

The occurrence of *Achlya recurva* (Saprolegniales, Oomycetes) in hydrocarbon-polluted soil from Argentina

Mónica M. Steciow

Instituto de Botánica Spegazzini, 53 N° 477, 1900- La Plata, Buenos Aires, Argentina

Summary

Saprolegniaceae are ubiquitous filamentous water molds. They occur as saprotrophs or parasitic on aquatic and terrestrial plants and on aquatic animals, and a number of interesting fungi belonging to the Saprolegniaceae have been isolated from the soil. In the course of an investigation of the water molds in Argentina, an unusual species of *Achlya* was isolated once from soil collections. *Brassica napus* seeds were used as bait as well as for the maintenance of this fungus in gross water cultures.

Achlya recurva Cornu (Saprolegniales, Oomycetes), was isolated from a hydrocarbon-polluted soil (crude oil) in the neighborhood of an oil tank from a distillery (Ensenada, Buenos Aires Province). This species is reported, described and illustrated for the first time from Argentina. Remarks on the habitat are also made because it was never found in polluted areas.

Key words

Achlya recurva, Saprolegniales, Hydrocarbons, Soil, Pollution, Argentina

Presencia de *Achlya recurva* (Saprolegniales, Oomycetes) en suelo contaminado con hidrocarburos en Argentina

Resumen

Las Saprolegniáceas son mohos acuáticos filamentosos ubicuos. Se encuentran como organismos saprotrofos o parásitos sobre plantas y animales, acuáticos o terrestres, y un número de hongos interesantes pertenecientes a las Saprolegniáceas han sido aislados del suelo. En el curso de una investigación de los hongos acuáticos realizada en Argentina, una especie inusual de *Achlya* fue aislada del suelo una sola vez. Semillas de *Brassica napus* fueron usadas como cebos así como para el mantenimiento de este hongo en cultivos de agua. *Achlya recurva* Cornu (Saprolegniales, Oomycetes), fue aislada de un suelo contaminado con hidrocarburos (petróleo crudo) en las proximidades de un tanque con petróleo de una destilería (Ensenada, Provincia de Buenos Aires). Esta especie es citada, descrita e ilustrada por primera vez para la Argentina. Se mencionan también las características del habitat ya que nunca fue encontrada en áreas contaminadas.

Palabras clave

Achlya recurva, Saprolegniales, Hidrocarburos, Suelo, Contaminación, Argentina

Saprolegniaceae are ubiquitous filamentous water molds, and occur as saprotrophs on a wide variety of substrata, principally in fresh water; although a few species are parasitic on aquatic and terrestrial plants and on aquatic animals [1-3].

These zoosporic fungi are collected from fresh water, such as ponds, streams, stagnant pools, rivers, as well as a diversity of soil habitats, and are isolated with some baits that are introduced into the sampled water. In Argentina they are also found in all those habitats and in hydrocarbon-polluted waters of Santiago River and affluents [4-6].

However, some species have been found in water and soil polluted by municipal sewage wastes [7-12].

The aim of this paper is to report on a collection of *Achlya recurva* from a hydrocarbon-polluted soil sample obtained in the neighborhood of an oil tank in Argentina (Ensenada, Buenos Aires province). This soil has a high content of long chain n-alkanes (C12-C34) as a result of periodic oil spills.

Some previous collections of this taxon, taken from unpolluted soil and water samples, have been reported in different countries of Europe [1], in south-east England [13], in Iceland [14], in the United States [15] and in Brazil [16].

MATERIALS AND METHODS

Samples of the wet soil from the surroundings of a crude oil tank from the YPF distillery (Ensenada, Buenos Aires Province, Argentina) were brought back to the laboratory in separate sterile polyethylene bags. Once a month, 100-150 g samples of wet soil were collected from

Dirección para correspondencia:

Dra. Mónica M. Steciow
Instituto de Botánica Spegazzini, 53 N° 477, 1900-
La Plata, Buenos Aires, Argentina
Fax: (+54 21) 530189-255004
E-mail: anmabarr@isis.unlp.edu.ar

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ten different sites of the described area. The collections were made between August and November of 1993, because the soil in this area was affected by accidental oil spills from the tank during these months.

Ten grams of soil were placed in Petri plates and covered with sterile water. Five sterilized *Brassica napus* seeds were then added to each plate of the "gross cultures", some "baits" floated on the surface of the water, others were in direct contact with the soil.

After a week mycelium appeared on the seeds. This "infested" substratum was then transferred to fresh, sterile, distilled water for the formation and subsequent maturation of zoosporangia, oögonia and antheridia.

The frequency of appearance of the fungi (%) was estimated by the ratio of the number of seeds in which the fungi appeared to the 50 seeds used as baits.

RESULTS

Saprolegniaceae were not very abundant in this polluted habitat. Three species of water molds were isolated in this study: *Dictyuchus monosporus*, *Saprolegnia parasitica* and *A. recurva*.

The first two species were previously found in Argentina [4]. On the other hand, *A. recurva* is reported for the first time in this country.

D. monosporus was isolated in August, September and November, with a frequency of appearance of 16, 30 and 20 %, respectively.

S. parasitica was isolated in September and October, with a frequency of appearance of 14 and 20 %, respectively.

A. recurva was not very abundant in the mentioned habitat. It was collected only in November, and from 50 *Brassica napus* seeds used as baits added to 10 Petri dishes, it only occurred on 7 of them, so its frequency of appearance is of 14 %.

SPECIES DESCRIPTION

Achlya recurva Cornu. (Figures 1-3) Ann. Sci. Nat. Bot., Ser. 5, 15: 22. 1872.

According to Johnson's description [1], the "arched" oögonial stalks, obtuse wall ornamentations, and small number of oöspores of *A. recurva* are the only features mentioned by Cornu on which one can base a comparison. It has spherical oögonia with numerous protuberances and sometimes has a few atypical oögonia that are irregular in shape, with elongated protuberances.

Our isolate is characterized by having: a mycelium moderately extensive; gemmae rarely formed; zoosporangia clavate, filiform or fusiform moderately abundant; zoospore discharge achlyoid, aplanoid or dictyoid; spore cluster falling away in part from exit pore. Oögonia abundant, lateral or terminal; oögonial wall unpitted, densely covered with truncate wall ornamentations, usually 12-19 µm. long.; apex of ornamentations thin-walled; oögonial stalks 20-150 µm long.; stout, recurved or bent. Antheridial branches androgynous, monoclinal or diclinous. Oöspheres maturing. Oöspores eccentric, spherical or ellipsoidal, filling the oögonium; 1 [2-6] 10 µm in number; 14 [20-25] 35 µm diam.

Material examined: Argentina, Buenos Aires province, Ensenada ; leg. M.M. Steciow, XI-1993, LPS 45284.

Distribution and habitat: Cosmopolite. Predominantly in soil, occasionally in fresh water.

A. recurva has been found in a polluted soil near a crude oil storing tank from YPF distillery (Ensenada,

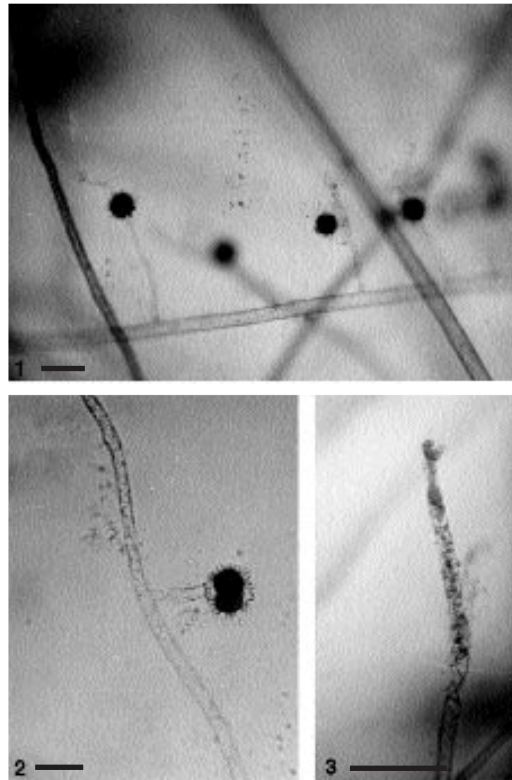


Figure 1-3. *Achlya recurva* Cornu; 1. Mycelium with ornamented oögonia, general aspect; 2. Oögonium with truncate wall ornamentations and immature oöspores; 3. Zoosporangium. Bars represent 100 µm in 1 & 3; 50 µm in 2.

Buenos Aires province, Argentina). The results of soil analysis show that there is a 20 % of total aliphatic hydrocarbons in the soil.

This species was previously collected on several occasions from unpolluted soils and it is more variable in certain features than expected [1]. *A. recurva* was reported as the most common species as well as *Achlya orion* and *Achlya flagellata* in 804 water and soil samples collected in 16 different Brazilian states from 1967 to 1985 [16].

In the isolate made in Michigan, United States [15], the oöspores were large (25-35 µm diam.) and few (2-4) in number. Among some isolates of *A. recurva* made in Iceland, representatives of this form have a preponderance of very large oögonia (65-88 µm diam.); the oöspheres are correspondingly large (25-28 µm) with up to 12 oöspores [14].

Nevertheless, these isolates show the two main characters of the species: dense, truncate wall ornamentation and predominantly androgynous antheridial branches.

In the Argentinian polluted area, the isolate fits the description made by other authors [1,15] in the diameter and number of oöspores, and in our material, monoclinal and diclinous antheridial branches are more predominant than the androgynous ones.

This is the first record of this species for Argentina, and it is important to remark the particular characteristics of the habitat in which this zoosporic fungus was found since it is a polluted soil, with a high content of hydrocarbons, especially n-alkanes.

DISCUSSION

Alkanes are generally considered to be easily biodegradable, the short-chain alkanes being degraded faster than the long-chain ones, and that branched-chain alkanes are less degradable than linear ones [17]. Oil entering a freshwater and soil ecosystem has two major effects on the indigenous microorganisms. It is toxic to some of them, whereas other microorganisms can use oil as a source of carbon and energy.

Little is known about the role in decomposition and community development of saprotrophic Chytridiomycetes and Oomycetes, the ubiquity and large numbers of which

testify to their potential importance [18].

Saprolegnia parasitica and some Chytridiomycetes were referred as fungi able to degrade oil hydrocarbons [19].

This contribution throws some light on a particular environmental condition in which *A. recurva* Cornu is able to survive, due to the fact that it may be an indigenous or probably immigrant species of aquatic origin, and spends all or part of its life cycle in stagnant water or in submerged muds.

For this reason *A. recurva* may belong to a microbial community with altered species diversity that is enriched in hydrocarbon-using organisms.

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