

Synchrospora gen. nov., a new Peronosporaceae genus with aerial lifestyle from a natural cloud forest in Panama

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Table S1. Details of isolates from *Synchrospora* and related oomycete genera considered in the phylogenetic studies. GenBank numbers for sequences obtained in the present study are printed in *italics*.

Species	Isolate codes ¹ ; status ²	Origin		GenBank accession numbers		
		Host / habitat	Location; year; collector; reference ³	ITS	LSU <i>βtub</i>	<i>cox1</i> <i>cox2</i>
<i>Aphanomyces euteiches</i>	ATCC 201684 = pea isolate	Root of <i>Pisum sativum</i>	Denmark; Funen; A.B. Petersen; Gaulin <i>et al.</i> 2018	OMPI01000392 ³	OMPI01000392 ⁴ OMPI01000009 ⁴	OMPI01000379 ⁴ OMPI01000379 ⁴
<i>Calycofera cryptica</i>	NBRC 32865; T	Yellow leaf of <i>Avicennia</i> sp.	Belize; 1996; n.a.; Bennett <i>et al.</i> 2017a	KY604972	KY604972 n.a.	KY604975 MF598483
<i>C. operculata</i>	ATCC 44952 = CBS 241.83 = IMI 249911 = NBRC 32629; T	Decaying leaf of <i>Avicennia marina</i>	Australia, Moreton Bay; 1980; K.G. Pegg & J.L. Alcorn; Bennett <i>et al.</i> 2017	KJ128038	JX115217 n.a.	KF853238 MF598482
<i>Elongisporangium anandrum</i>	CBS 285.31; A/T	<i>Rheum rhaponticum</i>	USA; C. Drechsler; Robideau <i>et al.</i> 2011	HQ643435	HQ665185 JAADXR010000031 ⁴	HQ708482 AB362328
<i>E. helicandrum</i>	CBS 393.54; A	<i>Rumex acetosella</i>	USA; n.a.; C. Drechsler; Lévesque & de Cock 2004	HQ643548	HQ665225 KJ595453	HQ708592 AB362329
<i>E. prolatum</i>	CBS 845.68; T	<i>Rhododendron</i> sp.	USA, Georgia; n.a.; W.A. Campbell; Lévesque & de Cock 2004	HQ643754	HQ665303 JAADVW010000542 ⁴	HQ708795 AB362330
<i>E. senticosum</i>	CBS122490	Soil, deciduous broadleaf forest	Japan, Takayama; 2009; Senda & Kageyama; Nguyen <i>et al.</i> 2022	HQ643773	HQ665093 JAADVQ010000246 ⁴	HQ708814 AB362317
<i>E. undulatum</i>	CBS 157.69 = IMI 323158	Soil under <i>Pinus</i> sp.	USA, Alabama; 1968; W.A. Campbell; Robideau <i>et al.</i> 2011	HQ643946	HQ665134 JAADV010000028 ⁴	HQ708987 KJ595348
<i>Globisporangium attrantheridium</i>	DAOM 230383			HQ643477	HQ665308 AB512819	HQ708524 AB512886
<i>G. middletonii</i>	CBS 528.74	Soil	The Netherlands; n.a.	AY598640	AY598640 KJ595457	HQ708738 AB362318
<i>G. minus</i>	CBS 226.88	Soil	UK, Berkshire; n.a.; G. Clark; Lévesque & de Cock 2004	HQ643696	HQ665168 KJ595446	HQ708740 AB362320
<i>G. multisporum</i>	CBS 470.50; T	Soil	USA, Illinois; A.W. Poitras; Lévesque & de Cock 2004	AY598641	HQ665239 KJ595455	HQ708744 AB362319
<i>G. paroecandrum</i>	CBS 157.64 = BPIC 1297	Loamy nursery soil	South Australia, Adelaide; 1962; O. Vaartaja; Uzuhashi <i>et al.</i> 2010	AY598644	AY598644 JAASFU010000644 ⁴	HQ708772 DQ071391
<i>G. rostratum</i>	CBS 533.74 = BR 649 = DAOM 229266	Soil	The Netherlands, Oostelijk Flevoland; 1971; A.J. van der Plaats-Niterink; Lévesque & de Cock 2004	AY598696	HQ665252 KJ595512	HQ708808 KJ595388
<i>G. spinosum</i>	CBS 275.67	Compost	The Netherlands, Baarn; n.a.; A.J. van der Plaats-Niterink; Lévesque & de Cock 2004	AY598701	HQ665181 JAADVN010000284 ⁴	HQ708834 KJ595366

Species	Isolate codes ¹ ; status ²	Origin	GenBank accession numbers			
		Host / habitat	Location; year; collector; reference ³	ITS	LSU <i>βtub</i>	<i>cox1</i> <i>cox2</i>
<i>G. splendens</i>	CBS 462.48	n.a.	USA; n.a.; J.T. Middleton; Lévesque & de Cock 2004	HQ643795	AY598655 AB512852	HQ708836 AB512921
<i>G. ultimum</i>	CBS122650	n.a.	France; n.a.; B. Paul; n.a.	HQ643864	HQ665103 KJ639291	HQ708905 KJ639199
<i>Halophytophthora avicennae</i>	BD635	Baiting; Rio Séqua estuary, Ria Formosa	Portugal, Tavira; 2015; T. Jung; Maia <i>et al.</i> 2022	OK033633	OK033575 OK091253	OK091198 OQ605397
<i>H. celeris</i>	CBS 147240 = BD885; T	Baiting; tidal channel in salt marsh, Ria Formosa	Portugal, Santa Luzia; 2015; T. Jung; Maia <i>et al.</i> 2022	OK033645	OK033587 OK091266	OK091210 OQ605398
<i>H. lusitanica</i>	CBS 147231 = BD686; T	Baiting; tidal pond in salt marsh, Ria Formosa	Portugal, Almancil; 2015; T. Jung; Maia <i>et al.</i> 2022	OK033663	OK033605 OK091284	OK091228 OQ605400
<i>H. macrosporangia</i>	CBS 147290 = BD639; T	Baiting; tidal channel in salt marsh, Ria Formosa	Portugal, Santa Luzia; 2015; T. Jung; Maia <i>et al.</i> 2022	OK033664	OK033606 OK091285	OK091229 OQ605401
<i>H. sinuata</i>	CBS 147237 = BD656; T	Baiting; tidal pond in salt marsh, Ria Formosa	Portugal, Santa Luzia; 2015; T. Jung; Maia <i>et al.</i> 2022	OK033671	OK033613 OK091293	OK091236 OQ605402
<i>H. thermoambigua</i>	CBS 147229 = BD651; T	Baiting; tidal pond in salt marsh, Ria Formosa	Portugal, Santa Luzia; 2015; T. Jung; Maia <i>et al.</i> 2022	OK033680	OK033622 OK091300	OK091244 OQ605403
" <i>Halophytophthora</i> " <i>exoprolifera</i> "	ATCC 76607 = CBS 252.93 = AN-1065 = IFO 32420; PT	Fallen leaf of <i>Bruguiera gymnorhiza</i>	Japan, Okinawa; 1988; A. Nakagiri; Ho <i>et al.</i> 1992	HQ643132	HQ665174 n.a.	HQ708205 n.a.
" <i>Halophytophthora</i> " <i>exoprolifera</i> "	JP1472	Fallen leaf in mangrove stand	Japan, Okinawa; 2018; T.Jung; this study	OQ600172	OQ600178 OQ605379	OQ605386 OQ605399
<i>Nothophytophthora amphigynosa</i>	CBS 142348 = BD268; T	Stream baiting in atlantic forest	Portugal, Sintra; 2015; T. Jung; Jung <i>et al.</i> 2017a	KY788382	OK047739 KY788515	OQ605387 OQ605404
<i>N. caduca</i>	CBS 142350 = CL328; T	Stream baiting in Valdivian rainforest	Chile, Valdivia; 2014; T. Jung; Jung <i>et al.</i> 2017a	KY788401	KY788470 KY788531	OQ605388 OQ605405
<i>N. chlamydospora</i>	CBS 142353 = CL316; T	Stream baiting in Valdivian rainforest	Chile, Valdivia; 2014; T. Jung; Jung <i>et al.</i> 2017a	KY788405	KY788450 KY788535	OQ616982 OQ605406
<i>N. intricata</i>	CBS 142354 = TJ275 = RK113-1s; T	Rhizosphere soil of <i>Aesculus hippocastanum</i>	Germany, Wiesbaden; 2011; T. Jung; Jung <i>et al.</i> 2017a	KY788413	OK047740 OQ605380	OQ605389 OQ605407
<i>N. irlandica</i>	CBS 147242 = PR13-109; T	Stream baiting	Ireland; 2014; R. O'Hanlon; O'Hanlon <i>et al.</i> 2021	MW364574	MW364589 MW367157	OQ605390 OQ605408
<i>Phytophthora castaneae</i>	ATCC 36818 = CBS 587.85 = IMI 325914 = WPC P15598	Soil	Taiwan; n.a.; H.S. Chang; Robideau <i>et al.</i> 2011	MH620122	KX251102 KX251098	MN883602 MH551178
<i>P. constricta</i>	CBS 125801 = CH 55C3 = TJ0306 = VHS 16130; T	Kwongan heathland	Australia, WA; 2006; VHS; Rea <i>et al.</i> 2011, Jung <i>et al.</i> 2022	ON000729	ON000635 OM975908	ON013795 OQ605409
<i>P. infestans</i>	CBS147289 = TJ1504 = T30-4; ET	Laboratory cross between <i>Solanum tuberosum</i> strains 80029 and 88133	The Netherlands; 1993; A. Drenth; Chen <i>et al.</i> 2022	MZ753914	OQ600179 MZ736454	MZ736428 OQ605410
<i>P. gallica</i>	CBS 111474 = CPHST BL35 = WPC P16826 = GAL1; T	Rhizosphere soil of riparian <i>Quercus robur</i>	France; 1998; T. Jung; Jung <i>et al.</i> 2022	MG865497	KX252594 KX252590	MH136893 HM534964
<i>P. pseudosyringae</i>	CBS 111772 = TJ1528 = WPC P10437 = PSEU6; T	Rhizosphere soil of <i>Q. robur</i>	Germany, Gerolzhofen; 1997; T. Jung; Chen <i>et al.</i> 2022	AY230190	KX250983 KX250979	OQ605391 OQ605411
<i>P. ×cambivora</i>	CBS141218 = IT 5-3 = TJ197; NT	Rhizosphere soil of <i>Quercus pubescens</i>	Italy, Sicily; 2013; T. Jung; Jung <i>et al.</i> 2017b	KU899179	OK033630 KU899255	MZ736422 OQ605412
<i>Phytophthora boreale</i>	CBS 551.88	Soil under <i>Brassica caulorapa</i>	China; n.a.; Y. Yang-nian; Robideau <i>et al.</i> 2011	HQ643372	HQ665261 EF408882	HQ708419 EF408876
<i>Ph. cucurbitacearum</i>	CBS 748.96 = IMI 333340	n.a.	Australia, Northern Territory; 1989; J. Duff; De Cock <i>et al.</i> 2015	HQ643381	AY598667 KJ595460	HQ708428 AB690680

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		Host / habitat	Location; year; collector; reference ³	ITS	LSU <i>βtub</i>	<i>cox1</i> <i>cox2</i>
<i>Ph. helicoides</i>	CBS 286.31; A/T	<i>Phaseolus vulgaris</i>	USA; n.a.; C. Drechsler; Robideau <i>et al.</i> 2011	HQ643383	HQ665186 JAADYE010000001 ⁴	HQ708430 DQ071377
<i>Ph. litorale</i>	CBS 118360; T	Soil of <i>Phragmites australis</i>	Germany, Lake Constance; 2003; J. Nechwatal; De Cock <i>et al.</i> 2015	HQ643386	HQ665082 JAADYB010001007 ⁴	HQ708433 KJ595418
<i>Ph. mercuriale</i>	CBS 122443 = STE-U 6204; T	Rhizosphere of <i>Macadamia integrifolia</i>	South Africa, Limpopo Province; n.a.; W.J. Botha; De Cock <i>et al.</i> 2015	AB725882	KF853236 KJ595466	KF853239 AB690666
<i>Ph. oedochilum</i>	CBS 292.37; A	–	USA; n.a.; C. Drechsler; Robideau <i>et al.</i> 2011	HQ643392	JAADXX010000902 ⁴ EF408883	JAADXX010000773 ⁴ JAADXX010000773 ⁴
<i>Ph. ostracodes</i>	CBS 768.73	Clay soil	Spain, Ibiza; 1972; A.J. van der Plaats-Niterink; Robideau <i>et al.</i> 2011	HQ643395	AY598663 EF408880	HQ708442 AB108013
<i>Ph. vexans</i>	CBS 119.80 = BR 484	Soil	Iran; 1985; D. Ershad; De Cock <i>et al.</i> 2015	HQ643400	HQ643400 JAADXV010000033 ⁴	HQ708447 GU133518
<i>Pilasporangium apinafurcum</i>	NBRC 105194 = MAFF 241059 = UZ300 ;T	Uncultivated soil	Japan, Wakayama; n.a.; n.a.; Uzuhashi <i>et al.</i> 2010	AB458660	AB458651 BCKD01000092 ⁴	MAFF 241059 CoxI ⁵ AB458820
<i>Pi. apinafurcum</i>	NBRC 105195 = MAFF 241060 = UZ301	Uncultivated soil	Japan, Wakayama; n.a.; n.a.; Uzuhashi <i>et al.</i> 2010	AB458657	AB458652 BCKE01000081 ⁴	MAFF 241060 CoxI ⁵ AB458818
<i>Pythium angustatum</i>	CBS 522.74	Soil	The Netherlands, Oostelijk Flevoland; A.J. van der Plaats-Niterink; Lévesque & de Cock 2004	HQ643437	AY598623 JAADXQ010000849 ⁴	HQ708484 KJ595387
<i>Py. aphanidermatum</i>	CBS 118.80	n.a.	n.a.; 1966; E. Laville; Lévesque & de Cock 2004	HQ643438	AY598622 JAADXP010001025 ⁴	HQ708485 JAADXP010000623 ⁴
<i>Py. conidiophorum</i>	CBS 223.88 = APCC 4005a	Soil	UK, Berkshire; n.a.; G. Clark; Lévesque & de Cock 2004	AY598629	HQ665166 KJ595486	HQ708555 KJ595361
<i>Py. deliense</i>	ATCC 12280 = CBS 314.33; A/T	Necrotic stem of <i>Nicotiana tabacum</i>	Indonesia, Sumatra; 1932; A. Meurs; Lévesque & de Cock 2004	HQ643522	HQ665204 KJ595497	HQ708568 KJ595372
<i>Py. insidiosum</i>	ATCC 58643 = CBS 574.85 = CDC B-4296; T	Horse	Costa Rica; before 1985; L. Mendoza; Robideau <i>et al.</i> 2011	HQ643570	HQ665273 KJ595515	HQ708614 AF196597
<i>Py. myriotylum</i>	CBS 254.70	<i>Arachis hypogaea</i>	Israel; n.a.; Z.R. Frank; Lévesque & de Cock 2004	HQ643701	AY598678 JAADWI010000209 ⁴	HQ708745 KJ595365
<i>Py. oligandrum</i>	CBS 382.34	Root of <i>Viola sp.</i>	UK; n.a.; C.G.C. Chesters; Robideau <i>et al.</i> 2011	HQ643715	HQ665223 JAADWG010000248 ⁴	HQ708759 KJ595381
<i>Py. vanterpoolii</i>	CBS 295.37; T	Root and stem base of <i>Triticum aestivum</i>	UK; 1936; T.C. Vanterpool; Robideau <i>et al.</i> 2011	HQ643952	HQ665193 JAADVD010000154 ⁴	HQ708993 JAADVD010000820 ⁴
<i>Saprolegnia parasitica</i>	CBS 223.65 = IMI 268364	Young <i>Esox lucius</i>	The Netherlands; 1965; A.J. van der Plaats-Niterink; n.a.	ADCG02001922 ⁴	ADCG02001922 ⁴ ADCG02000918 ⁴	ADCG02004126 ⁴ ADCG02004126 ⁴
<i>Synchytrium medusiformis</i>	CBS 149011 = PA229; T	Fallen leaf, tropical cloud forest	Panama, Volcano Baru; 2019; K. Broders & Y. Balci; this study	OQ600177	OQ600184 OQ605385	OQ605396 OQ605417
<i>S. medusiformis</i>	PA228	Fallen leaf, tropical cloud forest	Panama, Volcano Baru; 2019; K. Broders & Y. Balci; this study	OQ600173	OQ600180 OQ605381	OQ605392 OQ605413
<i>S. medusiformis</i>	PA230	Fallen leaf, tropical cloud forest	Panama, Volcano Baru; 2019; K. Broders & Y. Balci; this study	OQ600174	OQ600181 OQ605382	OQ605393 OQ605414
<i>S. medusiformis</i>	PA231	Fallen leaf, tropical cloud forest	Panama, Volcano Baru; 2019; K. Broders & Y. Balci; this study	OQ600175	OQ600182 OQ605383	OQ605394 OQ605415
<i>S. medusiformis</i>	PA232	Fallen leaf, tropical cloud forest	Panama, Volcano Baru; 2019; K. Broders & Y. Balci; this study	OQ600176	OQ600183 OQ605384	OQ605395 OQ605416
<i>Synchytrium sp.</i> ⁶	E14413A	Stem, <i>Croton alnifolius</i> in tropical cloud forest	Ecuador, Mindo; n.a.; n.a.; n.a.	KM265501	n.a.	n.a.

n.a. = not available.

¹ Abbreviations of isolates and culture collections: ATCC = American Type Culture Collection, Manassas, USA; BD, CL and TJ: Dr Thomas Jung's personal culture collection, housed at Mendel University in Brno, Czech Republic and the University of Algarve, Faro, Portugal; CBS = CBS collection at the Westerdijk Fungal Biodiversity Institute, Utrecht, Netherlands; CH: Chuanxue Hong laboratory at Virginia Polytechnic Institute and State University, Virginia Beach, VA, USA; CPHST BL: USDA-APHIS-PPQ-Center for Plant Health, Science & Technology-Beltsville Laboratory, Beltsville, MD, USA; IMI: CABI Biosciences, UK; JP, PA: Culture collection of Mendel University in Brno, Czech Republic; DAOM = Canadian National Mycological Herbarium, Agriculture and Agri-Food Canada, Ottawa, Canada; IFO = Institute for Fermentation, Osaka, Japan; MAFF: Research Center of Genetic Resources, NARO, Tsukuba, Japan; NBRC: NITE Biological Resource Center, Tokyo, Japan; VHS: Vegetation Health Service Collection, Department of Environment and Conservation, Perth, Australia; WPC = World Phytophthora Collection, University of California Riverside, USA; other isolate names and numbers are as given by the collectors and on GenBank, respectively.

² T, ex-type strain; ET, ex-epitype strain; NT, ex-neotype strain; PT, ex-paratype strain; A, authentic strain, identified by the author of the species; A/T, authentic strain, probably used for original description.

³ References:

Bennett, R.M.; de Cock, A.W.A.M.; Lévesque, A.; Thines, M. *Calycofera* gen. nov., an estuarine sister taxon to *Phytopythium*, Peronosporaceae. *Mycol. Prog.* **2017**, *16*, 947–954.

Chen, Q., Bakhshi, M., Balci, Y., Broders, K.D., Cheewangkoon, R., Chen, S.F., Fan, X.L., Gramaje, D., Halleen, F., Horta Jung, M., et al. (2022). Genera of phytopathogenic fungi: GOPHY 4. *Stud. Mycol.* **2022**, *101*, 417–564.

de Cock, A.W.A.M.; Lodhi, A.M.; Rintoul, T.L.; Bala, K.; Robideau, G.P.; Abad, Z.G.; Coffey, M.D.; Shahzad, S.; Lévesque, C.A. *Phytopythium*: molecular phylogeny and systematics. *Persoonia* **2015**, *34*, 25–39.

Gaulin, E.; Pel, M.J.C.; Camborde, L.; San-Clemente, H.; Courbier, S.; Dupouy, M.-A.; Lengellé, J.; Veyssiere, M.; Le Ru, A., Grandjean, F.; et al. Genomics analysis of *Aphanomyces* spp. identifies a new class of oomycete effector associated with host adaptation. *BMC Biology* **2018**, *16*, 43.

Ho, H.H.; Nakagiri, A. A new species of *Halophytophthora* from Atlantic and Pacific subtropical islands. *Mycologia* **1992**, *84*, 548–554.

Jung, T.; Scanu, B.; Bakonyi, J.; Seress, D.; Kovács, G.M.; Durán, A.; Sanfuentes von Stowasser, E.; Schena, L.; Mosca, S.; Thu, P.Q.; et al. *Nothophytophthora* gen. nov., a new sister genus of *Phytophthora* from natural and semi-natural ecosystems. *Persoonia* **2017a**, *39*, 143–174.

Jung, T., Horta Jung, M.; Scanu, B.; Seress, D.; Kovács, D.M.; Maia, C.; Pérez-Sierra, A.; Chang, T.-T.; Chandelier, A.; Heungens, A.; et al. Six new *Phytophthora* species from ITS Clade 7a including two sexually functional heterothallic hybrid species detected in natural ecosystems in Taiwan. *Persoonia* **2017b**, *38*, 100–135.

Jung, T.; Milenković, I.; Corcobado, T.; Májek, T.; Janoušek, J.; Kudláček, T.; Tomšovský, M.; Nagy, Z.; Durán, A.; Tarigan, M.; et al. Extensive morphological and behavioural diversity among fourteen new and seven described species in *Phytophthora* Clade 10 and its evolutionary implications. *Persoonia* **2022**, *49*, 1–57.

Lévesque, C.A.; de Cock, A.W.A.M. Molecular phylogeny and taxonomy of the genus *Pythium*. *Mycol. Res.* **2004**, *108*, 1363–1383.

Maia, C.; Horta Jung, M.; Carella, G.; Milenković, I.; Janoušek, J.; Tomšovský, M.; Mosca, S.; Schena, L.; Cravador, A.; Moricca, S.; et al. Eight new *Halophytophthora* species from marine and brackish-water ecosystems in Portugal and an updated phylogeny for the genus. *Persoonia* **2022**, *48*, 54–90.

Nguyen, H.D.T.; Dodge, A.; Dadej, K.; Rintoul, T.L.; Ponomareva, E.; Martin, F.N.; de Cock, A.W.A.M.; Lévesque, C.A.; Redhead, S.A.; Spies, C.F.J. Whole genome sequencing and phylogenomic analysis show support for the splitting of genus *Pythium*. *Mycologia* **2022**, *114*, 501–515.

O'Hanlon, R.; Destefanis, M.; Milenković, I.; Tomšovský, M.; Janoušek, J.; Bellgard, S.E.; Weir, B.S.; Kudláček, T.; Horta Jung, M.; Jung, T. Two new *Nothophytophthora* species from streams in Ireland and Northern Ireland: *Nothophytophthora irlandica* and *N. lirii* sp. nov. *PLoS ONE* **2021**, *16*, e0250527.

Rea, A.J.; Burgess, T.I.; Hardy, G.E.St.J.; Stukely, M.J.C.; Jung, T. Two novel and potentially endemic species of *Phytophthora* associated with episodic dieback of kwongan vegetation in the south-west of Western Australia. *Plant Pathol.* **2011**, *60*, 1055–1068.

Robideau, G.P.; de Cock, A.W.A.M.; Coffey, M.D.; Voglmayr, H.; Brouwer, H.; Bala, K.; Chitty, D.W.; Désaulniers, N.; Eggertson, Q.A.; Gachon, C.M.M.; et al. DNA barcoding of oomycetes with cytochrome c oxidase subunit I and internal transcribed spacer. *Mol. Ecol. Resour.* **2011**, *11*, 1002–1011.

Uzuhashi, S.; Tojo, M.; Kakishima, M. Phylogeny of the genus *Pythium* and description of new genera. *Mycoscience* **2010**, *51*, 337–365.

⁴ Genome sequence sourced from the GenBank Whole-Genome Shotgun contigs.

⁵ Sequences retrieved from the website “GeneBank Project, NARO” (https://www.gene.afrc.go.jp/databases-micro_search_en.php, accessed on 24 April 2023).

⁶ Submitted to GenBank as Fungal sp. E14413A.