Scutellospora striata sp.nov., a newly described glomeromycotan fungus from La Gran Sabana, Venezuela

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Abstract — Examination of soil samples from a sclerophyllous shrubland near the town of Iboribó in La Gran Sabana, Venezuela, revealed an undescribed species of Scutellospora whose spores are ornamented with finger-print-like processes, are ochraceous yellow with a pinkish tint, and have a complex wall structure. The new species, named Scutellospora striata, is the third Scutellospora species described from La Gran Sabana, Venezuela.

Key words — arbuscular mycorrhizal fungus, AMF, Gigasporaceae, taxonomy, tropical species

Introduction

The La Gran Sabana region is located in southeastern Venezuela, South America. It is a highly undulate plain occupying ca. 30.000 km² of a slope from 1450 m to 750 m above sea level directed from the north to the south. This mosaic of igneous and metamorphic rock is one of the earliest shields of the earth crust. It formed the western section of the ancient supercontinent of Gondwana (Schubert & Huber 1989). It was formed in Precambrian age and due to its antiquity and advanced phase of weathering, soils originated from that substrate (Roraima Formation) are mainly sandy with a very small clay fraction and generally very low nutrient content. La Gran Sabana is also the land of the tepuis, which are mountains of vertical walls and flat hilltops (tablelands), and an outstanding region due to the high degree of endemism of its flora (Rull 1991). The plant cover of La Gran Sabana is an intricate mosaic, composed of...
numerous types of vegetation. With the exception of the continuous forests at the foot of the eastern tepuis, forests occur in patches encircled by extensive treeless savannas, as well as by shrublands (Dezzeo 1994).

Shrublands are primary plant communities in which the shrub stratum constitutes the principal functional compartment. They consist of a well-developed shrubby stratum 1-3 m high, occasionally with emergent shrubs up to 5 or 7 m tall, with predominantly sclerophyllous leaves (Huber 1994), which almost always grow on rocky sandstone outcappings or on white quartzitic sands. According to Huber & Febres (2000) they contain a significant number of endemic plants.

During the inventory of the arbuscular mycorrhizal fungi (AMF) associated with the sclerophyllous shrublands of La Gran Sabana, spores of an undescribed species of the genus *Scutellospora* with a distinctive ornamentation were found. The fungus is described here as *S. striata* sp. nov.

**Material and methods**

Intermittent soil samples were taken during two years below vegetation in a sclerophyllous shrubland situated at Iboribó (5°36.796’N, 61°29.351’W) in La Gran Sabana. This shrubland grows on sandstone outcrops (Huber 1994). It is highly diverse in plant species, but among the most common are *Clusia pusilla*, *Gongylolepis benthamiana*, *Euphronia guianensis*, *Humiria balsamifera*, *Calliandra* sp., *Bonnetia sessilis* and some small rosettes belonging to the *Cyperaceae* family such as *Rhynchospora barbata* and *Bulbostylis conifera*. Open pot trap cultures started from these soils were maintained in a glasshouse for three months and then dried for one week. The content of the pot was stored at room temperature (=20°C) for almost one year to break latency of spores (Morton et al. 1993). Then, spores were isolated and used to start pure cultures that all failed. Therefore, the description of the species presented below was prepared based on spores isolated only from trap cultures and field soils. The cultures were initiated with *Vigna luteola* as the host plant, but it died and then was replaced by wild plants germinating from the seed bank. Various very interesting species of *Scutellospora* spp. were isolated from this place (Herrera-Peraza et al. 2001, Walker et al. 1998). However, no pure culture of any of them could be obtained.

Spores were isolated from the trap pots or from the field soils by wet sieving, decanting and sucrose centrifugation (Sieverding 1991). The isolated spores were suspended in water and illuminated with light from a quartz-iodine fibre-optic source. Their color was determined by comparison with a color chart for British fungi (Anon 1969). The specimens were mounted in polyvinyl alcohol lacto-glycerol (PVLG) or in PVLG mixed with Melzer’s reagent (1:1, v/v). Wall description and terminology are based on those suggested by Walker (1983) and Walker & Vestberg (1998). Type material has been deposited in the Venezuelan National Herbarium (VEN) and the Cuban National Herbarium, IES-CITMA (HAC).

To study more carefully the external appearance of the spores, a number of them were prepared for Scanning Electron Microscopy (SEM). Prior to the preparation of the material for SEM, spores were put under a dissecting microscope to remove or to
break the outer unit component with the aid of fine tweezers. Then, intact or broken
spores were rinsed in a phosphate buffer solution and immediately fixed in 1% osmium
tetroxide at 4°C for 1 h. Fixed samples were dehydrated for 5 min in each dilution of an
acetone series (20, 40, 70, 80 and 100%), dried at critical point with liquid CO₂, placed on
aluminum metal holders, coated with 200 Å gold-palladium and observed for SEM.

**Taxonomic description**

**Scutellospora striata** Cuenca & R.A. Herrera sp.nov.  
Figures 1-3  
MYCOBank MB 511702

*Spore singulatim enatae in solo, ochraceae roseo suffusae, superficie nitida, vulgo globosae
vel subglobosae, 130–184 × 116–152 µm, supra suspensorem bulbosum ochraceum locatae.*

*Spore* parietur *structura 6-tunicata.* Tunicae prima et secunda respective unitaria
et laminata, caeterae omnes membranae. Tunica prima 6–10 µm crassa ochraceae, in juventute tenuiter laminata et ornata muri 1.0–1.5
µm latis, invicem 0.5–0.8 µm separatis, striatim dispositis, vestigia digitalia referentibus.

*Tunica* tertia, 0.7 µm crassa, rigida, firmiter tunicae secundae adpressa. *Tunica* quarta, quinta et sexta, *flexibles,* membranae. *Tunica* quarta *difficilis visu,* sed Melzeris reactivo
dilute rosea evadens. *Tunica* quinta et sexta firmissime adpressae, solum sub microscopio
Normanski obviae, vel sexta Melzeris reactivo purpurea evadens. Scutellum germinativum
varie et dense plicatum. Cellulae auxiliares nobis non observatae.

**Holotype:** Slide no. Cuenca 479-4, 13 Feb. 1998, Venezuelan Institute for Scientific
Research.

**Etymology** Latin *striata* "with striae", referring to the spore ornamentation composed
of elongated, generally parallel elements separated by grooves.

Spores borne singly in soil, ochraceous yellow of a pinkish tint in color
(Ochraceous [8G] to Saffron [49] according to the color chart), having a
shinning surface when observed under a dissecting microscope and illuminated
with tungsten lamp, generally globose or subglobose (Fig. 1a), 130–184 × 116–
152 µm (mean 163 × 152 µm, n= 13) with a terminal attached bulbous base,
produced from a septate subtending hypha. Bulbous spore base ochraceous
yellow in color and 22–29 µm wide, with a recurved septum at its base.

Spore wall structure composed of 6 components or layers generally
organized in 3 groups. With the exception of components 1 and 2, being unit
and laminated, respectively, all the remaining components are membranous.
Component 1 is contiguous with the sporophore outer wall component, 1.5–
2.0 µm thick, and have a smooth surface (Figs. 2a, b and 3). Component 2 is
laminated, 5.0–10.0 µm thick, and ochraceous yellow (Fig. 3). In young spores
the component 2 is finely laminated and ornamented with muri 1.0–1.5 µm
wide and spaced 0.5–0.8 µm apart (Fig. 1b). When seen in a plane view, the
muri resemble a finger-print. When spores develop 1 to 3 thick laminae (1.0–
2.0 µm thick) originate from component 2 outwards (Figs. 3a-c). Each of these
laminae have the same ornamentation as described above. When three laminae
are formed, next fine inseparable laminae are synthesized inward. (Fig. 3c). As mentioned before, each thick lamina is ornamented on the upper surface with muri showing a striate pattern. The muri are commonly squared, angular or wave-like in a cross section. The striations rarely follow the same direction on the surface of each of the thick laminae and, thereby, in a plane view the spore ornamentation seems to be composed of tiny squares or rhombs (Fig. 1c). At each two-muri interception wall material is deposited to form a small columella. Therefore, in a cross section the component 2 is composed of up to three lines of rounded cavities resulting from inter-muri and columella inter-spaces (Fig. 2c).

Component 3, measuring approx. 0.7 µm, is a rigid membrane tightly adhered to the lower surface of component 2 or separates from it in vigorously crushed spores (Fig. 1h). Components 4 to 6 are flexible membranes usually tightly adherent to each other.

Component 4 is generally very difficult to discern (Fig. 1f), but its presence becomes evident in Melzer’s reagent because it reacts pale pink (Fig. 1g). Components 5 and 6 are firmly cemented in between and can be discerned only under a microscope equipped with Nomarski interference contrast or in spores crushed in Melzer’s reagent because component 6 becomes readily purple in it. None of these innermost membranes are beaded or amorphous. Germination shield 64 × 72 µm in size with complex infolding (Figs. 1e and 3b).

Bulbous sporophore lacks ornamentation. The wall of the sporophore is composed of two layers that are contiguous with components 1 and 2 of the spore wall (Figure 1d). This wall is 1.5–2.0 µm thick, reaching up to 3.0–5.0 µm near the spore base. The pore at the attaching point is approximately 1.0 µm diam. Hyphae attached to the sporophore are regularly septated, measuring 5.0–9.0 µm diam., and have walls 1.0–2.0 µm thick. Auxiliary cells unknown.

Distribution and habitat. Known only from La Gran Sabana, Venezuela. Spores of this species have been collected only from the sclerophyllous shrubland at Iboribó and in a treeless savanna dominated by Axonopus canescens, also in the way to the Iboribó shrubland. Soils are highly acidic, sandy with a very low exchangeable phosphorus and medium level of total N.

Mycorrhizal associations unknown. Attempts to form mycorrhizae in pure culture have failed, though the species sporulated in a multispecies pot culture with Scutellospora spinosisimna, and other unknown species of Acaulospora, Glomus, and Scutellospora.

Figure 1. *Scutellospora striata*. a) Intact spore mounted in PVLG. b) Ornamentation of spore wall component 2 seen in a plane view. c) Ornamentation of spore wall component 2 of older spore. It resembles rhombs due to the overlapping laminae, each ornamented with striae. d) Non-ornamented bulbous suspensor. e) Germination shield. f) Crushed spore with inner group of membranous components. Most internal components are labeled. g) Heavily crushed spore mounted in PVLG+Melzer’s reagent with stained components 4 and 6. h) Cross view of spore with components 1-6 arranged in two groups.
Figure 2. SEM images of *S. striata*. a) Intact spore with the outermost unit component obscuring the ornamented spore wall component 2. b) The striae on the upper surface of component 2 visible through the broken component 1. c) Cross view of component 2 with lines and round cavities.

**Discussion**

*Scutellospora striata* can be readily distinguished from other species in the genus by its peculiar ornamentation. Under a dissecting microscope, the ornamentation is not always evident, because the unit outer component is smooth and usually shines under incident light, though it detaches from the spore easily after low pressure. The presence of the very robust component 1 was evidenced by SEM (Fig. 2a). It has a smooth surface, which is often free of organic debris. However, in some spores lacking the outer component 1, fine soil debris firmly adhere to the spore surface, which show the ornamentation when detached. The ornamentation of component 2 could be visualized under SEM only after manipulating the spore to break the outer unit component (Fig. 2b).

Component 2 is quite complex. Because each layer of the laminated component 2 is ornamented with striae, in a plane view the striae of overlapping layers are visible as tiny squares or rhombs (Fig. 1c). When spores are very young and only one layer (subcomponent) of component 2 is differentiated or when the outermost subcomponent is in focus, the ornamentation resembles a finger-print (Figs. 1b and 3a).

Assessing the number of wall components is very difficult. The number of inner components may be determined when first intact spores are mounted in PVLG for 1-2 hours and crushed by applying pressure to the cover slip to

Figure 3 (on next page). Differentiation of the laminate spore wall component 2 of *S. striata*. a) Only one lamina of component 2 of young spore. Outer unit component 1 is transparent and easy to see. b) Component 1 and two laminae of component 2 of older spore. Germination shield is also visible. c) Component 1 and four laminae of component 2 of mature spore.
push the internal membranes out (Fig. 1f). Component 4 may also be revealed in spores crushed in PVLG+Melzer’s reagent, because it stains light pink (Fig. 1g).

The sporulation of S. striata in both trap cultures and the field was not abundant. Unfortunately, attempts to grow this fungus in one-species cultures failed and, hence, the properties of its mycorrhizae remain unknown, similar to those of many other unculturable members of the Glomeromycota (Fitter 2005).

Of the described species of the genus Scutellospora, eleven produce ornamented spores. However, while the ornamentation of S. striata spores consists of striae resembling a finger-print when seen in a plane view, that of spores of S. coralloidea, S. dipapillosa, S. gregaria, S. heterogama, S. persica and S. verrucosa is composed of warts, S. crenulata of dome-like subpolygonal papillae separated by pits, S. minuta of spines with round apices, S. nigra of pits, S. nodosa of knobs, and S. spinosissima of blunt spines.

In addition to S. crenulata and S. spinosissima, S. striata is the third newly described species from La Gran Sabana, Venezuela.

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**Literature cited**


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