

## Checklist of Algerian fungi – Part 2: Chromistan Fungal Analogues (Oomycota, Bigyra, Cercozoa)

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### Abstract

This publication provides an updated checklist of Chromistan Fungal Analogues (CFA) in Algeria. This is a compilation of information on substrate and locality from where CFA fungi have been recorded, or original descriptions available. By screening all available bibliographic sources and herbaria (fungaria) catalogues it was possible to delineate 83 species of CFA belonging to 21 genera and from which several species have not been yet reported in the literature for Algeria. This checklist is the first comprehensive species list fully dedicated to Algerian Chromistan Fungal Analogues.

**Key words** – Mycobiota, Chromista, biodiversity, literature and herbaria catalogs survey, species list.

### Introduction

In 1981 Thomas Cavalier-Smith established kingdom Chromista with 6 phyla, distinguished from Plantae because of its more complex chloroplast-associated membrane topology and rigid tubular multipartite ciliary hairs. In 2017, Cavalier-Smith discussed the Kingdom Chromista and proposed eight phyla as a new synthesis emphasis. Kirk *et al.* (2008) estimated the Chromistan fungal analogues (CFA) as 1039 known species and included the phyla *Hyphochytriomycota*, *Labyrinthista*, and *Oomycota* along with some taxa of uncertain position (*incertae sedis*).

The first written contribution on CFA from Algeria dates back to 1846, when Durieu (1846) reported the observation of 3 species in *Cryptogamie* volume of the *Flore d'Algérie*, based on reports made by members of the Scientific Commission for the Exploration of Algeria from which the mycologists Louis-René Tulasne (1815-1885), Charles Tulasne (1816–1884) and Joseph-Henri Lévillé (1796-1870) were in charge of the fungi. After that, it took not less than 40 years to resume Algerian CFA inventory with the contributions of Saccardo and Berlese (1886), Saccardo (1888), Jaczewski (1893), Patouillard (1897a,b, 1903), Hennings (1902) who increased the number of CFA taxa occurring in Algeria to 8.

But the greatest contribution to the knowledge of the fungi of Algeria and consequently of the CFA is undoubtedly due to the French botanist and mycologist René Maire (1878-1949) who collected plants for study in Algeria and Morocco between 1902 and 1904 before settling

permanently in Algeria as professor of botany at the Faculty of Sciences in Algiers (1911-1949). Before his installation in Algeria he already described 8 taxa of Chromista of which 5 were new to Algeria (Maire 1906).

As soon as he was installed in Algeria he reported the observation of 28 taxa of CFA of which several new to Algeria in his series of contributions entitled *Schedae ad Mycothecam Boreali-Africanam* (1912-1919) describing briefly the 401 fungal specimens included in his *exsicata* distributed under name “*Mycotheca boreali Africana*” (1912-1919). After that he published several contributions reporting CFA taxa observations (Maire *et al.* 1926; Maire 1927, 1933, 1945; Maire and Wilczek 1936). In this later contribution he reported the observation of *Peronospora crucianellae* Maire new to science.

After the considerable contribution of Maire the inventory of Algerian CFA in Algeria marked a long break only briefly interrupted by the discovery in 1950 of *Labyrinthula algeriensis* new to science (Hollande and Enjumet 1955).

The inventory of Algerian CFA did not resume until the 1980s period during which Bernard Paul a professor at the University of Oran in Algeria invested himself on the knowledge of the aquatic and phytopathogenic fungi of Algeria. He reported during his stay in Algeria (1976-1990) the observation of a great number of CFA taxa of which several were new to science (Paul 1982, 1983, 1984, 1985, 1986 a,b,c, 1987a, b, 1988 a,b, 1990; 2000; Paul and Baghdadi 1984,1985, Paul and Bouziheb 1986; Paul and Zourkane 1987, Paul *et al.* 1992).

In the same period the Romanian mycologist Anghel Richiteanu who stayed 2 years in the city of Blida near Algiers reported the observation of 41 taxa of parasitic fungi including 18 CFA taxa of which several were new to Algeria (Richiteanu 1991). His results therefore have been published. Only later in the 2010s were published the first contributions of Algerian researchers (most often phytopathologists) reporting the observation of CFA taxa of which some new to Algeria (Corbière *et al.* 2010; Lazreg 2015; Lazreg *et al.* 2013, 2016; Benabdelkader and Ghechi 2013; Benabdelkader *et al.* 2015; Rekad *et al.* 2017; Smahi *et al.* 2017).

Next to the inventory established on literature analysis it was possible to collect useful informations on Algeria CFA by scrutinizing the online catalogs of herbaria some of which Madrid, Montpellier, MPU, PC and BUCM hold a great number of specimens of CFA collected from Algeria including several unpublished news species for Algeria.

## Materials and Methods

Algeria, ca. 2.4 million km<sup>2</sup> in area, is the largest country of Africa since the partition of Sudan in 2011. It is situated to the north of this continent, its entire northern coastline stretches for ca. 1200 km along the southern boundary of the Mediterranean Sea, while inland it is delimited clockwise, along a boundaries totalling ca. 6400 km, by Tunisia, Libya, Niger, Mali, Mauritania, Sahrawi Arab Democratic Republic and Morocco. The country, which is mainly mountainous with an average altitude of 800 m, stretches from north to south (18°57'N to 37°08'N) to a distance of ca. 2000 km and from west to east (08°39'W to 12°00'E) to a distance of ca. 2100 km; the western parts of Algeria are only ca. 160 km from the Atlantic Ocean. The Mediterranean coastline and the two major mountain ranges, the Tell Atlas and the Saharan Atlas, delimitates southwards three major topographic and climatic regions (1) the Tell, (2) the Hauts-Plateaux and (3) the Sahara (Fig. 1).

The Tell region, stretching only 80-190 km inland, includes the coastal strip and the Tell Atlas mountains (Tellian Atlas), that consist of narrow coastal plains, hills and mountains. The annual precipitation ranges from semi-arid (400-600 mm) to moderately humid with an increasing gradient from west to east where some permanent wetland areas occur. Although this region represents only ca. 4% of the Algerian territory, it includes 70% of the country's agricultural soils and hosts 65% of the population. The natural vegetation of this area is typically Mediterranean and many of the mountain slopes are covered with dense forest or scrub of mainly

oaks (*Quercus suber*, *Q. ilex*, *Q. coccifera*), junipers (*Juniperus oxycedrus*, *J. thurifera*, *J. phoenicea*), aleppo pine (*Pinus halepensis*) and Atlas cedar (*Cedrus atlantica*).

The Hauts-Plateaux area is essentially a huge basin, ca. 950 km in length, lying at an altitude of ca. 1000 to 1400 mm between the parallel mountain ranges of the Tell Atlas to the north and the Saharan Atlas to the south. This basin, which is 190 km at its widest point, includes a series of depressions running along a central south-west to north-east axis that support in some places shallow saline wetlands (Chotts and Sebkhass), which are seasonally flooded and become more saline as they gradually dry out. The region covers 13% of the country and hosts 26.5% of its population. The annual precipitation of the region is ca.150-400 mm and agriculture is limited to the cultivation of salt-tolerant cereals; natural vegetation is represented mainly by steppes of *Stipa tenacissima*, *Artemisia herba-alba* and *Lygeum spartum*.

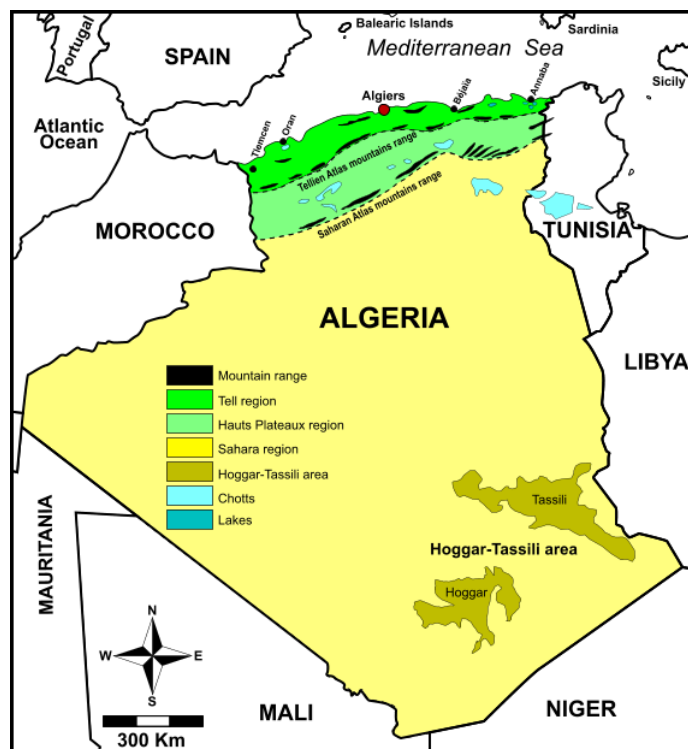


Figure 1. Major biogeographical/bioclimatic regions of Algeria (see text for details)

The Saharan area is essentially a vast arid to desertic area characterized by very little rainfall (< 100 mm per annum) and only ephemeral streams. The Sahara desert is not homogenous and takes on many forms. In the far north-west it consists of stony and gravely desertic high land known as the Hamada du Draâ. Eastwards, the southern slopes of the Saharian Atlas descend over a distance of c. 250 km to a central depression at an altitude of 200-500 m running south-west to north-east and filled by extensive ergs (vast sandy desertic areas with mobile dunes). In the centre of the region the land rises up to the stony plateau of Tademait, while further south it drops away into the Tidikelt depression that lies at an altitude of less than 200 m. Southwards and eastwards of this depression, the land rises again through a series of mountains of different heights, including Mount Tahat (ca. 3000 m), the highest peak in Algeria. This mountainous area, with its deep canyons and high plateaux, delimitate the Hoggar-Tassili region that can be considered as a fourth topographic and climatic region of Algeria due to its situation that make it under the influence of the West African monsoon. The whole Saharan region covers 83% of the country, but hosts only 8.5% of its population in several oases developed from underground rivers or aquifers. Agriculture, in almost all cases limited to the

oases, is based on the cultivation of the date palm and food crops. Natural vegetation cover is very scarce and represented mainly by highly adapted bushes and trees.

### Data Collection

The species listed here were compiled from bibliographical and herbaria online databases sources. A main list of Algerian CFA has been developed and the taxa are given in alphabetical sequence of orders, families and genera. The names of authors of fungal taxa are abbreviated according to Kirk and Ansell (1992) and Kirk *et al.* (2008). Species of each group were given in a taxonomic sequence and accepted names are highlighted in bold. The systematic arrangement in the present list follows the system of classification of Cavalier-Smith (2017). Name corrections, authorities, and taxonomic assignments of all taxa reported in this work were checked against the databases Index fungorum ([www.indexfungorum.org](http://www.indexfungorum.org)) and Mycobank ([www.mycobank.org](http://www.mycobank.org)). Otherwise stated the taxa listed have been observed on aerial parts of the given plant hosts

### Abbreviations

**TA:** Tellian Atlas area, **HP:** High plateaux area, **SD:** Sahara desert area, and **WL:** Without locality.

**Herbaria:** BR: Botanical Garden Meise (Belgium), BUCM: Herbarium of the Bucharest Institute of Biological Sciences (Romania), M: Royal Botanical Garden of Madrid (Spain), MPU: Montpellier University (France), NY: New York Botanical Garden (USA), PC: Muséum d'histoire Naturelle de Paris (France), and UPS: Uppsala University (Sweden).

### Results

#### Checklist of Algerian Chromistan Fungal Analogues

##### Bigyra / Labyrinthulaceae

1. ***Labyrinthula algeriensis*** Hollande & Enjumet  
Hollande & Enjumet (1955)  
**TA:** Sea water – parasite of *Laminaria iberica* (phylum Ochrophyta).

##### Cercozoa / Plasmodiophoridae

2. ***Plasmodiophora brassicae*** Woronin  
Maire (1917a, 1926)  
**TA:** roots of *Cardamine parviflora*.
3. ***Sorosphaerula veronicae*** (J. Schröt.) Neuh. & Kirchn.  
Maire *et al.* (1926), Maire (1927)  
**TA:** *Veronica hederifolia* subsp. *maura* (= *V. hederifolia* subsp. *sibthorpioides*).
4. ***Spongospora subterranea*** (Wallr.) Lagerh.  
Ayoutantis (1924), Maire *et al.* (1926)  
**TA:** tubers of *Solanum tuberosum*.
5. ***Sporomyxa scauri*** L. Léger  
Léger (1907), Saccardo (1913), Maire *et al.* (1926)  
**WL:** Endoparasite of the beetle *Scaurus tristis*.

Oomycota / Albuginaceae

6. ***Albugo candida*** (Pers.) Roussel (syn. *Cystopus candidus*, *Uredo candida*)  
Durieu (1846), Saccardo & Berlese (1886), de Jacewski (1893), Hennings (1902),  
Maire (1906, 1917b, 1933), Tits (1925), Andreánszky (1934), Richiteanu (1991),  
[BUCM, M, MPU, PC, UPS]  
**TA HP SD:** *Capsella bursa-pastoris*, *Convolvulus tricolor*, *Diplotaxis* sp., *Filago  
pygmaea*, *Hirschfeldia geniculata*, *H. incana*, *Oligomeris subulata*, *Reseda alba*,  
*Savignya longistyla*, *Sinapis hispida* (= *Sinapis flexuosa*), *S. pubescens*, *Sisymbrium  
irio*, *S. runcinatum*.
7. ***Albugo capparis*** (de Bary) Kuntze (syn. *Cystopus capparidis*)  
Maire (1917b), [M]  
**TA:** *Capparis spinosa*.
8. ***Albugo lepigoni*** (de Bary) Kuntze  
[BR]  
**TA:** *Lepigonum rubrum* (= *Spergularia rubra*), *Spergula salina* (= *Spergularia  
marina*).
9. ***Pustula tragopogonis*** (Pers.) Thines (syn. *Albugo tragopogonis*, *Cystopus  
tragopogonis*)  
Saccardo (1888), Patouillard (1897a), Maire (1906, 1915), Richiteanu (1991), [BR,  
BUCM, M]  
**TA SD :** *Launaea nudicaulis*, *Phagnalon saxatile*, *Senecio vulgaris*.
10. ***Wilsoniana bliti*** (Biv.) Thines (syn. *Albugo bliti*, *Cystopus bliti*)  
Maire (1917b), [M]  
**TA:** *Amaranthus retroflexus*.
11. ***Wilsoniana portulacae*** (DC.) Thines (syn. *Cystopus portulacae*)  
Maire (1906, 1919, 1933), [M, MPU]  
**TA SD :** *Portulaca oleracea*.

Oomycota / Leptolegniaceae

12. ***Aphanomyces helicoides*** Minden  
Paul (1983)  
**SD:** River water.

Oomycota / Myzocytiopsidaceae

13. ***Protascus subuliformis*** P.A. Dang. (syn. *Protascus subuliformis* var. *maupasii*)  
Maupas (1915), Maire (1915b), Saccardo (1926)  
**TA:** Parasite of the nematods *Rhabditis teres* and *R. Giardii*.

\*Note: This species have been reported by Maupas (1915) from nematodes living among mosses used as packaging material for orvets (legless lizard) imported from France to Algeria.

Oomycota / Peronosporaceae

14. ***Bremia lactucae*** Regel  
Maire (1906), Richiteanu (1991), [BUCM]  
**TA:** *Galactites tomentosa*, *Hedypnois rhagadioloides*, *Senecio* sp., *Sonchus* sp.,  
*Sonchus oleraceus*.

15. *Hyaloperonospora camelinae* (Gäum.) Göker, Voglmayr, Riethm., Weiss & Oberw.  
(syn. *Peronospora camelinae*)  
Saccardo (1926), Constantinescu (1991), [BERN]  
TA: *Camelina microcarpa*  
\*Note : Cited in Saccardo for North Africa without precision of country while Constantinescu (1991) refer to a specimen collected in 1916 in Algeria and hold in BERN herbarium (Specimen 4191).
16. *Hyaloperonospora nesliae* (Gäum.) Göker, Riethm., Voglmayr, Weiss & Oberw.  
(syn. *Peronospora nesleae*)  
Maire (1927)  
HP: *Vogelia apiculata* (= *Neslia paniculata* subsp. *thracica*).
17. *Hyaloperonospora parasitica* (Pers.) Constant. (syn. *Botrytis parasitica*, *Peronospora parasitica*).  
Durieu (1846), Maire (1915, 1919), Constantinescu (1991), Richiteanu (1991), [M, BERN]  
TA: *Senecio vulgaris*, *Cheiranthus Cheiri* (= *Erysimum* × *cheiri*), *Sisymbrium irio*
18. *Peronospora astragalina* Syd.  
Richiteanu (1991), [BUCM]  
TA: *Astragalus* sp., *Astragalus pentaglottis* (= *A. echinatus*).
19. *Peronospora aestivalis* Syd.  
Richiteanu (1991), [BUCM]  
TA: *Medicago littoralis*, *Melilotus infestus*.
20. *Peronospora affinis* Rossmann  
Maire and Wilczek (1936), Richiteanu (1991)  
TA: *Fumaria capreolata*, *F. munbyi*.
21. *Peronospora alpestris* Gäum.  
Constantinescu (1991)  
TA: Ferns.
22. *Peronospora alsinearum* Casp.  
Maire (1915a), Richiteanu (1991), [M]  
TA: *Cerastium atlanticum*, *Stellaria media*.
23. *Peronospora arborescens* (Berk.) de Bary  
Maire (1915, 1927), [M]  
TA: *Papaver Rhoas*, *Hypecoum pendulum*.
24. *Peronospora asperuginis* J. Schröt.  
Maire (1919), [M]  
TA: *Asperugo procumbens*.
25. *Peronospora atlantica* Gäum.  
Constantinescu (1991)  
TA: *Cerastium atlanticum*.

- 26. *Peronospora calothea*** de Bary  
Maire (1906, 1919), El-Assfoury *et al.* (2013), [M]  
**TA:** *Asperula hirsuta*, *Galium aparine*.
- 27. *Peronospora cephalariae*** Vincens  
Battandier *et al.* (1914)  
**TA:** *Cephalaria mauritanica*.
- 28. *Peronospora chlorae*** de Bary  
Maire (1917b)  
**TA:** *Erythraea maritima* (= *Centaureum maritimum*).
- 29. *Peronospora conglomerata*** Fuckel  
Patouillard (1903), Maire (1916), [M]  
**TA:** *Geranium* sp., *Geranium lucidum*.
- 30. *Peronospora coronillae*** Gäum.  
Richiteanu (1991)  
**TA:** *Coronilla atlantica*.
- 31. *Peronospora coronopi*** Gäum.  
Richiteanu (1991)  
**TA:** *Coronopus didymus* (= *Lepidium didymum*).
- 32. *Peronospora crucianellae*** Maire  
Maire (1945), Constantinescu (1991), [MPU]  
**SD:** *Crucianella hirta*.
- 33. *Peronospora crustosa*** (Fr.) Fr. (syn. *Botrytis crustosa*, *Plasmopara nivea*)  
Durieu (1846), [BPI, M]  
**TA:** *Arbutus unedo*, *Smyrniium olusatrum*.
- 34. *Peronospora dipsaci*** Tul.  
Maire (1917b), [M]  
**TA:** *Dipsacus silvestris* (= *D. fullonum*).
- 35. *Peronospora euphorbiae*** Fuckel  
Maire (1915a), [M, MPU]  
**TA:** *Euphorbia peploides* (= *E. peplus* var. *minima*).
- 36. *Peronospora farinosa*** (Fr.) Fr. (syn. *Peronospora effusa*, *P. rumicis*, *P. vistulensis*)  
Maire (1906, 1916), Richiteanu (1991), [BUCM, M, MPU]  
**TA:** *Beta vulgaris*, *Chenopodium album*, *C. opulifolium*, *Rumex thyrsoides*, *Salsola kali*.
- 37. *Peronospora ficariae*** Tul.  
Patouillard (1903), Maire (1906), Richiteanu (1991), [BUCM]  
**TA:** *Ranunculus macrophyllus*, *R. trilobus*.
- 38. *Peronospora grisea*** de Bary  
Maire (1919), [M]  
**TA:** *Veronica tournefortii* (= *V. persica*).

- 39. *Peronospora lamii*** A. Braun  
Maire (1919), Richiteanu (1991), [BUCM, M]  
**TA:** *Lamium amplexicaule*.
- 40. *Peronospora leptoclada*** Sacc.  
Maire (1906)  
**TA HP:** *Helianthemum apertum* and *H. niloticum* (both = *H. ledifolium*).
- 41. *Peronospora polycarpi*** Mayor & Vienn.-Bourg.  
Richiteanu (1991), [BUCM]  
**TA:** *Polycarpon tetraphyllum*  
\*Note : According to Richiteanu (1991) this taxon have been already collected by Maire (1915a) on the same host under name *Peronospora scleranthi* Rabenh in Maire's mycothecam Africa-Boreali exsiccata.
- 42. *Peronospora radii*** de Bary (syn. *Peronospora radii* var. *epiphylla*, *P. radii* var. *foliicola*)  
Maire (1919), Richiteanu (1991), [BUCM, M, MPU]  
**TA:** *Chrysanthemum myconis* (= *Coleostephus myconis*), *C. segetum* (= *Glebionis segetum*).
- 43. *Peronospora scleranthi*** Rabenh. ex J. Schröt.  
Maire (1915a), [M]  
**TA:** *Polycarpon tetraphyllum*.
- 44. *Peronospora trifoliorum*** de Bary  
Maire (1915, 1919), Richiteanu (1991), [BUCM, M]  
**TA:** *Medicago murex*, *Trigonella foenum-graecum*.
- 45. *Peronospora trigonellae*** Gäum.  
Constantinescu (1991)  
**TA:** *Trigonella foenum-graecum*  
\*Note: According to Constantinescu (1991) this taxon correspond to the specimen labeled *Peronospora trifoliorum* De Bary in Maire's mycothecam Africa-Boreali exsiccata.
- 46. *Peronospora viciae*** (Berk.) de Bary (syn. *Peronospora pisi*)  
[MPU]  
**TA:** *Pisum sativum*
- 47. *Phytophthora capsici*** Leonian  
Benabdelkader and Ghechi (2013), Benabdlkader *et al.* (2015)  
**TA:** *Capsicum annuum*.
- 48. *Phytophthora cinnamomi*** Rands  
Smahi *et al.* (2017)  
**TA:** Soil under *Quercus suber* (cork oak).
- 49. *Phytophthora citrophthora*** (R.E. Sm. & E.H. Sm.) Leonian  
Laundon and Waterston (1964), Laviola *et al.* (1990), Evoli (2016).



- 50. *Phytophthora cryptogea*** Pethybr. & Laff.  
Azouaoui-Idjer *et al.* (2012)  
**HP:** Roots of *Cupressus sempervirens*
- 51. *Phytophthora gonapodyides*** (H.E. Petersen) Buisman  
Smahi *et al.* (2017), NCBI  
**TA:** Soil under *Quercus suber* (cork oak)
- 52. *Phytophthora infestans*** (Mont.) de Bary  
Corbière *et al.* (2010), Rekad *et al.* (2017), El Houcine *et al.* (2017)  
**TA:** *Solanum tuberosum*, *S. lycopersicon*.
- 53. *Phytophthora multivora*** P.M. Scott & T. Jung  
Smahi *et al.* (2017)  
**TA:** Soil under *Quercus suber* (cork oak).
- 54. *Phytophthora palmivora*** (E.J. Butler) E.J. Butler  
[MPU]  
**WL:** *Phoenix dactylifera*.
- 55. *Phytophthora quercina*** T. Jung  
Smahi *et al.* (2017)  
**TA:** Soil under *Quercus suber* (cork oak)
- 56. *Plasmopara smyrnii*** Savul. & M. Bechet  
[NY]  
**TA:** *Smyrniium olusatrum*  
\*Note : This taxon have been identified in 1989 by O. Constantinescu (1933–2012) after examination of a specimen labeled *Plasmopara nivea* (Ung.) Schröt from a Maire's mycothecam Africa-Boreali exsiccata exemplar held by New York Botanical Garden.
- 57. *Plasmopara viticola*** (Berk. & M.A. Curtis) Berl. & De Toni  
Patouillard (1897b), Richiteanu (1991), [BUCM]  
**TA:** *Vitis vitifera*.
- 58. *Pseudoperonospora urticae*** (Lib.) E.S. Salmon & Ware (syn. *Peronospora urticae*)  
Maire (1919), Richiteanu (1991), [M]  
**TA:** *Urtica urens*, *U. dioica*.

Oomycota / Pythiaceae

- 59. *Cystosiphon pythioides*** Roze & Cornu (syn. *Pythium pythioides*)  
Paul and Baghdadi (1985)  
**HP:** Pond water.
- 60. *Globisporangium carolinianum*** (V.D. Matthews) Uzuhashi, Tojo & Kakish. (syn. *Pythium catenulatum*)  
Paul (1982)  
**SD:** River water containing organic matter.

- 61. *Globisporangium echinulatum*** (V.D. Matthews) Uzuhashi, Tojo & Kakish. (syn. *Pythium echinulatum*)  
Paul and Bouziheb 1986.  
**TA:** River water, Diseased cauliflower seedlings and soil from a greenhouse.
- 62. *Globisporangium glomeratum*** (B. Paul) Uzuhashi, Tojo & Kakish. (syn. *Pythium glomeratum*)  
Lazreg (2015), Lazreg *et al.* (2016)  
**TA:** Roots of *Pinus halepensis* seedlings growing in forest nurseries.
- 63. *Globisporangium heterothallicum*** (W.A. Campb. & F.F. Hendrix) Uzuhashi, Tojo & Kakish. (syn. *Pythium heterothallicum*)  
Lazreg (2015), Lazreg *et al.* (2016)  
**TA:** Roots of pine seedlings (*Pinus halepensis*) growing in nurseries.
- 64. *Globisporangium multisporum*** (Poitras) Uzuhashi, Tojo & Kakish. (syn. *Pythium multisporum*)  
Paul *et al.* (1984)  
**TA:** Pond water.
- 65. *Globisporangium pulchrum*** (Minden) Uzuhashi, Tojo & Kakish. (syn. *Pythium pulchrum*)  
Paul (1982)  
**SD:** Water from a tank in a date palm grove.
- 66. *Globisporangium ramificatum*** (B. Paul) Uzuhashi, Tojo & Kakish. (syn. *Pythium ramificatum*)  
Paul (1986a)  
**TA:** Dam water containing organic matter.
- 67. *Globisporangium rostratum*** (E.J. Butler) Uzuhashi, Tojo & Kakish.  
Paul (1983)  
**TA:** Soils and water samples.
- 68. *Globisporangium segnitium*** (B. Paul) Uzuhashi, Tojo & Kakish. (syn. *Pythium segnitium*)  
Malha *et al.* 2003 (unpublished) (NCBI accession KF831233)  
**WL:** Host/source of isolation not specified.
- 69. *Globisporangium toruloides*** (B. Paul) Uzuhashi, Tojo & Kakish. (syn. *Pythium polycarpum*, *Pythium toruloides*)  
Paul (1986b), Paul (1986c)  
**TA:** River water containing organic matter.
- 70. *Globisporangium ultimum*** (Trow) Uzuhashi, Tojo & Kakish. (syn. *Pythium ultimum*)  
Lazreg (2015), Lazreg *et al.* (2013, 2016)  
**TA:** Aleppo pine seedlings from nurseries.
- 71. *Pythium aphanidermatum*** (Edson) Fitzp.  
Paul and Zourkane 1987  
**HP:** Mixture of decaying green bean seeds and soil.

- 72. *Pythium aquatile*** Höhnk  
Paul (1982)  
**SD:** Freshwater in date palm grove.
- 73. *Pythium capillosum*** B. Paul (syn. *Pythium capillosum* var. *helicoides*)  
Paul (1987a), Paul (1988b)  
**HP:** soil.
- 74. *Pythium contiguanum*** B. Paul (syn. *Pythium dreschleri*)  
Paul (1988a, 2000)  
**TA:** Soil from saline area (Sebkha).
- 75. *Pythium cryptogynum*** B. Paul  
Paul (1990)  
**TA:** Reservoir water.
- 76. *Pythium diclinum*** Tokun.  
Paul *et al.* (1992)  
**TA:** diseased pine seedlings (*Pinus halepensis*) growing in a forest nursery
- 77. *Pythium ornamentatum*** B. Paul  
Paul (1987b)  
**TA:** soil.
- 78. *Pythium perillum*** Drechsler  
Paul & Macih (2000) NCBI accession AF203785)  
**WL:** Host/source of isolation not specified.
- 79. *Pythium torulosum*** Coker & P. Patt.  
Paul (1982)  
**SD:** River water (saprophyte of several freshwater algae)
- 80. *Pythium tracheiphilum*** Matta  
Paul *et al.* (1992)  
**TA:** diseased pine seedlings (*Pinus halepensis*) growing in a forest nursery

### Saprolegniaceae

- 81. *Achlya radiosa*** Maurizio  
Paul (1984)  
**TA:** Rivulets and river water.
- 82. *Saprolegnia diclina*** Humphrey  
Paul (1983)  
**TA:** river water.
- 83. *Saprolegnia ferax*** (Gruith.) Kütz.  
Paul (1983)  
**SD:** water from Irrigation canal under palm groove in a oasis

## Conflict of Interest

The authors do not have any conflicts of interest.

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