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A new freshwater species of Achlya from Tierra del Fuego Province, Argentina

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Abstract Achlya ambispora sp. nov. occurring on litter (floating dead leaves and twigs) in Las Cotoras stream, Tierra del Fuego Province, Argentina, is described and illustrated and compared with similar species. The species produces principally androgynous and monoclinous, rarely diclinous antheridial branches; oogonial wall and oospores are distinctly yellowish at maturity and differ from other species in having also 1–6(–22) centric-subcentric oospores, in oogonia sometimes apiculate, that are frequently intercalary or proliferate in chains.

Keywords Chromista; Achlya; new species; Argentina; systematics

INTRODUCTION

During a survey of Chromistan organisms on floating dead leaves and twigs in streams of Tierra del Fuego Province, Argentina, a new species belonging to Oomycota was found. It is unique in producing androgynous, monoclinous, and diclinous antheridial branches and 1–6(–22) centric-subcentric oospores.

It is here described as Achlya ambispora sp. nov. and illustrated.

This is the first contribution to the knowledge of the water moulds of Tierra del Fuego, the southernmost Province of Argentina. Very little is known about the Argentinian water moulds since the literature contains few references, principally about habitats of Buenos Aires Province (Beroqui de Martínez 1970; Steciow 1988, 1993a, 1993b, 1998).

MATERIAL AND METHODS

The method described by Johnson (1956, 1974) and Sparrow (1960) was used. Isolations were made from water samples, containing small dead twigs, decaying leaves, etc., brought into the laboratory and distributed in sterilised Petri dishes containing several halves of hemp seeds (Cannabis sativa). After growth of the fungus on the seeds a single hypha or spore was isolated and transferred to a weak medium (cornmeal agar). After 2–3 days a block of agar at the edge of the colony was cut off and placed in another sterilised Petri dish containing distilled water, with half a hemp seed on the agar block in order to obtain a new colony. Measurements and observations were made on that colony.

The type specimen is deposited in the Mycological Herbarium of Spegazzini Institute (LPS) and in its culture collection.

To study morphological variations caused by temperature effects, age of culture, and different sources of water, the cultures were examined after incubation at 10°C, 15°C, 25°C, and 31°C for 10, 15, and 30 days.

Diameters of fungus colonies, diameters of oogonia, number of oospores per oogonia, and diameters of oospores were calculated from 50 counts of each of 3 replicates (in distilled water and sterilised pond water). The total percentage of type of antheridial branches and type of oospores was calculated from all these replicates.

SPECIES DESCRIPTION

Achlya ambispora Steciow, sp. nov. Fig. 1–22

Mycelium densum, cultura in seminibus Cannabis sativa, 1–3 cm diam. Hyphae ramosae, pleraque 24–106 μm late in base. Sporangia copiosa in
Fig. 1-6  

Achlya ambispora. Fig. 1 Mycelium with oogonia and monoclinous and androgynous antheridial branches, PCM. Fig. 2 Terminal and intercalary gemmae, PCM. Fig. 3 Oogonia with diclinous and androgynous antheridial branches, PCM. Fig. 4 Oogonia proliferating in chains, PCM. Fig. 5 Zoosporangia, PCM. Fig. 6 Intercalary oogonia with monoclinous antheridial branch. Scale bars: Fig. 1-5 = 100 μm; Fig. 6 = 50 μm.

Fig. 7-14  

Achlya ambispora. Fig. 7 Detail of androgynous and monoclinous antheridial branches. Fig. 8-10 Androgynous antheridial branches; antheridia apically appressed. Centric-subcentric oospores. Fig. 11 Lateral apiculate oogonia with diclinous antheridial branch. Fig. 12 Intercalar apiculate oogonia with monoclinous antheridial branch. Fig. 13-14 Oogonia with 1–several centric-subcentric oospores inside. Scale bars: Fig. 7, 14 = 50 μm; Fig. 8-13 = 10 μm.
culturis juvenilibus, filiform vel naviculata, 250–
650 (−995) μm longa et 15–44 μm lata, symphoa vel
basipeta. Ejecto sporarum pro genus typica, spori
globosi 10–12 μm. Gemmae frequentis. Oogonia
copiosa, sphaerica, pyriform, doliform, rarissimo
apiculata, (30–)48–80 (−110) μm diam ramulus
lateralibus, intercalarius vel terminalibus
provenientia, 12–114 μm diam. Paries oogoni sine
projectionibus, oospori 1–6 (−22) per oogonium,
centrici (80%) ad subcentrici (20%), (16–)20–27 (−
29) μm diam. Ramulus antherialis, ramosus, plerumque
origine androgyna (60%) sed interdum monocolia
(30%) et diclia (10%).

HOLOTYPUS: In foliis et ramis dejectis non
determinatis, Arroyo Las Cotorras, Departamento de
Ushuaia, Provincia de Tierra del Fuego, Argentina;
M. Steciow, 5 Dec 1997, LPS no. 45528; culture
collection no. 619 (Spagazzini Institute).

Mycelium limited or extensive, denser near periph-
ery of the colony; 2-week-old hemp seed colony, 1–
3 cm diam., principal hyphae branched, slender to
stout, 24–106 μm at the base. Gemmae abundant in
old colonies, filiform or irregular, terminal or inter-
calary, single or in chains, germinating by a slender
hypha or functioning as zoosporangia. Zoosporanga
moderately abundant in young colonies, filiform or
naviculata, 250–650 (−995) μm × 15–44 μm (taken
at the widest point), proliferating sympodially,
cymosely or in basipetalal succession. Zoospore
discharge achloryd (from primary and secondary
zoosporangia); spore cluster persistent or not at exit
pore, remaining as an irregular clump at the tip of
the sporangium. Encysted spores globose, 10–12 μm
diam. Oogonia very abundant, lateral, occasionally
terminal or intercalary, spherical, pyriform or dolio-
form, sometimes apiculate, (30–)48–80 (−110) μm
diam. Oogonal wall smooth, without projections,
yellowish at maturity, pitted only at the point of at-
tachment of antherial cells; inner surface occasional-
ly irregular. Oogonial stalks usually stout, straight,
rarely bent, 12–114 μm diam. (½–2 times the diam-
eter of the oogonium in length). Antherial branches
always present. Antherial cells simple, apically
apressed. Fertilisation tubes not observed. Oospores
centric (80%) or subcentric (20%), always maturing,
not filling the oogonium, sphaerical, or ellipsoid; 1–
6–22 in number; (16–)20–27 (−28) μm. Antherial
branches 60% androgynous, 30% monocolia; 10% diclia,
frquently branched.

ETYMOLOGY: From the Latin, ambio meaning both,
sporum meaning spore; referring to the dimorphic
nature of the oospores (sexual resting spores).

SPECIMEN EXAMINED: ARGENTINA, Tierra del
Fuego Province, Ushuaia Department, Las Cotorras
stream, on unidentified dead leaves and branches; M.
M. Steciow, 5 Dec 1997, LPS 45528, culture collec-
tion no. 619.

MORPHOLOGY: It is important to note that the types
of oospores and antherial branches and the meas-
urements of oogonia and oospores are very constant
features of this species. There was little variation in
type and size of zoosporangia in different tempera-
ture and water conditions; they were filiform and
reached a mean range of length of 350–600 μm. The
shape of oogonia remained constant, mainly spheri-
cal, rarely pyriform, sometimes apiculate.

This species did not grow at 31°C, which is re-
lated to the original habitat conditions where this
species was found (5°C). The initial growth rate was
faster at 25°C (in sterilised pond water and distilled
water), but after 10 days there was little difference
in mean diameter of colonies from the other two

### Table 1 Ranges of morphological measurements of *Achyla ambispora* grown at 3 temperatures for 10 days.

<table>
<thead>
<tr>
<th>Temp. °C</th>
<th>Colony diam. (cm)</th>
<th>Oogonia diam. (μm)</th>
<th>Oospores diam. (μm)</th>
<th>Oospores per oogonium</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>3</td>
<td>38–51</td>
<td>18–23</td>
<td>(1) 2–3 (7)</td>
</tr>
<tr>
<td>10</td>
<td>1.5–3</td>
<td>(38) 49–52</td>
<td>20–26</td>
<td>(1) 2–5</td>
</tr>
<tr>
<td>25</td>
<td>2.3</td>
<td>46–51 (59)</td>
<td>23–26</td>
<td>(1) 2–4 (5)</td>
</tr>
</tbody>
</table>

*Fig. 15–22 Achyla ambispora.* *Fig. 15–17* Detail of filiform zoosporangia with characteristic discharge achloryd; spore cluster persistent, remaining as an irregular clump. *Fig. 18* Oogonium with centric oospores. *Fig. 19–22* Details of oogonia with subcentric oospores. Scale bars: *Fig. 15* = 100 μm; *Fig. 16–19* = 50 μm; *Fig. 20–22* = 10 μm.
temperature regimes (Table 1). Cultures incubated at 25°C showed little further linear growth, while cultures at lower temperatures continued to grow to form larger colonies. At 5°C the colonies develop slender secondary hyphae, giving the colonies a denser aspect than they reached at higher temperatures (10 and 25°C).

Oogonial production was unaffected by the different temperatures; all developed oogonia, but mature oospores were less abundant at lower temperatures (principally at 5 and 10°C after 10–15 days) and the number of oogonia was lower at these temperatures. However, the number of zoosporangia at 5 and 10°C was higher than in cultures kept at 25°C.

At these temperatures and water types, production of gemmae was more abundant in older cultures. At 10–15 days, they were very scanty.

DISCUSSION

*Achlya ambispora* has close affinities to *A. racemosa* (Coker 1923; Johnson 1956). Both species have predominantly androgynous antheridal branches and some diclinous, a smooth oogonial wall, and the oospores are yellowish at maturity.

However, *A. ambispora* also has characteristic monoclinous branches and not exiguous ones, as develops in *A. racemosa*. In the Argentine species, the oogonia are sometimes apiculate and the oospores are centric-subcentric and 1–6(22) per oogonium, whereas in *A. racemosa* the oogonia are never apiculate and the oospores are only centric, 1–10 per oogonium (Johnson 1956, 1974).

This new species also differs from *A. apiculata*, which has mainly monoclinous antheridal branches and occasionally androgynous and diclinous ones, and the oospores are all subcentric within oogonia often apiculate, occasionally spherical or pyriform (rarely oval or irregular); the oospores are larger, (20–)35–40(–48) μm, and the oogonia stalks are bent, curved, or once-coiled (rarely straight as in *A. ambispora* (Johnson 1956).

*A. ambispora* appears to resemble *A. colorata*, but the latter has papillate oogonia with larger oospores and frequently immature oospheres, and androgynous, exiguous, and diclinous antheridal branches (Johnson 1956, 1973, 1974).

According to Johnson (1956) and Seymour (1970), the sexual features are important to characterise a particular species of Saprolegniaceae. Oospores of similar structure have been found in most species of *Achlya* (Johnson 1956) except *A. oblongata* and *A. treleaseana*. However, it is very common to see two types of oospores in several Saprolegnia species; *S. furcata*, *S. ferax*, *S. diclina*, and *S. uliginosa* have centric oospores, rarely subcentric ones, and *S. terrestris* has subcentric oospores, rarely centric ones (Seymour 1970).

This species did not show variability in types of antheridal branches, types of oospores, size and shape of oogonia, and number of oospores per oogonium, nor in frequency of these features at different conditions.

These features provide strong support for erecting the new species, and particularly the development of two types of oospores at maturity.

Oospores were observed leaving some hyphae from an old culture in a new water Petri dish (at 20°C) and germinating 4–5 days later. Both centric and subcentric oospores germinated within the oogonia, which had a broken wall. Of a total of 50 oospores observed, only 20 had germinated, previously fertilised, after 5 days.

Following the classification of Johnson (1956), *A. ambispora* would belong to the subgenus Centroachlya.

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