

Table S5. Common pathogens causing damages on pines in European nurseries

Disease name/type	Pathogen name	Host Plant species*	Country of detection**	References
Pine Pitch Canker Disease	<i>Fusarium circinatum</i>	<i>Pinus elliotii</i> , <i>P. echinata</i> , <i>P. muricata</i> <i>P. palustris</i> , <i>P. radiata</i> , <i>P. tuberculata</i>	Canada, USA	1, 2
		<i>Pinus maximinoi</i> , <i>P. patula</i> , <i>P. tecunumanii</i>	Colombia	3
		<i>Pinus patula</i>	South Africa	4, 5
		<i>Pinus pinaster</i> , <i>P. radiata</i>	Portugal, Spain	6, 7
		<i>Pinus taeda</i>	Brazil, Uruguay	8, 9
		<i>Pinus radiata</i>	France, Chile	10,11
Other nursery diseases caused by <i>Fusarium</i> spp.	<i>Fusarium oxysporum</i> , <i>F. solani</i> , <i>Fusarium</i> sp., <i>F. stilboides</i> , <i>F. verticillioide</i>	<i>Pinus canariensis</i> , <i>P. eldarica</i> , <i>P. halepensis</i> , <i>P. nigra</i> , <i>P. pinaster</i> , <i>P. pinea</i> , <i>P. radiata</i> , <i>P. sylvestris</i>	Bulgaria, Denmark, Germany, Lithuania, Macedonia, Portugal, Romania, Russia, Spain, Sweden, Turkey, Ukraine	12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25
Cylindrocarpon Root Decay	<i>Cylindrocarpon</i> sp., <i>C. cylindroides</i> , <i>C. destructans</i> , <i>C. didymum</i> , <i>C. tenue</i>	<i>Pinus eldarica</i> , <i>P. halepensis</i> , <i>P. pinaster</i> , <i>P. pinea</i> , <i>P. sylvestris</i>	Portugal, Russia, Spain, Sweden	26, 27, 23, 28, 29
Charcoal root rot and Black root rot	<i>Macrophomina phaseolina</i>	<i>Pinus pinaster</i>	Israel, Portugal, Turkey	30, 31, 32
Phytophthora Damping-off and Root Rot	<i>P. cinamomi</i> , <i>P. cactorum</i> , <i>P. P. citricola sensu lato</i> , <i>P. citrophthora</i> , <i>P. crassamura</i> , <i>P. cryptogea</i> , <i>P. drechsleri</i> , <i>P. nicotianae</i> , <i>P. plurivora</i> , <i>P. pini</i> , <i>P. syringae</i>	<i>Pinus brutia</i> , <i>P. eliottii</i> , <i>P. halepensis</i> , <i>P. mugo</i> , <i>P. muricata</i> , <i>P. nigra</i> , <i>P. peuce</i> , <i>P. pinaster</i> , <i>P. pinea</i> , <i>P. radiata</i> , <i>P. strobus</i> , <i>P. sylvestris</i> , <i>P. wallichiana</i> , <i>Pseudotsuga menziesii</i> , <i>Picea abies</i>	Croatia, France, Germany, Hungary, Italy, Lithuania, Poland, Russia, Spain, Turkey	33, 34, 35, 36, 37
Pythium Root Rot	<i>Pythium aphanidermatum</i> , <i>P. intermedium</i> , <i>P. irregulare</i> , <i>Pythium</i> sp., <i>P. ultimum</i> , <i>Phytopyhtium vexans</i>	<i>Pinus butia</i> , <i>P. halepensis</i> , <i>P. nigra</i> , <i>P. nigra</i> subsp. <i>pallasiana</i> , <i>P. pinaster</i> , <i>P. pinea</i> , <i>P. radiata</i> , <i>Pinus</i> spp., <i>P. sylvestris</i>	Denmark, Portugal, Romania, Russia, Sweden, Turkey, Ukraine	14, 17, 18, 38, 23, 37, 39
Rhizoctonia Blight	<i>Rhizoctonia solani</i> , <i>Rhizoctonia</i> sp. (teleomorph, <i>Thanatephorus</i> or <i>Ceratobasidium</i>)	<i>Pinus nigra</i> , <i>P. nigra</i> subsp. <i>pallasiana</i> , <i>P. pinaster</i> , <i>P. pinea</i> , <i>P. sylvestris</i>	Bulgaria, Finland, Macedonia, Poland, Portugal, Turkey, Ukraine	13, 40, 41, 42,43, 17, 24, 25
Brown spot needle blight	<i>Lecanosticta acicola</i> (<i>Mycosphaerella dearnessii</i>)	<i>Pinus banksiana</i> , <i>P. echinata</i> , <i>P. glabra</i> , <i>P. halepensis</i> , <i>Pinus mugo</i> , <i>P. palustris</i> ., <i>P. palustris</i> x <i>P. taeda</i> , <i>P. pithyusa</i> , <i>P. ponderosa</i> , <i>P. pumila</i> , <i>P. rigida</i> , <i>P. serótina</i> , <i>P.</i>	Worldwide	44, 45, 46

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strobis, P. sylvestris, P. taeda, P. virginiana

Disease name/type	Pathogen name	Host Plant species*	Country of detection**	References
Dothistroma Needle Blight	<i>Dothistroma septosporum</i> (<i>Mycosphaerella pini</i>), <i>D. pini</i>	<i>Pinus aristata, P. attenuata, P. brutia, P. cembra, P. contorta, P. coulteri, P. densifolia, P. flexilis, P. jeffreyi, P. mugo, P. muricata, P. nigra</i> subsp. <i>laricio, P. pinaster, P. ponderosa, P. radiata, P. sylvestris, Pinus spp.</i>	Worldwide Lithuania, Sweden, Ukraine	47, 48, 49, 50, 51, 52
Needle blight	<i>Neocatenulostroma germanicum</i> (<i>Catenulostroma germanicum</i>)	<i>Pinus mugo, P. sylvestris, P. sylvestris</i> subsp. <i>pallasiana</i>	Lithuania, Ukraine	52
Sphaeropsis blight, Diplodia Shoot Blight, Canker and Collar Rot	<i>Sphaeropsis sapinea</i> (<i>Diplodia sapinea, D.pinea</i>)	<i>Pinus halepensis, P. leucoderma, P. mugo, P. nigra P. nigra</i> subsp. <i>laricio, P. pinaster, P.pinea, P. radiata, P. sylvestris</i>	Worldwide Estonia, Greece, Italy, Lithuania, Portugal, Slovak republic, Spain, Ukraine	53, 54, 55, 56, 57, 58, 26, 31, 59, 60, 39
NeedleCast	<i>Naemacyclus minor</i> (<i>Cyclaneusma minus</i>)	<i>Pinus mugo, P. nigra, P. ponderosa, Pinus sp., P. strobis, P. sylvestris</i>	Worldwide	61, 62
	<i>Lophodermium conigenum, L. pinastri, L. seditiosum, Lophodermium sp.</i>	<i>Pinus halepensis, P. nigra, P. nigra</i> subsp. <i>laricio, P. pinaster, P. pinea, P. radiata, Pinus sp., P. sylvestris</i>	Worldwide Bulgaria, Estonia, Finland, Macedonia, Poland, Portugal, Romania, Russia, Slovenia , Sweden, UK, Ukraine	63, 64, 65, 40, 41, 66, 67, 68, 17, 26, 69, 70, 71, 72, 73, 74, 25
	<i>Lophodermella sulcigena</i> (<i>Hypodermella sulcigena</i>)	<i>Pinus montana, P. sylvestris</i>	Russia	73
	<i>Rhizosphaera kalkhoffii</i>	<i>Picea spp, Pinus mugo, P. nigra, P. strobis, Pinus sylvestris</i>	Ukraine	39
	<i>Pestalotia hartigii, Pestalotia sp., Pestalotiopsis funerea, Pestalotiopsis sp.</i>	<i>Pinus halepensis, P. mugo, P. pinaster, P. pinea, Pinus spp., P. sylvestris</i>	Macedonia, Portugal, Spain, Ukraine	41, 26, 75, 39
Phoma Blight	<i>Phoma macrostoma, Phoma pini, Phoma sp.</i>	<i>Pinus eldarica, P. pinaster, P-sylvestris</i>	Ukraine, Spain, Turkey	22, 75, 24, 25
Scleroderris Canker (Brunchorstia disease)	<i>Gremmeniella abietina</i>	<i>Pinus contorta, Pinus spp., Pinus sylvestris</i>	Worldwide Estonia, Finland, Poland, Russia, Spain, Sweden	76, 77, 78, 79, 80, 81, 27, 82, 83, 84

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Sirococcus Shoot Blight		<i>Sirococcus conigenus</i> (= <i>Sirococcus stobilinus</i>)	<i>Pinus contorta</i> , <i>P. halepensis</i> , <i>P. nigra</i> var. <i>maritima</i> , <i>Pinus</i> spp., <i>P. sylvestris</i>	Spain, Sweden, UK	85, 86, 74
Caliciopsis canker		<i>Caliciopsis pinea</i>	<i>Pinus insignis</i> , <i>P. pinaster</i>	Italy	87
Disease name/type		Pathogen name	Host Plant species*	Country of detection**	References
Cenangium canker or Twig blight		<i>Cenangium ferruginosum</i> (= <i>C. abietis</i>), <i>Cenangium</i> sp.	<i>Pinus halepensis</i> , <i>Pinus</i> spp., <i>P. sylvestris</i>	Poland, Russia, Spain	67, 80, 27, 82
Phomopsis canker and foliar blight		<i>Phomopsis</i> sp.	<i>Pinus pinea</i> , <i>P. sylvestris</i>	Portugal, Ukraine	31, 25
Rusts	Twist rust	<i>Melampsora pinitorqua</i> , <i>M. larici-populina</i> , <i>Melampsora</i> sp.	<i>Pinus halepensis</i> , <i>P. nigra</i> , <i>P. pinea</i> , <i>P. sylvestris</i>	Finland, Italy, Macedonia, Russia, Slovenia, Sweden, Ukraine	88, 89, 90, 41, 91, 92, 86, 93, 39
	Needle rust	<i>Coleosporium pini</i> , <i>Coleosporium</i> spp., <i>C. tussilaginis</i> ,	<i>Pinus mugo</i> , <i>P. nigra</i> var. <i>maritima</i> , <i>Pinus</i> spp., <i>P. sylvestris</i>	Poland, Russia, UK	94, 69, 95
Snow molds	Brown felt blight	<i>Herpotrichia juniper</i> , <i>Typhula graminearum</i> , <i>T. incarnata</i> , <i>T. ishikariensis</i>	<i>Pinus nigra</i> , <i>Pinus</i> spp., <i>P. sylvestris</i>	Finland, Macedonia, Russia	40, 41, 69
	Snow blight	<i>Phacidium infestans</i>	<i>Pinus cembra</i> , <i>Pinus</i> spp., <i>P. sylvestris</i>	Estonia, Finland, Lithuania, Russia, Sweden	96, 40, 69, 97, 98
Gray mold		<i>Botrytis cinerea</i>	<i>Pinus mugo</i> , <i>P. nigra</i> , <i>P. sylvestris</i> , <i>Pinus</i> spp.	Bulgaria, Denmark, Macedonia, Poland, Portugal, Russia, Sweden, Ukraina	13, 99, 41, 100, 26, 74, 23, 25, 101
Other fungi isolated occasionally from seeds, seedlings, soil and irrigation water in pine nurseries (EPPO member countries)		<i>Acremonium</i> spp., <i>Alternaria alternata</i> , <i>Alternaria</i> sp., <i>Anthostomella pinea</i> , <i>Armillaria</i> spp., <i>Arthrinium</i> spp., <i>Aspergillus flavus</i> , <i>A. glaucus</i> , <i>A. niger</i> , <i>Aureobasidium pullulans</i> , <i>Cenangium ferruginosum</i> , <i>Cephalosporium</i> spp., <i>Cladosporium cladosporioides</i> , <i>Cl. herbarum</i> , <i>Chrysosporium pannorum</i> , <i>Coniothyrium fuckelii</i> , <i>Epicoccum nigrum</i> , <i>Fusarium moniliforme</i> , <i>F. redolens</i> , <i>Gliocladium roseum</i> , <i>Heterobasidion annosum</i> , <i>H. Irregulare</i> , <i>Lachnellula pini</i> , <i>Mucor</i> spp., <i>Nigrospora</i> sp., <i>Ophiostoma minus</i> , <i>Ostrachoderma</i> spp., <i>Paecilomyces farinosus</i> , <i>P. variotii</i> , <i>Penicillium chrysogenum</i> , <i>P. expansum</i> , <i>P. purpureum</i> , <i>Penicillium</i> spp., <i>Phoma fimeti</i> , <i>Rhizina undulata</i> , <i>Rhizopus nigricans</i> , <i>Rhizopus</i>	<i>Pinus contorta</i> , <i>P. eldarica</i> , <i>P. halepensis</i> , <i>P. mugo</i> , <i>P. nigra</i> , <i>P. pinaster</i> , <i>P. pinea</i> , <i>P. radiata</i> , <i>Pinus</i> spp., <i>P. sylvestris</i> , <i>P. uncinata</i>	Algeria, Belarus, Bulgaria, Czech Republic, Finland, Italy, Lithuania, Macedonia, Poland, Portugal, Romania, Russia, Slovakia, Slovenia, Spain, Sweden, Turkey, Ukraine, UK	102, 103, 12, 104, 40, 105, 57, 58, 106, 41, 67, 107, 108, 109, 17, 26, 31, 110, 68, 69, 74, 91, 111, 70, 75, 112, 113, 114, 23, 24, 115

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spp., *Sclerophoma pythiophila*,
Sclerotinia sclerotiorum,
Solenophoma pythiophilla,
Stemphylium spp., *Sydowia*
polyspora, *Telephora terrestris*,
Trichoderma viride, *T. koningii*,
Trichotecium roseum *Truncatella*
angustata, *T. hartigii*, *Ulocladium*
atrum, *Verticillium*
chlamydosporum, *Verticillium*
spp.

*Not all the coniferous species listed in a row were reported to be infected by all pathogen species, but at least by one of them.

** Not all pathogen species in a row were found in all listed countries, but at least in one of them.

Table. – Reports of Pine Pitch Canker Disease in pine nurseries from all over the world and reports of other fungal diseases of pine seedlings in nurseries from countries of the Euro-Mediterranean region. As for the pathogens with a worldwide distribution only reports on pine seedlings in nurseries from the Euro-Mediterranean region have been highlighted.

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