**Supplementary Table 1.** Isolates used in this study and respective secondary metabolite (SM) cluster prediction. All isolate genomes are available at the JGI MycoCosm data portal, except for *Basidiobolus meristosporus* B9252 and *Basidiobolus heterosporus* B8920 that were obtained from Chibucos et al. 2016. MycoCosm data for individual genomes can be accessed by appending Portal Id to ‘https://mycocosm.jgi.doe.gov/<Portal Id>”. NRPS: Non-ribosomal peptide synthetases. SM: Secondary metabolite core gene number PKS: Polyketide synthases, TC: Terpene Cyclases

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Isolate/Species** | **Phylum** | **Subphylum** | **Sample identifier** | **Genome size (Mb)** | **Number of gene models** | **SM** | **HYBRID** | **NRPS** | **NRPS-Like** | **PKS** | **PKS-Like** | **TC** | **Mycocosm Portal ID /NCBI accesion** | **References** |
| *Basidiobolus meristosporus B9252* | Zoopagomycota | Entomophthoromycotina | N161 | 103.9 | 13273 | 44 | 1 | 13 | 17 | 2 | 5 | 6 | GCA\_000697375.1 | Chibucos et al. (2016) |
| *Basidiobolus heterosporus B8920* | Zoopagomycota | Entomophthoromycotina | N168 | 47.63 | 9331 | 23 | 0 | 10 | 8 | 1 | 0 | 4 | GCA\_000697455.1 | Chibucos et al. (2016) |
| *Basidiobolus meristosporus CBS 931.73* | Zoopagomycota | Entomophthoromycotina | Basme2finSC | 89.49 | 16111 | 44 | 0 | 19 | 11 | 3 | 1 | 10 | Basme2finSC | Mondo et at. (2017)  |
| *Conidiobolus coronatus NRRL28638 v1.0* | Zoopagomycota | Entomophthoromycotina | Conco1 | 39.9 | 4790 | 13 | 0 | 1 | 7 | 0 | 3 | 2 | Conco1 | Chang et al. (2015) |
| *Conidiobolus thromboides FSU 785 v1.0* | Zoopagomycota | Entomophthoromycotina | Conth1 | 24.64 | 4266 | 8 | 0 | 0 | 4 | 1 | 1 | 2 | Conth1 | Unpublished |
| *Coemansia mojavensis RSA 71 v1.0* | Zoopagomycota | Kickxellomycotina | Coemoj1 | 14.29 | 6859 | 11 | 0 | 1 | 0 | 6 | 1 | 3 | Coemoj1 | Unpublished |
| *Coemansia reversa NRRL 1564 v1.0* | Zoopagomycota | Kickxellomycotina | Coere1 | 21.84 | 4069 | 11 | 0 | 1 | 0 | 6 | 2 | 2 | Coere1 | Chang et al. (2015) |
| *Coemansia spiralis RSA 1278 v1.0* | Zoopagomycota | Kickxellomycotina | Coespi1 | 18.93 | 4298 | 15 | 0 | 1 | 0 | 11 | 1 | 2 | Coespi1 | Unpublished |
| *Dimargaris cristalligena RSA 468 single-cell v1.0* | Zoopagomycota | Kickxellomycotina | DimcrSC1 | 30.78 | 3721 | 33 | 0 | 21 | 7 | 0 | 2 | 3 | DimcrSC1 | Ahrendt et al. (2018) |
| *Kickxella alabastrina RSA 675 v1.0* | Zoopagomycota | Kickxellomycotina | Kicala1 | 22.26 | 4190 | 7 | 0 | 0 | 1 | 2 | 2 | 2 | Kicala1 | Unpublished |
| *Linderina pennispora ATCC 12442 v1.0* | Zoopagomycota | Kickxellomycotina | Linpe1 | 26.2 | 4785 | 23 | 0 | 1 | 0 | 15 | 3 | 4 | Linpe1 | Mondo et at. (2017)  |
| *Martensiomyces pterosporus CBS 209.56 v1.0* | Zoopagomycota | Kickxellomycotina | Marpt1 | 19.82 | 4577 | 23 | 0 | 1 | 0 | 5 | 14 | 3 | Marpt1 | Unpublished |
| *Ramicandelaber brevisporus CBS 109374 v1.0* | Zoopagomycota | Kickxellomycotina | Rambr1 | 25.53 | 5177 | 5 | 0 | 0 | 1 | 1 | 1 | 2 | Rambr1 | Unpublished |
| *Smittium culicis ID-206-W2* | Zoopagomycota | Kickxellomycotina | SmiculW2\_1 | 71.05 | 5686 | 4 | 0 | 0 | 1 | 2 | 1 | NA | SmiculW2\_1 | Wang et al. (2017) |
| *Smittium culicis GSMNP* | Zoopagomycota | Kickxellomycotina | SmicuMNP\_2 | 77.12 | 6440 | 4 | 0 | 0 | 1 | 2 | 1 | NA | SmicuMNP\_2 | Wang et al. (2017) |
| *Smittium mucronatum ALG-7-W6* | Zoopagomycota | Kickxellomycotina | Smimuc2 | 102.35 | 4347 | 5 | 0 | 0 | 1 | 3 | 1 | NA | Smimuc2 | Wang et al. (2017) |
| *Zancudomyces culisetae COL-18-3* | Zoopagomycota | Kickxellomycotina | Zancul2 | 28.64 | 4222 | 5 | 0 | 0 | 1 | 0 | 3 | 1 | Zancul2 | Wang et al. (2017) |
| *Piptocephalis cylindrospora RSA 2659 single-cell v3.0* | Zoopagomycota | Zoopagomycotina | Pipcy3\_1 | 10.75 | 2143 | 3 | 0 | 0 | 0 | 0 | 1 | 2 | Pipcy3\_1 | Ahrendt et al. (2018) |
| *Syncephalis fuscata S228 v1.0* | Zoopagomycota | Zoopagomycotina | Synfus1 | 29.36 | 4726 | 5 | 0 | 1 | 0 | 0 | 1 | 3 | Synfus1 | Unpublished |
| *Syncephalis plumigaleata NRRL S24 v1.0* | Zoopagomycota | Zoopagomycotina | Synplu1 | 32.91 | 8130 | 4 | 0 | 1 | 0 | 0 | 1 | 2 | Synplu1 | Unpublished  |
| *Syncephalis pseudoplumigaleata Benny S71-1 single-cell v1.0* | Zoopagomycota | Zoopagomycotina | Synps1 | 16.27 | 2941 | 6 | 0 | 1 | 0 | 0 | 1 | 4 | Synps1 | Ahrendt et al. (2018) |
| *Thamnocephalis sphaerospora RSA 1356 single-cell v1.0* | Zoopagomycota | Zoopagomycotina | Thasp1 | 18.2 | 3697 | 4 | 0 | 0 | 1 | 0 | 1 | 2 | Thasp1 | Ahrendt et al. (2018) |
| *Rhizophagus irregularis DAOM 181602 v1.0* | Mucoromycota | Glomeromycotina | Gloin1 | 91.08 | 10868 | 7 | 0 | 1 | 0 | 0 | 1 | 5 | Gloin1 | Tisserant et al. (2013) |
| *Rhizophagus irregularis DAOM 197198 v2.0* | Mucoromycota | Glomeromycotina | Rhiir2\_1 | 136.81 | 11110 | 7 | 0 | 1 | 1 | 0 | 1 | 4 | Rhiir2\_1 | Chen et al. (2018) |
| *Rhizophagus irregularis A1 v1.0* | Mucoromycota | Glomeromycotina | RhiirA1\_1 | 125.87 | 11046 | 4 | 0 | 1 | 1 | 0 | 2 | NA | RhiirA1\_1 | Chen et al. (2018) |
| *Rhizophagus irregularis A4 v1.0* | Mucoromycota | Glomeromycotina | RhiirA4 | 138.3 | 10848 | 3 | 0 | 1 | 0 | 0 | 2 | NA | RhiirA4 | Chen et al. (2018) |
| *Rhizophagus irregularis A5 v1.0* | Mucoromycota | Glomeromycotina | RhiirA5 | 131.46 | 10893 | 2 | 0 | 1 | 0 | 0 | 1 | NA | RhiirA5 | Chen et al. (2018) |
| *Rhizophagus irregularis B3 v1.0* | Mucoromycota | Glomeromycotina | RhiirB3 | 124.89 | 10707 | 3 | 0 | 1 | 0 | 0 | 2 | NA | RhiirB3 | Chen et al. (2018) |
| *Rhizophagus irregularis C2 v1.0* | Mucoromycota | Glomeromycotina | RhiirC2 | 122.97 | 10677 | 4 | 0 | 1 | 1 | 0 | 2 | NA | RhiirC2 | Chen et al. (2018) |
| *Lobosporangium transversale NRRL 3116 v1.0* | Mucoromycota | Morteriellomycotina | Lobtra1 | 42.77 | 7348 | 6 | 0 | 1 | 0 | 1 | 1 | 3 | Lobtra1 | Mondo et at. (2017)  |
| *Mortierella elongata AG-77 v2.0* | Mucoromycota | Morteriellomycotina | Morel2 | 49.86 | 9032 | 6 | 0 | 0 | 3 | 0 | 1 | 2 | Morel2 | Uehling et al. (2017) |
| *Mortierella multidivaricata RSA 2152 T v1.0* | Mucoromycota | Morteriellomycotina | Mormul1 | 37.67 | 7462 | 7 | 0 | 0 | 3 | 1 | 1 | 2 | Mormul1 | Unpublished |
| *Mortierella verticillata NRRL 6337* | Mucoromycota | Morteriellomycotina | Morve1 | 41.85 | 8493 | 8 | 0 | 4 | 2 | 1 | 1 | NA | Morve1 | Broad Institute |
| *Mortierella sp. GBAus27b* | Mucoromycota | Morteriellomycotina | MorGBAus27b\_1 | 44.97 | 13953 | 21 | 0 | 3 | 13 | 1 | 1 | 3 | MorGBAus27b\_1 | Unpublished (Gregory Bonito) |
| *Absidia repens NRRL 1336 v1.0* | Mucoromycota | Mucoromycotina | Absrep1 | 47.42 | 8575 | 14 | 0 | 1 | 1 | 1 | 1 | 10 | Absrep1 | Mondo et at. (2017)  |
| *Backusella circina FSU 941 v1.0* | Mucoromycota | Mucoromycotina | Bacci1 | 48.65 | 9250 | 16 | 0 | 1 | 5 | 2 | 1 | 7 | Bacci1 | Unpublished |
| *Blakeslea trispora NRRL 2456 v1.0* | Mucoromycota | Mucoromycotina | Blatri1 | 37.51 | 6062 | 12 | 0 | 1 | 3 | 1 | 1 | 6 | Blatri1 | Unpublished |
| *Absidia padenii NRRL 2977 v1.0* | Mucoromycota | Mucoromycotina | Chlpad1 | 34.33 | 7616 | 11 | 0 | 1 | 1 | 0 | 0 | 9 | Chlpad1 | Unpublished |
| *Circinella umbellata NRRL1351 v1.0* | Mucoromycota | Mucoromycotina | Cirumb1 | 51.27 | 7773 | 12 | 0 | 0 | 4 | 1 | 1 | 6 | Cirumb1 | Unpublished |
| *Cokeromyces recurvatus NRRL 2243 v1.0* | Mucoromycota | Mucoromycotina | Cokrec1 | 28.12 | 5928 | 13 | 0 | 1 | 2 | 2 | 1 | 7 | Cokrec1 | Unpublished |
| *Cunninghamella echinulata NRRL 1382 v1.0* | Mucoromycota | Mucoromycotina | Cunech1 | 29 | 5915 | 10 | 0 | 1 | 0 | 1 | 1 | 7 | Cunech1 | Unpublished |
| *Dichotomocladium elegans RSA 919- v1.0* | Mucoromycota | Mucoromycotina | Dicele1 | 39.78 | 6567 | 8 | 0 | 0 | 1 | 1 | 1 | 5 | Dicele1 | Unpublished |
| *Fennellomyces sp. T-0311 v1.0* | Mucoromycota | Mucoromycotina | Fenlin1 | 45.9 | 7672 | 14 | 0 | 0 | 5 | 1 | 1 | 7 | Fenlin1 | Unpublished |
| *Gilbertella persicaria var. persicaria CBS 190.32-T v1.0* | Mucoromycota | Mucoromycotina | Gilper1 | 25.73 | 6150 | 12 | 0 | 1 | 3 | 1 | 1 | 6 | Gilper1 | Unpublished |
| *Gongronella butleri v1.0* | Mucoromycota | Mucoromycotina | Gonbut1 | 33.01 | 6298 | 12 | 0 | 1 | 2 | 1 | 1 | 7 | Gonbut1 | Unpublished |
| *Hesseltinella vesiculosa NRRL3301 v2.0* | Mucoromycota | Mucoromycotina | Hesve2finisherSC | 27.22 | 6117 | 11 | 0 | 1 | 2 | 1 | 1 | 6 | Hesve2finisherSC | Mondo et at. (2017)  |
| *Mucor cordense RSA 1222 v1.0* | Mucoromycota | Mucoromycotina | Kircor1 | 40.95 | 9104 | 22 | 0 | 1 | 7 | 2 | 1 | 11 | Kircor1 | Unpublished |
| *Lichtheimia corymbifera JMRC:FSU:9682* | Mucoromycota | Mucoromycotina | Liccor1 | 33.53 | 7358 | 13 | 0 | 0 | 5 | 1 | 1 | 6 | Liccor1 | Schwartze et al. (2014) |
| *Lichtheimia hyalospora v1.0* | Mucoromycota | Mucoromycotina | Lichy1 | 33.28 | 6757 | 15 | 0 | 0 | 6 | 1 | 1 | 7 | Lichy1 | Unpublished |
| *Mucor circinelloides CBS277.49 v2.0* | Mucoromycota | Mucoromycotina | Mucci2 | 36.6 | 11719 | 15 | 0 | 1 | 4 | 2 | 1 | 7 | Mucci2 | Corrochano et al. (2016) |
| *Mycotypha africana NRRL 2978 v1.0* | Mucoromycota | Mucoromycotina | Mycafr1 | 29.2 | 5937 | 11 | 0 | 1 | 1 | 2 | 1 | 6 | Mycafr1 | Unpublished |
| *Parasitella parasitica v1.0* | Mucoromycota | Mucoromycotina | Parpar1 | 32.77 | 6765 | 13 | 0 | 1 | 2 | 2 | 1 | 7 | Parpar1 | Unpublished |
| *Phascolomyces articulosus v1.0* | Mucoromycota | Mucoromycotina | Phaart1 | 47.61 | 7974 | 14 | 0 | 0 | 7 | 1 | 1 | 5 | Phaart1 | Unpublished |
| *Pilaira anomala RSA1997 v1.0* | Mucoromycota | Mucoromycotina | Pilano1 | 34.9 | 6925 | 13 | 0 | 1 | 3 | 1 | 1 | 7 | Pilano1 | Unpublished |
| *Pilobolus umbonatus NRRL 6349 v1.0* | Mucoromycota | Mucoromycotina | Pilumb1 | 34.77 | 5872 | 8 | 0 | 1 | 0 | 1 | 1 | 5 | Pilumb1 | Unpublished |
| *Radiomyces spectabilis NRRL 2753 v1.0* | Mucoromycota | Mucoromycotina | Radspe1 | 30.41 | 6228 | 13 | 0 | 0 | 3 | 1 | 1 | 8 | Radspe1 | Unpublished |
| *Rhizopus microsporus var. chinensis CCTCC M201021* | Mucoromycota | Mucoromycotina | Rhich1 | 45.74 | 10264 | 22 | 0 | 2 | 6 | 1 | 2 | 11 | Rhich1 | Wang et al. (2013) |
| *Rhizopus microsporus ATCC11559 v1.0* | Mucoromycota | Mucoromycotina | Rhimi\_ATCC11559\_1 | 24.08 | 5856 | 12 | 0 | 1 | 3 | 1 | 1 | 6 | Rhimi\_ATCC11559\_1 | Lastovetsky et al. (2016) |
| *Rhizopus microsporus var. microsporus ATCC52814 v1.0* | Mucoromycota | Mucoromycotina | Rhimi\_ATCC52814\_1 | 24.95 | 5849 | 13 | 0 | 1 | 3 | 1 | 1 | 7 | Rhimi\_ATCC52814\_1 | Lastovetsky et al. (2016) |
| *Rhizopus microsporus var. microsporus ATCC52813 v1.0* | Mucoromycota | Mucoromycotina | Rhimi1\_1 | 25.97 | 5811 | 12 | 0 | 1 | 3 | 1 | 1 | 6 | Rhimi1\_1 | Mondo et at. (2017)  |
| *Saksenaea vasiformis B4078* | Mucoromycota | Mucoromycotina | Sakvas1 | 42.5 | 5877 | 9 | 0 | 1 | 1 | 1 | 0 | 6 | Sakvas1 | Chibucos et al. (2016) |
| *Spinellus fusiger NRRL 22323 v1.0* | Mucoromycota | Mucoromycotina | Spifus1 | 38.2 | 5394 | 14 | 0 | 0 | 6 | 1 | 1 | 6 | Spifus1 | Unpublished |
| *Sporodiniella umbellata MES 1446 v1.0* | Mucoromycota | Mucoromycotina | Spoumb1 | 26.24 | 5768 | 15 | 0 | 1 | 6 | 1 | 1 | 6 | Spoumb1 | Unpublished |
| *Syncephalastrum racemosum:13706* | Mucoromycota | Mucoromycotina | Synrac1 | 30.75 | 11124 | 15 | 0 | 0 | 7 | 1 | 1 | 6 | Synrac1 | Mondo et at. (2017)  |
| *Mucor heterogamus NRRL 1489 v1.0* | Mucoromycota | Mucoromycotina | Zyghet1 | 54.49 | 14998 | 18 | 0 | 2 | 3 | 1 | 1 | 11 | Zyghet1 | Unpublished |
| *Mortierella humilis PMI\_1414* | Mucoromycota | Mucoromycotina | Morhum1 | 36.2 | 12012 | 10 | 0 | 3 | 2 | 1 | 1 | 3 | Morhum1 | Unpublished (Gregory Bonito) |
| *Rhizopus delemar 99-880 from Broad* | Mucoromycota | Mucoromycotina | Rhior3 | 46.1 | 17467 | 10 | 0 | 1 | 6 | 1 | 1 | 1 | Rhior3 | Ma et al. (2009) |
| *Phycomyces blakesleeanus NRRL1555 v2.0* | Mucoromycota | Mucoromycotina | Phybl2 | 53.9 | 16528 | 12 | 0 | 1 | 2 | 1 | 1 | 7 | Phybl2 | Corrochano et al. (2016) |
| *Umbelopsis ramanniana AG # v1.0* | Mucoromycota | Mucoromycotina | Umbra1 | 23.08 | 9931 | 12 | 0 | 1 | 4 | 0 | 1 | 6 | Umbra1 | Unpublished |