

Occurrence of Symphyla (Myriapoda) in the region of the Upper Solimões River, Amazonas, Brazil

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Abstract – The present work aimed at identifying the Symphyla species diversity and abundance in various land-use systems under different degrees of intensification in western Amazonia. This is the first inventory of Symphyla in primary and secondary forest, crops, agroforestry systems and pastures which was carried out in Benjamin Constant municipality, in the region of the Upper Solimões River, Brazil. Samples (n = 101) were collected using a metal corer, and the symphylian extraction was carried out using Berlese-Tullgren funnels. Two genera and three species of symphylians were encountered. Considering the diversity encountered in Amazonian inventories, with only four genera and five known species overall, the three species found in the present study are considered a reasonable representation of the regional diversity. Two of the *Hanseniella* species found have been known to cause plant damage.

Index terms: *Hanseniella*, *Symphylella*, biodiversity, soil fauna.

Ocorrência de Symphyla (Myriapoda) na região do Alto Rio Solimões, Amazonas

Resumo – O objetivo deste trabalho foi identificar a diversidade e a abundância de espécies de Symphyla em diversos sistemas de manejo do solo em diferentes graus de intensificação no oeste da Amazônia. Este é o primeiro inventário de Symphyla em florestas primárias e secundárias, roças, sistemas agroflorestais e pastagens, realizado na região do Alto Rio Solimões, em Benjamin Constant, AM. As amostras (n = 101) foram coletadas com uma sonda de metal, e a extração dos sínfilos foi efetuada com o aparelho de Berlese-Tullgren. Foram registrados dois gêneros e três espécies de sínfilos. Considerando a diversidade encontrada em inventários efetuados na Amazônia, que no geral têm apenas quatro gêneros e cinco espécies conhecidas, as três espécies registradas neste estudo são consideradas razoavelmente representativas da diversidade na área. Duas das espécies do gênero *Hanseniella* encontradas são conhecidas como causadoras de danos a plantas.

Termos para indexação: *Hanseniella*, *Symphylella*, biodiversidade, fauna do solo.

Introduction

Symphyla comprehends the families Scutigereleididae and Scolopendrellidae, which have 15 genera and 200 species worldwide (Scheller & Adis, 2002). Although they are of little economic importance, there are records of symphylians as agriculture pests, attacking mainly roots. *Scutigereilla immaculata* is considered a dangerous pest in some areas, for damaging vegetables and fruits in gardens and greenhouses (Waterhouse, 1968). Its control is difficult, since all stages live at different soil depths (Simigrai & Berry, 1974). These animals can migrate vertically in response to variations in soil temperature (Edwards, 1961) and moisture (Waterhouse, 1968). In Brazil, there are records of *Hanseniella* sp. attacking roots of rice (Loureiro & Galvão, 1970) and pineapple (Loureiro & Fortes, 1972), both in Minas Gerais State.

Pineapple damages were also reported in the state of Bahia (Sanches, 1981). In Amazonia, few studies on symphylians have been undertaken, and these have focused mostly on forest systems of Central Amazonia, close to Manaus (Scheller, 1979; Scheller, 1992; Scheller & Adis, 1996; Adis et al., 1997). Among the 200 species recognized, only four genera and five species have been recorded in Amazonia (Scheller & Adis, 2002).

After deforestation for agriculture, improper management is the main cause of degradation in tropical ecosystems in Brazil. Furthermore, the intensification of agriculture can also reduce biodiversity (Moreira et al., 2008). However, little is known about the effects of these land transformations on the symphylian communities in Brazil. Therefore, the present study was conducted to identify the Symphyla species diversity and abundance

in various land-use systems under different degrees of intensification in western Amazonia.

Material and Methods

The collection sites were located in western Amazonia, in the Upper Solimões River region, close to the borders between Brazil, Peru and Colombia, in the municipality of Benjamin Constant (4°21'–4°26'S and 69°36'–70°1'W), 1,116 km west of Manaus. The samples were collected according to the Below-Ground Biodiversity project methodology (Karyanto et al., 2008).

The experimental layout consisted of six windows, with a total of 101 sampling points distributed in three communities: Guanabara (windows 1 and 2), Nova Aliança (windows 3, 4 and 5) and Benjamin Constant (window 6). Each sampling point was at a distance of at least 100 m from the others, and consisted of an area of 300 m², in which the samples were taken. The 101 sampling points were classified into the main representative land-use types: 20 in primary forest, 40 in secondary forest, 10 in agroforestry systems, 18 in crops and 13 in pastures. The soil samples were collected during the wet season, from March to April 2004. A corer of 3.5x3.5x10 cm was used and the samples were collected within a depth of 0–5 cm. The three samples taken at each point (n = 101) consisted of four subsamples (n = 12). The Symphyla were extracted using Berlese-Tullgren funnels (Franklin & Moraes, 2006; Karyanto et al., 2008; Moraes & Franklin, 2008) and preserved in 70% alcohol. Keys of Scheller (1979) and Scheller & Adis (2002) were used to identify the specimens collected.

Results and Discussion

Among the five species already recorded by other authors in Amazonia, three were encountered in the study area at the Upper Solimões River: *Hanseniella arborea* Scheller, 1979; *Hanseniella orientalis* (Hansen, 1903) (Scutigereidae); and *Symphylella adisi* Scheller, 1993 (Scolopendrellidae) (Table 1).

Out of the total specimens collected, 49% were *S. adisi* (Table 1), the smallest species known in Amazonia (with a length of about 1.5 mm). Although it was not recorded in primary forests in this study, former studies showed the presence of *S. adisi* in primary upland forests, “campinarana” forests and floodplain forests of black, white and mixed black-white water (Adis et al., 1997). The abundance of *S. adisi* is affected by soil moisture and temperature, and the species can be found in periodically flooded soils of Central Amazonia. It spends the inundation phase in the soil, submerged for 5–7 months, but its survival strategy is still unknown (Adis et al., 1997).

H. arborea, a larger symphylan (with a length of around 2.7 mm), was the second most abundant species encountered, amounting 38% of the total individuals collected. Although it was not found in pastures (Table 1), former records show the presence of this species in primary non-flooded upland forests, “campinarana” forests, floodplain forests (white water) and “igapó” (black water) (Scheller & Adis, 2002). In floodplain forests, *H. arborea* adults were collected at the height of 3.6 m in tree trunks of the black-water region of Tarumã Mirim, Amazonas, where they survive the flooding period of 5–7 months (Scheller, 1979; Adis & Scheller, 1984).

H. orientalis, a species similar in size to *H. arborea*, was not recorded in primary forests and pastures (Table 1). Apparently, this species has the most restricted distribution in comparison to the others, and is absent in primary forests, “campinaranas” and floodplain forests (“várzea”, “igapó” and mixed water). This species was recorded in caverns in Central Amazonia, and in pastures located approximately 30 km north of Manaus along the BR-174 highway (Manaus – Boa Vista) (Scheller & Adis, 2002).

Adults and subadults totaled 48% of the individuals collected, followed by juveniles with ten pairs of legs. Initial development stages (five and six pairs of legs) were not recorded, probably due to the extraction method, which is more efficient for the capture of larger,

Table 1. Mean density (individuals per m²), dominance in relation to total individuals (%) and the presence of Symphyla species (+ present; - not recorded) in primary forest, secondary forest, cropping and agroforestry systems, in the region of the Upper Solimões River, Amazonas.

Species	Density	Dominance	Primary forest	Secondary forest	Agroforestry systems	Crops	Pastures
<i>Symphylella adisi</i>	432	49	-	+	+	+	+
<i>Hanseniella arborea</i>	336	38	+	+	+	+	-
<i>Hanseniella orientalis</i>	112	13	-	+	+	+	-

more mobile stages that can escape from the humidity reduction and heat inside the sample being extracted, or to a real absence at the sampling period.

The data presented are the results of a two-month study carried out during the wet season and using a single collecting technique. Given the few scientists and the little research on Symphyla done so far in Brazilian Amazonia, and the fact that most studies were performed in Central Amazonia, it is not possible to reach broader conclusions regarding the diversity and abundance of Symphyla in the region yet. Considering the diversity encountered in Amazonian inventories, which features only four genera and five species overall, the three species found in the present study can be considered a reasonable representation of the regional diversity. The two species found belong to the *Hanseniella* genus, known to attack agricultural crops in Brazil, although nothing is yet known of the impact of these symphylans on crop roots in Amazonia.

Conclusions

1. The three species of Symphyla (Myriapoda) found in the present study can be considered a reasonable representation of the regional diversity in the region of the Upper Solimões River, Brazil.

2. Two of the *Hanseniella* species found have been known to cause plant damage.

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References

ADIS, J.; SCHELLER, U. On the natural history and ecology of *Hanseniella arborea* (Myriapoda, Symphyla, Scutigerelellidae), a migrating symphylan from an Amazonian black-water inundation forest. **Pedobiologia**, v.27, p.35-41, 1984.

ADIS, J.; SCHELLER, U.; MORAIS, J.W. de; ROCHUS, C.; RODRIGUES, J.M.G. Symphyla from Amazonian non-flooded

upland forests and their adaptations to inundation forests. **Entomologica Scandinavica**, v.51, p.307-317, 1997.

EDWARDS, C.A. The ecology of symphyla. Part III. Factors controlling soil distributions. **Entomologia Experimentalis et Applicata**, v.4, p.239-256, 1961.

FRANKLIN, E.; MORAIS, J.W.M. de. Soil mesofauna in Central Amazon. In: MOREIRA, F.M.S.; SIQUEIRA, J.O.; BRUSSARD, L. (Ed.). **Soil biodiversity in Amazonian and other Brazilian ecosystems**. Oxfordshire: CABI Publishing, 2006. p.142-162.

KARYANTO, A.; RABMADI, C.; FRANKLIN, E.; SUSILO, F.X.; MORAIS, J.W. de. Soil Collembola, Acari and other mesofauna – the Berlese method. In: MOREIRA, F.M.S.; HUISING, J.E.; BIGNELL, D.E. (Ed.). **A handbook of tropical soil biology: sampling & characterization of below-ground biodiversity**. London: Earthscan, 2008. p.85-95.

LOUREIRO, M.C.; FORTES, J.M. *Hanseniella* sp. (Symphyla) nova praga rizófaga de *Ananas comosus* (L.) Merr., no Brasil. **Ceres**, v.18, p.217-221, 1972.

LOUREIRO, M.C.; GALVÃO, J.D. Nota sobre *Hanseniella* sp. (Symphyla) praga de arroz (*Oryza sativa* L.) em Viçosa, Minas Gerais. **Ceres**, v.17, p.86-90, 1970.

MORAIS, J.W. de; FRANKLIN, E. Mesofauna do solo na Amazônia Central. In: MOREIRA, F.M.S.; SIQUEIRA, J.O.; BRUSSARD, L. (Ed.). **Biodiversidade do solo em ecossistemas brasileiros**. Lavras: UFLA, 2008. p.372-408.

MOREIRA, F.M.S.; SIQUEIRA, J.O.; BRUSSARD, L. Soil organisms in tropical ecosystems: a key role for Brazil in the global quest for the conservation and sustainable use of biodiversity. In: MOREIRA, F.M.S.; SIQUEIRA, J.O.; BRUSSARD, L. (Ed.). **Biodiversidade do solo em ecossistemas brasileiros**. Lavras: UFLA, 2008. p.1-12.

SANCHES, N.F. **Ocorrência de *Hanseniella* sp. (Myriapoda, Symphyla) na rizosfera de abacaxizeiros na região produtora de Coração de Maria, BA**. Cruz das Almas: Embrapa Mandioca e Fruticultura, 1981. 129p.

SCHELLER, U. A study of Neotropical Symphyla (Myriapoda): list of species, keys to genera and description of two new Amazonian species. **Amazoniana**, v.12, p.169-180, 1992.

SCHELLER, U. *Hanseniella arborea* n.sp., a migrating symphylan from an Amazonian blackwater inundation forest (Myriapoda, Symphyla, Scutigerelellidae). **Acta Amazonica**, v.9, p.603-607, 1979.

SCHELLER, U.; ADIS, J. A pictorial key for the symphylan families and genera of the Neotropical Region south of Central Mexico (Myriapoda, Symphyla). **Studies on Neotropical Fauna and Environment**, v.31, p.57-61, 1996.

SCHELLER, U.; ADIS, J. Symphyla. In: ADIS, J. (Ed.). **Amazonian Arachnida and Myriapoda**. Moscow: Pensoft, 2002. p.547-554.

SIMIGRAI, M.; BERRY, R.E. Resistance in broccoli to the garden symphylan. **Journal of Economic Entomology**, v.67, p.371-373, 1974.

WATERHOUSE, J.S. Studies on the garden symphylan, *Scutigerelella immaculata* (Symphyla: Scutigerelellidae). **The Canadian Entomologist**, v.100, p.172-178, 1968.