



Cornuvia (Myxomycetes: Trichiales), a new genus for Mexico

Cornuvia (Myxomycetes: Trichiales), un género nuevo para México

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Abstract

The first field collections of *Cornuvia serpula* (Wigand) Rostaf. from the Neotropics are reported herein. They were recovered from accumulated leaf litter of *Quercus* sp. in a cloud forest in Chiapas, Mexico. This paper includes a full taxonomic description based on the Mexican specimens and is supported by micrographs obtained from light and scanning electron microscope examinations. Some comments on the ecology of the species based on information in the literature and from observations of the field collected specimens are included.

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Keywords: Amoebozoa; Cloud forests; Neotropics; Scanning electron microscopy

Resumen

Se registran las primeras colectas de campo de *Cornuvia serpula* (Wigand) Rostaf. encontradas en el neotrópico, recolectadas en acumulaciones de hojarasca de *Quercus* sp. en un bosque mesófilo de montaña en Chiapas, México. Se incluye una descripción taxonómica basada en los ejemplares mexicanos, con fotografías de microscopía de campo claro y electrónica de barrido. Se incluyen también algunos comentarios sobre la ecología de la especie basados en la literatura y en las observaciones de las colectas neotropicales.

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Palabras clave: Amoebozoa; Bosque mesófilo de montaña; Neotrópico; Microscopía electrónica de barrido

Introduction

Cornuvia (Myxomycetes, Amoebozoa) is a monospecific genus that was described by Rostafinski (1873) towards the end of the 19th century. The single species in the genus, *Cornuvia serpula* (Wigand) Rostaf., is easy to identify because of its small, sessile sporocarps or plasmodiocarps, its loose non-elastic capillitium formed of threads marked with prominent rings, and its banded-reticulate spores (Martin & Alexopoulos, 1969). The species was placed originally in the genus *Arcyria* by Wigand (1863) but later transferred to the genus *Cornuvia* by Rostafinski because of its peculiar combination of characters. It is a rare

species, described originally from Germany (Wigand, 1863) but also reported from other temperate or subtropical areas of the Northern Hemisphere, such as Denmark, England, Michigan in the USA, India, and Japan (Bjørnekeær & Klinge, 1963; Ing, 1999; Lakhanpal & Mukerji, 1981; Martin, & Alexopoulos, 1969; Yamamoto, 1998). A recent record from France was from a moist chamber culture of *Quercus* cf. *ilex* leaves and twigs collected from a roadside ditch (Seraoui, 2008). The only southern hemisphere record of the species is from Tanzania in tropical East Africa (Ndiritu, Winsett, Spiegel, & Stephenson, 2009). A recent paper on the myxobiota of Central America reports a record of this species obtained in moist chamber culture from Costa Rica (Rojas & Calvo, 2014). However, *C. serpula* has not previously been reported in the field from the Neotropics in spite of intensive study of various countries in the

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region (Lado & Wrigley-de Basanta, 2008). The techniques of collection in the field and culture in moist chambers are complementary methods for obtaining Myxomycetes, but fruitings in the field often provide larger, better developed specimens and confirm the natural presence of the species in the area. A full taxonomic description of *C. serpula* is presented herein, based on material collected in a cloud forest in Chiapas, southeastern Mexico. The characters of these material were examined by light and scanning electron microscopy and are illustrated with micrographs.

Materials and methods

The study area consists of the cloud forests of the Lagunas de Montebello National Park, in the municipalities of La Independencia and La Trinitaria, in the state of Chiapas, southeastern Mexico. This park has a total area of 6033 ha and is situated between 16°04'20"-16°09'38" N, and 91°38'14"-91°47'41" W. It is considered as one of the conservation priority regions by the National commission for the study and use of the biodiversity of Mexico (Conabio) (Arriaga et al., 2000). Surveys in this area were carried out from 2004 to 2006, and known or suspected habitats of myxomycetes were examined in the field. Collections were glued into herbarium boxes and then dried *in situ*. The localities were geo-referenced using a GPS Garmin 12XL (datum NAD 27). The specimens are deposited in the herbarium of the Autonomous University of Tlaxcala (TLXM). Small sporocarps were mounted in Hoyer's medium for microscope measurements and observations. Spore, capillitium, and other morphological measurements were made of 25 structures from each of the collections. Descriptive data and light micrographs were obtained using a differential interference contrast (DIC) microscope. The critical-point drying technique was used for scanning electron microscopy (SEM) preparations and SEM analyses. Electron micrographs of specimens were obtained by the Scanning Electron Microscopy Department of the Royal Botanic Garden of Madrid, using a Hitachi S-3000N scanning electron microscope, at 10-15 kV. Color notations in parentheses are from Kornerup and Wanscher (1978).

Description

Cornuvia serpula (Wigand) Rostaf., in Fuckel, Jahrb. Nassauischen Vereins Naturk. 27-28:76 (1873).

Figs. 1-8

Sporophores sessile, in small groups, sporocarps sub-globose to pulvinate up to 0.4 mm diameter, short plasmodiocarps from 0.6-3.2 mm long × 0.2-0.4 mm wide, unbranched, sinuous, reddish yellow (4A6-7) (Figs. 1 and 2). Peridium membranous, pale yellow, translucent, delicate, with outer smooth surface; dehiscence irregular. Capillitium formed by a lax network of branched threads with few free ends, bright yellow, smooth, 1.9-3.1 μm diameter, ornamented with prominent rings perpendicular to the thread axis (Fig. 3), the threads are irregularly grooved and packed with sinuous rings with a smooth surface

visible by SEM (Figs. 5 and 6); rings either evenly distributed or clustered at intervals of 1.5-5.0 μm, occasionally up to 8.8 μm between adjacent groups; rings 3.1-6.3 μm diameter, × 0.8-1.6 μm thick. Spores reddish yellow (4A6-7) in mass, yellow by transmitted light, sub-globose, 10.0-11.6 (-12.6) μm diameter (mean diameter 11 μm) including ornamentation, banded-reticulate forming 9-14 meshes to the hemisphere, meshes from 0.8-2.7 μm diameter, bands 0.8-1.6 μm high (Fig. 4) with the crown densely packed with granules visible by SEM (Figs. 7 and 8). Plasmodium not observed in the Mexican collections but reported by Coon (1907) to be translucent white to cream.

Taxonomic summary

Habitat and distribution

This species was found in Mexico on accumulated leaf litter of *Quercus* sp. in a cloud forest dominated by species of *Pinus*, *Quercus*, *Liquidambar*, *Cecropia*, and *Heliconia*. Known from Germany, Denmark, England, France, the United States (Michigan), East Africa, India, Japan, and Costa Rica.

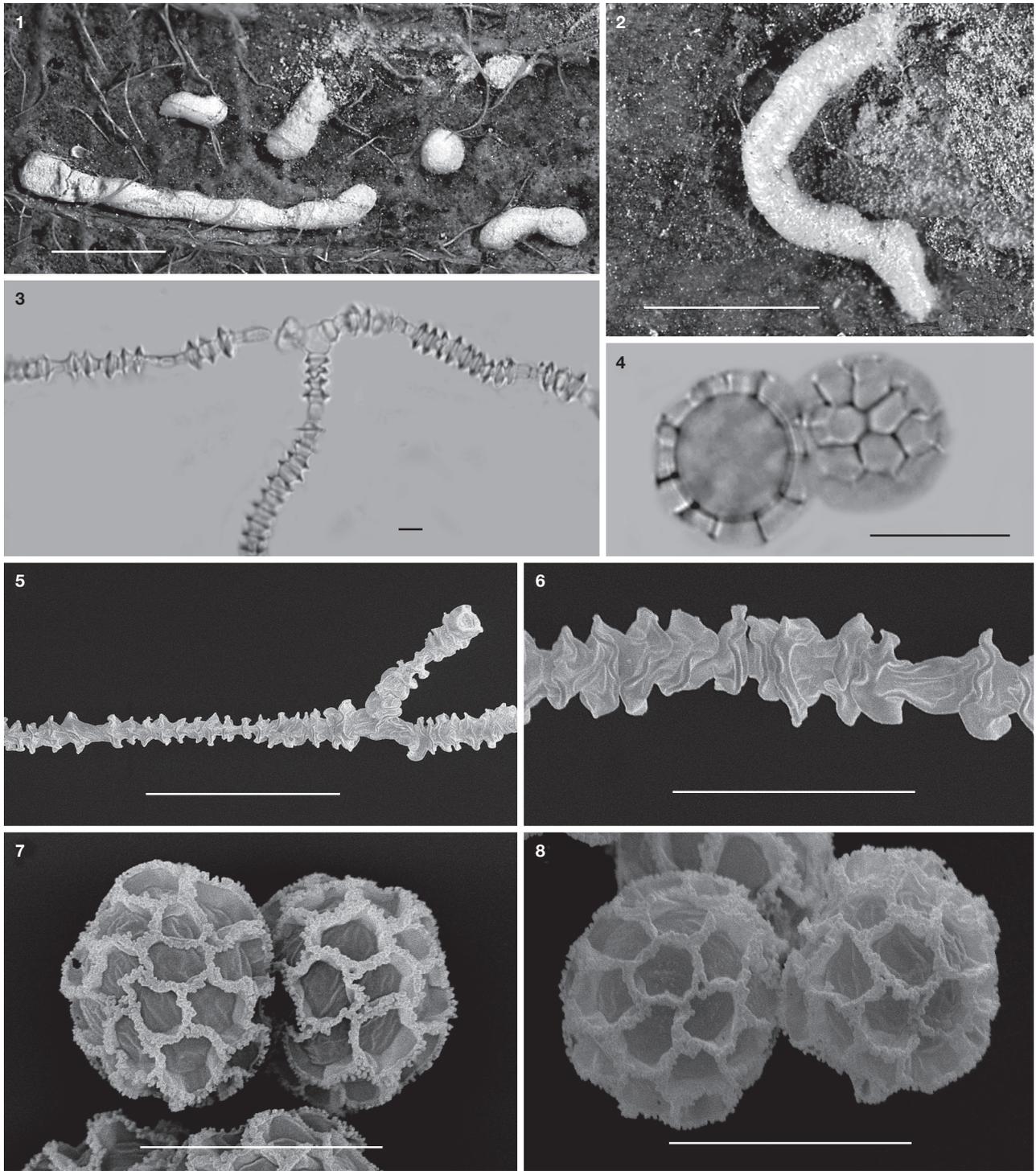
Material examined

Mexico: Chiapas, Municipio La Trinitaria, Lagunas de Montebello National Park, Grutas de San Rafael, 16°07'58" N, 91°43'34" W, 1 490 m, cloud forest, leaf litter, 08-09-2006, Rodríguez-Palma 2972; *ibid.*, 06-10-2006, Estrada-Torres 11312.

Discussion

The Mexican material shows characters that fit perfectly with the descriptions of the species given by Bjørneckær and Klinge (1963), Coon (1907), Ing (1999), Lister (1925), Martin and Alexopoulos (1969), and Seraoui (2008). *Cornuvia serpula* is easy to identify because of its small, sessile, bright yellow sporocarps or plasmodiocarps, its capillitium marked with prominent rings, and its banded-reticulate spores. Nevertheless, the studied specimens show some differences from the description given by Rammeloo (1983), who mentioned that the peridium is "rather thick, clear brownish (pale yellow and delicate in the Mexican specimens), and the capillitium in the Indian specimen studied by him had a diameter of 1.6-2.4 μm (1.9-3.1 μm in the Mexican specimens) with the rings up to 3.6 μm diameter (3.1-6.3 μm diameter in the Mexican specimens). However, the latter author considered that the specimens he studied from England and India belonged to one species, because of the great similarity of the spores, in spite of the capillitium and peridium differences that he observed. The Mexican specimens, in spite of the minor differences noted above, also conform to the circumscription of this morphospecies, although molecular studies could help to clarify whether specimens from different geographical areas represent similar species with small morphological differences, or if they are one variable species.

The unusual combination of characters makes the taxonomic position of *Cornuvia* uncertain. It was described originally in



Figures 1-8. *Cornuvia serpula*. 1, Sporocarps and plasmodiocarps. Bar= 1 mm (Estrada-Torres 11312); 2, plasmodiocarp. Bar= 1 mm (Rodríguez-Palma 2972); 3, threads of the capillitium as viewed with light microscopy. Bar= 5 μ m (Estrada-Torres-11312); 4, spores as viewed with light microscopy. Bar= 10 μ m. (Rodríguez-Palma-2972); 5-6, capillitium as viewed by SEM. Fig. 5 Bar= 20 μ m, Fig. 6 Bar= 10 μ m (Estrada-Torres-11312); 7-8, spores as viewed by SEM. Bars= 10 μ m (Estrada-Torres-11312).

the genus *Arcyria* (Wigand, 1863) as *A. serpula*, but it differs from other species in that genus in its sessile plasmodiocarpic habit, and having banded-reticulate spores, rather than finely warted spores as in most *Arcyria* species. Although *C. serpula* does not have spiral bands on the capillitium, Coon (1907) showed that the method of formation of the elaters was similar

to that observed in *Trichia fallax* (= *T. decipiens*), and this separated *Cornuvia* from the species of *Arcyria*. Lister (1925) included *C. serpula*, along with *Calonema*, *Hemitrichia*, *Oligonema*, and *Trichia*, in the family Trichiaceae because of the color and ornamentation of the spores, but other authors such as Ing (1999) prefer to include it in the family Arcyriaceae,

arguing that *C. serpula* has no spiral bands on the capillitium like most of the rest of the Trichiaceae. However, Neubert, Nowotny, and Bauman (1993) included *C. serpula* in the family Trichiaceae since the capillitium is birefringent by polarized light while the capillitium of members of the family Arcyriaceae is not. In spite of this, the majority of authors do not separate the 2 families, recognizing only the Trichiaceae, so *Cornuvia* would belong there (Keller & Braun, 1999; Lakhanpal & Mukerji, 1981; Martin & Alexopoulos, 1969). In a recent phylogenetic study using the SSU rRNA as molecular marker, Fiore-Donno, Clissmann, Meyer, Schnittler, and Cavalier-Smith (2013) found that a specimen of *C. serpula* from France is included in a monophyletic group which also includes some sessile species of *Trichia* and species of the genera *Metatrachia* and *Oligonema*, supporting to some extent the placing of *Cornuvia*, *Oligonema* and at least some species of *Trichia* in a separate family from *Arcyria*.

The Mexican collections of *C. serpula* were found in accumulated *Quercus* litter in a cloud forest. The microenvironment is similar to that reported by Seraoui (2008), accumulated litter of leaves and twigs of *Quercus* cf. *ilex*, who commented that all the European reports of the species have been associated with oaks. The leaves of *Q. ilex* are hairy on the underside just like the leaves of Mexican oaks, including the species on which the specimen of *C. serpula* was found. In many plant species, pubescent leaves can help to conserve water, can serve as a UV barrier to protect against excessive sun, and some produce essential oils (Molina-Montenegro, 2008). All of these characters could directly or indirectly favor the development of species like *C. serpula*. Ing (1999) pointed out that *C. serpula* is not frequently known in the British Isles and recorded only from a tannery in Cornwall, in piles of spent oak bark used for their tannic acid content. This microbially rich substrate was used by Coon (1907) in his observations of the life cycle of the species at the beginning of the last century. He germinated the spores in water and was able to describe germination, the swarm cells, and the small plasmodia that he found on the bark, washed onto glass, and photographed. He reported that the “true colour of the plasmodium is translucent white”, but that when feeding it becomes stained cream from the color of the food. He also observed sclerotium formation and morphogenesis of the sporocarps, so all stages of the life cycle from his first and “subsequent gatherings” (Coon 1907). Ing (1999) assumed that the disappearance of the species from the British Isles was associated with “the demise of tan-yards” and doubted it will be found again since this habitat no longer exists. Another observation made by Coon (1907) was that sporocarps of *C. serpula* in his cultures, unlike other myxomycetes, were formed partly submerged, having moved from the damp tan to the bottom of the Petri dish, and in the field were found “some inches from the surface, in wet or damp tan”. These observations led him to suggest that this system would limit its wind dispersal and perhaps was a reason for the rarity of this species. The new Mexican collections, found deep under piles of accumulated oak litter appear to support the observations made by Coon (1907), although the small inconspicuous sporocarps could be another reason why it has not been detected in the field before in the

Neotropics. This is in spite of the prevalence of the genus *Quercus* from Canada to Colombia, with around 160 species in Mexico alone (Valencia, 2004), and the intensive surveys for myxomycetes done in recent years (Estrada-Torres, Wrigley-de Basanta, Conde, & Lado, 2009; Lado, Estrada-Torres, Stephenson, Wrigley-de Basanta, & Schnittler, 2003). The field collections reported here along with the collection from moist chamber culture from Costa Rica (Rojas & Calvo, 2014) confirm the presence of this species in the Neotropics. So *C. serpula* could be a species of much wider distribution than worldwide records so far suggest, and be found in deep piles of litter, at least in the Northern Hemisphere, following the distribution of certain species of *Quercus* where a suitable microhabitat for its development appears to exist.

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