 m, 03-04.ix.2013, pitfall-trap, V Linardi leg. 1 male in slide (INPA): **Maranhão**, *Pinheiro*, backyard of a house in urban area, 02°31'49"S, 45°05'50"W, 11 m, 16.i.2014, pitfall-trap, VJC Bastos & VC Bastos leg. 5 males and 7 females in slides and 4 specimens in ethanol (INPA): **Pará**, *Salinópolis*, east of the city, land of an urban area, 00°37'28"S, 47°20'31"W, 18 m, 28-30.xii.2012, pitfall-trap, MBCS Graça leg. 2 females in slides (15133, 15186/CRFS-UEPB): **Pernambuco**, *Fernando de Noronha*, Rata Island, beach slope, 03°48'43.1"S, 32°23'12.7"W, 19.vii.2012, entomological aspirator, ECA Lima & AS Ferreira leg. 2 males and 2 females in slides and 49 specimens in ethanol (CC/UFRN): **Rio Grande do Norte**, *Vera Cruz*, Agro Humus Farm, in manure, 06°02'S, 35°25'W, rural area, 105

m, 10.ii.2015, entomological aspirator, NN Godeiro leg. 21 specimens in ethanol (MNRJ): **Rio de Janeiro**, *Rio de Janeiro*, Quinta da Boa Vista, Horto Botânico of National Museum, 22°54'S, 43°13'W, urban area, 15 m, 23.x.1981, manual, MC Mendonça leg. 2 females in slides and 9 specimens in ethanol (MNRJ): *idem*, "Barra da Tijuca neighborhood", 23°00'S, 43°22'W, urban area, 7 m, 19.i.2013, TC Silveira leg.

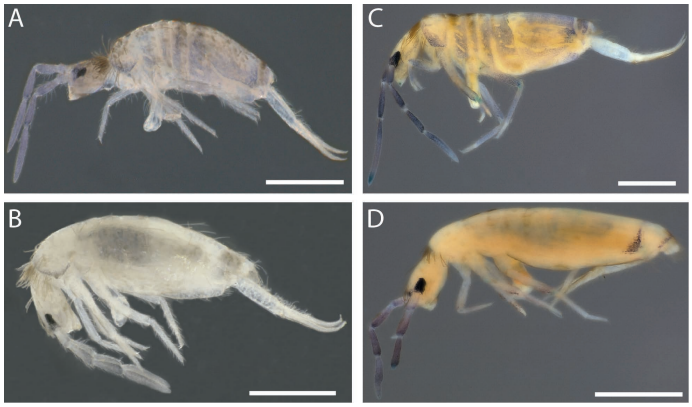

Figure 1A–D. Habitus of *Seira dowlingi* preserved in ethanol (lateral view). **A**, pigmented specimen from Pará, Brazil; **B**, depigmented specimen from Amazonas, Brazil; **C**, pigmented specimen from Arizona, USA; **D**, depigmented specimen from Arizona, USA. Scale bars: 0.5 mm.

Geographical records. Dominican Republic, Cuba, Galápagos, Panama, Puerto Rico, United States from Illinois and Arizona states, Peru (new record) and Brazil (new records) from Amazonas, Pará, Maranhão, Rio Grande do Norte, Rio de Janeiro states, plus Fernando de Noronha archipelago (Fig. 2).

Remarks. This new records of *S. dowlingi* extends to 34 the number of *Seira* species known from Brazil (Zeppelini et al. 2019). *Seira dowlingi* was already studied in Brazil 10 years ago based in specimens from Itabotaí, Rio de Janeiro, but it was mistakenly identified as *Seira domestica* (Nicolet, 1842) (Mendonça et al. 2009). This misidentification probably occurred due to similar color patterns displayed by both species (Fig. 1), with pigment generally restricted covering the antennae (see Cipola et al. 2018b: 6, Fig. 2A). However, the current taxonomy of *Seira*, as well as other Collembola, is strongly based in the study of chaetotaxy elements, which can clearly separate both species (Christiansen & Bellinger 2000, Cipola et al. 2018b). Other previous identifications of *S. domestica* from Central and South America are quite possibly mistaken as well (see Mari-Mutt & Bellinger 1990: 103, Christiansen & Bellinger 2000: 62), since these records were made literary before the 1970s, when the chaetotaxy was not clearly comprehended and well applied for Entomobryidae. In this sense, we believe that such records lacking the use of chaetotaxy characters for identification are not reliable, and within the New World, *S. domestica* is only confirmed in North America (Christiansen & Bellinger 2000).

Seira caheni, a junior synonym of *S. dowlingi*, presents similar color and chaetotaxy patterns when compared to type locality populations of *S. dowlingi*. In fact, both taxa have the same variations in color pattern, regardless of the geographic region, heavy or reduced pigmentation on trunk (Fig. 1, see also Mari-Mutt 1986: 150). Even so, the revalidation of *S. caheni* needs to be better evaluated, since its specimens (at least from its type locality, Galapagos) are devoid of one macrochaeta (**Pa2**) on dorsal head (see Jacquemart 1976: 150, Fig. 6), which is present in *S. dowlingi* (see Soto-Adames 2008: 12, Fig. 27). In the same sense, the identity of specimens determined as *S. caheni* from Puerto Rico and Cuba needs to be better evaluated since they hold one extra macrochaeta (**M2**) on dorsal head and other macrochaeta (**p1i2p?**) posteriorly on second thoracic segment (Gruia 1983: 200, Mari-Mutt 1986: 152), while both chaetae are absent in specimens from Galapagos (Jacquemart 1976). Thus, the presence of *S. caheni* in continental islands may be a diffusion of populations of *S. dowlingi* which did not clearly differ from its original stock, as stated by Christiansen & Bellinger (2000: 62, acknowledging Ernest Bernard's analysis of Wray's slides of *S. dowlingi*). Obviously, these morphological variations combined with molecular data and distribution may in the future contribute to the break of *S. dowlingi* populations into two or more valid species, as well as the revalidation of *S. caheni*, as observed in other Collembola groups (Porco et al. 2012, Zhang et al. 2014, Katz et al. 2015).

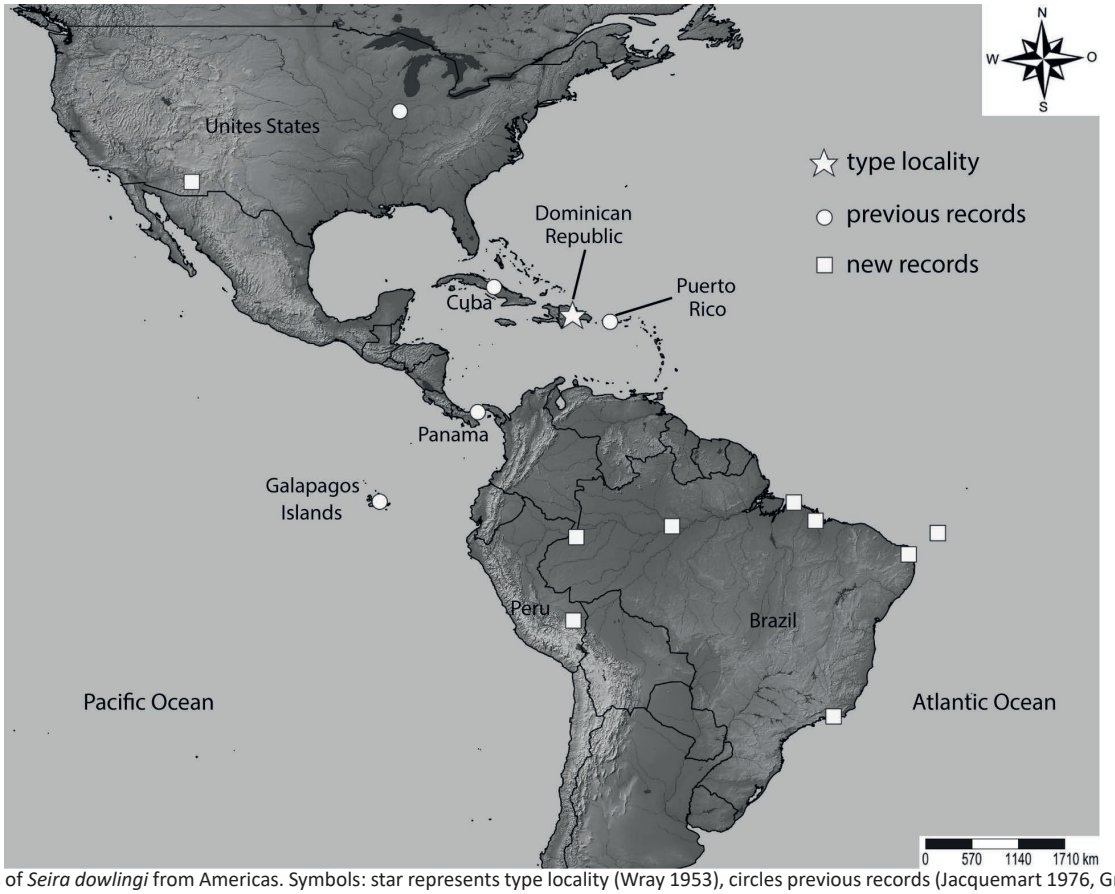

Figure 2. Records of *Seira dowlingi* from Americas. Symbols: star represents type locality (Wray 1953), circles previous records (Jacquemart 1976, Gruia 1983, Mari-Mutt 1986, Mari-Mutt & Bellinger 1990, Christiansen & Bellinger 2000, Katz et al. 2015), and squares new records.

Regardless, according to these new records, *S. dowlingi* presents a wide distribution in Neotropical and Nearctic Regions, from southern Brazil to United States (Fig. 2). This wide distribution appears to be common in at least part of Neotropical *Seira*, as also seen for *Seira brasiliana* (Arlé, 1939) (Soto-Adames 2008, Bellinger et al. 2019).

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Authors' Contributions

NGC identified the specimens from the United States and the northern region of Brazil and wrote the manuscript. NNG identified the specimens from others locality and made corrections of the manuscript. BCB made manuscript corrections.

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