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Arcangeliella scissilis, a rare American semihypogeous fungus

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As a consequence of the finding of *Arcangeliella scissilis* in Costa Rica, we thought to carry out a full description of this material, giving some aspects on its taxonomy, ecology and distribution.

Key words: *Arcangeliella,* Russulales, Astrogastraceous, Costa Rica

INTRODUCTION

The study of the hypogeous *Russulales* has been a subject of great interest for the senior author in the last years (Moreno-Arroyo et al. 1998a, b; Calonge, Vidal 1999, 2001; Moreno-Arroyo et al. 1999; Calonge, Martín 2000; Vidal et al. 2002).

The presence of *Arcangeliella scissilis* in Costa Rica has been reported a few years ago (Calonge, Mata 2005), and now we are trying to give some new information on this very rare species.

MATERIAL AND METHODS

Central America. **Costa Rica:** Guanacaste, Bagaces, Área de Conservación Arenal, Sector Finca Rio Naranjo, Collection consisted in 18 basidiomes, which appeared closely aggregated being difficult to separete each other, due to be partially melted at the base (Fig. 1). No specific smell or taste was appreciated in fresh. They were growing semihypogeous in riparian forest soil, under *Quercus* sp., 24-V-1999, leg. Isaac López. INB 1545920.

After the field observation, the material was studied in the laboratory under the light microscope, using 3% KOH as liquid medium and observed in a Nikon

Labophot. For SEM a spore deposit was coated with gold and observed in a Hitachi S-3000N, belonging to Real Jardín Botánico of Madrid.

RESULTS

Arcangeliella scissilis Zeller & C.W. Dodge, *Ann. Mo. Bot. Gard.* 22: 369 (1935)

≡ *Martellia scissilis* (Zeller & C.W. Dodge) Singer & A.H. Sm., *Mem. Torrey Bot. Club* 21: 45 (1960).

≡ *Zelleromyces scissilis* ((Zeller & C.W. Dogge) Trappe, T. Lebel & Castellano, *Mycotaxon* 81: 205 (2002).

= *Hydnangium gilkeyae* Zeller & C.W. Dodge *Ann. Mo. Bot. Gard.* 22: 371 (1935).

= *Zelleromyces gilkeyae* Singer & A.H. Sm. *Mem. Torrey Bot. Club* 21: 21 (1960).

= *Martellia gilkeyae* (Zeller & C.W. Dodge) Singer & A.H. Sm., *Mem. Torrey Bot. Club* 21: 32 (1960).

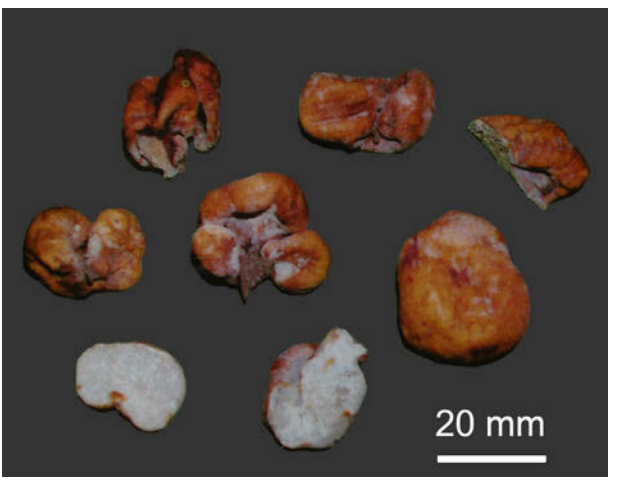

Fig.1. Basidiomata of *Arcangeliella scissilis*.

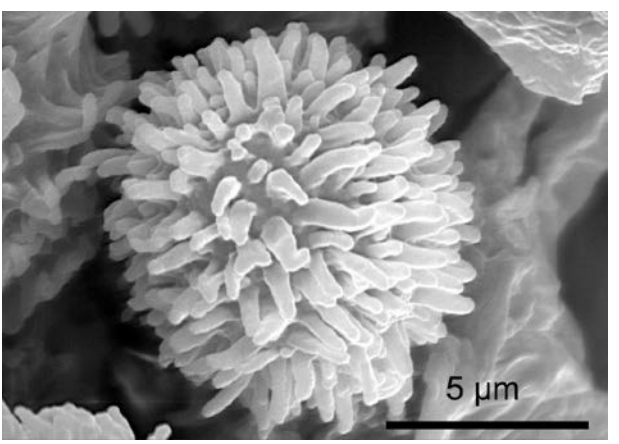

Fig. 2. Spore of *Arcangeliella scissilis* seen under the SEM.

Basidioma globose to tuberiform, 23–35 mm diameter in fresh. *Peridium* smooth, cream with orange, to dark reddish tones. In wet weather the surfase changes to viscid or muscilaginose. The consistency of basidioma is solid, sofl in fresh conditions and coriaceus when dry, with venous surface.

Gleba partially exposed at base of basidioma, where a rudimentary prolonged stipe-like formation can be observed (Fig. 1). *Gleba* in section appears with a labyrinthic structure, with chambers 0.1–0.4 mm diameter, full of spores, showing a cream colour when mature. *Columella* absent. Sections of the fresh basidioma exuding a white latex, which changes to lemon yellow in a few minutes. Smell and taste indistinct.

When observed under the light microscope it is possible to distinguish an *epicutis* made up of filiform *hyphae*, 8–12 × 5–7 μm, with a gelified apical cell. *Peridium* filamentous, 120–160 μm thick. The external layer shows a yellowish orange pigmentation, made up with modified hyphae, 2–3 μm diameter. *Hymenial context* made up with amber colour laticiferous hyphae 10 μm diameter, without septa, and hyaline 4-6 μm diameter hyphae, septate, without clamp connections, but with some rare sphaerocyst nests at the context centre. *Sphaerocysts*, 8–14 μm diameter. *Subhymenium* made up with globose elements, 9–23 μm diameter, rare. *Basidia* cylindrical to elliptical, 45–55 × 9–11 μm, hyaline which does not change in the presence of KOH, with 1–2–4 sterigmata, 5–6 μm long. *Cystidia* claviform, 40–60 × 10–12 μm, hyaline. *Spores* globose, yellowish in mass, 10–16 μm diameter, including spines, which are cylindrical to filiform 2–4 μm long, amyloid (Fig. 2).

DISCUSSION

After a first look to the studied material, we thought that it was an *Arcangeliella*, due to the presence of an abundant white latex, rudimentary to absent stipe and a partially nude gleba at the base. Thanks to the excellent article published by Thiers (1984), on the genus *Arcangeliella*, it has been possible to include our material within this genus.

The material from Costa Rica was coincident with that of *Zelleromyces gilkeyae* (Singer, Smith 1960) that is why we decided to identify both taxa. Nevertheless, the problem of the genera delimitation in the Astrogastraceous is a big one, according to Singer and A.H. Smith (1960). The production of an abundant latex in fresh is a fundamental character in *Zelleromyces*, which makes possible the separation with *Gymnomyces* and *Martellia,* without latex. However, this character is difficult to observe when working with dry material or herbarium specimens.

Thus, Beaton et al. (1984) and Zhang and Yu (1990) have proposed, as a better character, the spore ornamentation. In this way, they suggest to include within the genus *Zelleromyces* only species with reticulate, subreticulate or winged spores. In *Martellia* those species with warty to spiny spores and in *Gymnomyces* all kind of spores; being possible the separation between the last two groups by the presence or absence of sphaerocyst nests, which are not always easy to locate. Thus, none of these methods is really functional.

In previous works (Moreno-Arroyo et al. 1998a, b, 1999; Calonge, Vidal 1999, 2001; Calonge, Martín 2000; Vidal et al. 2002), we have followed Beaton´s et al. concept (1984), but in the actual situation the presence of abundant latex and spiny spores places our material in an intermediate position, among *Zelleromyces, Gymnomyces* and *Cystangium.*

Within this chaos, Vidal (2004) has been trying to get a reasonable explanation rediscribing the genus *Arcangeliella* (Cavara 1900) to which the genus *Zelleromyces* is synonymysed. Thus, within the actual Vidal´s concept, all the genera from the Astrogastraceous, lacking stipe or any rest of it, from the sterile base or columella, are included in *Arcangeliella*. This is the case of our material from Costa Rica. Other important characters, besides latex presence, are hymenial trama, generally homomerous; despite the possibility to observe some dispersed sphaerocysts, in *A. scissilis.* On the other hand the spores may be reticulate, subreticulate, warty, spiny, globose to ellipsoid.

At the same time, the other species with well-developed stipe and percurrent columella are included in a restored genus, *Gastrolactarius* R. Heim ex Vidal (Vidal 2004).

Regarding to molecular biology studies, carried out on this group, Miller et al. (2001) have demonstrated that *Arcangeliella* and *Zelleromyces* aligne within *Lactarius* section, while *Macowanites, Gymnomyces, Cystangium* and *Martellia* do within *Russula* clades.

Concerning the ecology of *Arcangeliella scissilis*, as far as we know, it grows under *Quercus* sp.; other authors have collected it under *Acer* (Singer, Smith 1960), *Alnus, Picea, Tsuga* (Desjardin 2003) and in the case of the so named *Martellia gilkeyae* it was found under *Corylus* (Singer, Smith 1960).

Its geographical distribution, until now, was limited to West of USA (Desjardin 2003), thus, the Costa Rican collection should be the first record outside the United States.

CONCLUSIONS

Arcangeliella scissilis represents a rare taxon which is limited to Western United States and Costa Rica. It seems to be associate to various species of vascular plants, such as *Acer, Alnus, Quercus, Picea, Tsuga* and *Corylus.*

From the phylogenetic point of view, *Arcangeliella* fits well within the *Lactarius* clades.

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REFERENCES

Beaton G., Pegler D.N., Young T.W.K.1984. Gasteroid Basidiomycota of Victoria State, Australia. 2. *Russulales.* Kew Bull. 39: 669-698.

Calonge F.D., Martín M.P. 2000. Morphological and molecular data on the taxonomy of *Gymnomyces, Martellia* and *Zelleromyces (Russulales).* Mycotaxon 76: 9-15.

Calonge F.D., Mata M. 2005. *Crucibulum laeve* var. *magnum* var. nov. y *Arcangeliella scissilis,* encontrados en Costa Rica. Bol. Soc. Micol. Madrid 29: 43-48.

Calonge F.D., Vidal J.M. 1999. *Gymnomyces ammophilus* Vidal & Calonge sp. nov., encontrado en Portugal. Bol. Soc. Micol. Madrid 24: 65-70.

Calonge F.D., Vidal J.M. 2001. *Macowanites vinaceodorus* sp. nov. (*Russulales*), a new gasteroid fungus from coastal dunes of Spain. Mycotaxon 79: 1-6.

Cavara F. 1900. *Arcangeliella borziana* nov. gen, nov. sp. Nuova Imenogasterea delle abetine di Vallombrosa. Nuovo Giorn. Bot. Ital. Ser. 7: 117-128.

Desjardin D.E. 2003. A unique ballistosporic hypogeous sequestrate *Lactarius* from California. Mycologia 95: 148-155. http://dx.doi.org/10.2307%2F3761974

Miller S.L., McClean T.M., Walker J.F., Buyck B. 2001. A molecular phylogeny of the *Russulales*, including agaricoid, gasteroid and pleurotoid taxa. Mycologia 93: 344-354. http://dx.doi.org/10.2307%2F3761656

Moreno-Arroyo B., Gómez J., Calonge F.D. 1998a. *Zelleromyces giennensis* sp. nov. (*Russulales*), a gasteroid fungus from the South of Spain. Cryptogamie, Mycol. 19: 107-111.

Moreno-Arroyo B., Gómez J., Calonge F.D. 1998b. *Zelleromyces meridionalis (Russulales, Elasmomycetaceae)* a new species from Spain. Mycotaxon 69: 467-471.

Moreno-Arroyo B., Gómez J., Calonge F.D. 1999. *Gymnomyces dominguezii* sp. nov. from Spain. Mycol. Res. 103: 215-218.

Singer R., Smith A.H. 1960. Studies on secotiaceous fungi. IX. The Astrogastraceous series. Mem. Torrey Bot. Club 21: 1-112.

Thiers H.D. 1984. The genus *Arcangeliella* Cav., in the Western United States. Sydowia 37: 296-308.

Vidal J.M., Calonge F.D., Martín M.P. 2002. *Macowanites ammophilus* (*Russulales*) a new combination based on new evidence. Rev. Catalana Micol. 24: 69-74.

Vidal J.M. 2004. *Arcangeliella borziana* and *A. stephensii,* two gasteroid fungi often mistaken. A taxonomic revision of *Lactarius*-related sequestrate fungi. Rev. Catalana Micol. 26: 59-82.

Zhang B., Yu Y.N. 1990. Two new species of gasteroid *Russulales* from China, with notes on taxonomy of *Gymnomyces, Martellia* and *Zelleromyces.* Mycol. Res. 94: 457-462.