

**Supplementary Table 1.** Traits of 22 *Phytophthora* species detected in selected restoration and disturbed areas in the Great San Francisco Bay Area, California, as of 2017. List is partial, based on pre 2017 data, and newly discovered interspecific hybrids are not included.

	Trait (explanation below table)	<i>Phytophthora</i> spp.			
		<i>P. amnicola</i>	<i>P. bilorbang</i>	<i>P. borealis</i>	<i>P. cactorum</i>
1	Scopus Citations	3	4	2	490
2	Clade ( <i>per</i> Martin et al. 2014)	6 (subclade 2)	6 (subclade 2)	6 (subclade 2)	1a
3	Sporangial caducity	No	No	No	Yes
4	Breeding system	Sexually sterile	Homothallic	Heterothallic (self-sterile, A1 or A2)	Homothallic
5	Both Mating types	n/a	No	Not known	n/a
6	Sexual reproduction	n/a	n/a	n/a	n/a
7	T opt. (°C)	25-32.5	25	15	25
8	T max. (°C)	37.5	32.5	30-32.5	31
9	T min. (°C)	Not known	5	<5	2
10	pH	Not known	n/a	Not known	5.8-7.1
11	Host range	n/a	Angiosperms and some conifers	n/a	Very large (angiosperms and conifers, woody and herbaceous plants)
12	Geographic Range	Australia	France, Oregon, Australia, Italy	Alaska	Worldwide
13	In nurseries and gardens	No	Yes	No	Yes
14	In wildlands	Yes	Yes	Yes	Yes
15	Plant parts affected	n/a	Root rot	n/a	Root, stem, flowers, leaves, fruits, seedlings
16	Genetic variation	n/a	No	n/a	Yes, some clones. Geography and host
17	Number of genetically distinct groups	n/a	n/a	n/a	2 AFLP <sup>1</sup> subgroups
18	Chemical controls used (product name or active ingredient)	n/a	n/a	n/a	Phoxim, dimethomorph, calcium chloride, copper oxychloride, Fosetyl-Al, mfenoxam, phopshites, mancozeb, fenamidone,

18	Chemical controls used (product name or active ingredient)	n/a	n/a	n/a	Phoxim, dimethomorph, calcium chloride, copper oxychloride, Fosetyl-Al, mfenoxam, phopshites, mancozeb, fenamidone, essential oils, chlorine
19	Other control techniques	n/a	n/a	n/a	Straw mulch, <i>GlIOCadium</i> , <i>Bacillus</i> , <i>Enterobacter</i> , resistance, steam, biochar, composts, <i>Trichoderma</i> ,

	Trait	<i>Phytophthora</i> spp.			
		<i>P. × cambivora</i>	<i>P. chlamydospora</i>	<i>P. cinnamomi</i>	<i>P. citricola</i>
1	Scopus Citations	135	23	1059	195
2	Clade (per Martin et al. 2014)	7a	6 (subclade 2)	7b	2c
3	Sporangial caducity	No	No	No	No
4	Breeding system	Heterothallic	Heterothallic (self-sterile, silent A1)	Heterothallic	Homothallic
5	Both Mating types	Rare	Not known	Rare	n/a
6	Sexual reproduction	Rare	n/a	Rare	n/a
7	T opt. (°C)	22-24	25-28	20-32.5	25-28
8	T max. (°C)	32	36-37	30-36	31
9	T min. (°C)	2	5	5-15	3
10	pH	4.5-7	n/a	5.5-7.5	5-7 but also 9 and 3 may have broader range
11	Host range	Large (angiosperms and some conifers, ornamentals and woody trees)	Angiosperms and conifers, ornamental woody plants	Very large (conifers and angiosperms, woody and herbaceous plants)	Very large, conifers and angiosperms

12	Geographic Range	Worldwide	Worldwide	Worldwide	Worldwide
13	In nurseries and gardens	Yes	Yes	Yes	Yes
14	In wildlands	Yes	Yes	Yes	Yes
15	Plant parts affected	Root, root collar, stem, branch, seedlings	Root and collar rot, shoot and foliage blight	Root, root collar, stem, seedlings	Root, stem, flowers, leaves, fruits, seedling
16	Genetic variation	Differences between A1 and A2	n/a	Yes	Assemblage of multiple species
17	Number of genetically distinct groups	n/a	n/a	6, A1 and A2	4 in CA, host driven, AFLP <sup>1</sup> genotypes all different
18	Chemical controls used (a.i.)	Metalaxyl, fosetyl-Al, copper, phosphites	n/a	Metalaxyl, fosetyl-Al, calcium sulphate, phosphites	Phosphite (preventive), mfenoxam, methyl bromide, methyl iodide
19	Other control techniques	Resistance, solarization	n/a	Composts, <i>Phlomis purpurea</i> root extracts, Biofumigation with Brassicaceae.	Resistance <i>Bacillus</i> , <i>Phialocephala</i> , <i>Brassica juncea</i> (biofumigation)
20	Notes	Chlamydospor es infrequent. Harder to isolate in summer. Slugs may carry short distances. Distribution along drainages and roads. Cankers infected by wood decay. Progenitor of hybrids	Hybrids with relatives, common in riparian ecosystems and aquatic habitats	Listed as one of the 100 worst invasive alien species worldwide in the Global Invasive Species Database	Chlamydospor es rare. Infested water and soil as inoculum. Tolerance to mfenoxam in CA. Aerial cankers common. Snails and ants local vectors. It is uncertain whether <i>citricola</i> proper is present in California

	Trait	<i>Phytophthora</i> spp.			
		<i>P. crassamura</i>	<i>P. cryptogea</i>	<i>P. drechsleri</i>	<i>P. erythroseptica</i>
1	Scopus Citations	1	266	130	113
2	Clade (per Martin et al. 2014)	6 (subclade 2)	8a	8a	8a
3	Sporangial	No	No	No	No

	caducity				
4	Breeding system	Homothallic	Heterothallic	Heterothallic	Homothallic
5	Both Mating types	n/a	yes	Not known	n/a
6	Sexual reproduction	n/a	yes	n/a	n/a
7	T opt. (°C)	25	25	28-31	25
8	T max. (°C)	32.5-<35	33	35-37	34
9	T min. (°C)	5	3	5	2.5
10	pH	n/a	5.6-7.2	5-7	5-7
11	Host range	Angiosperms and conifers, woody and herbaceous plants	Very large, conifers and angiosperms, woody and herbaceous plants	Angiosperms and conifers, woody and herbaceous plants	Wide host range, ornamentals and herbaceous crop plants
12	Geographic Range	North America, Europe, Australia	Worldwide	Worldwide	Worldwide
13	In nurseries and gardens	Yes	Yes	Yes	Yes
14	In wildlands	Yes	Yes	Yes	No
15	Plant parts affected	Root and collar rot	Root, root collar, stem, seedlings	Root rot, stem cankers, fruit rot	Root, root collar, seed rot, leaf and petiole bight
16	Genetic variation	Yes, geography and host	Assemblage of multiple species	n/a	Low genetic diversity
17	Number of genetically distinct groups	2, mtDNA	4	n/a	n/a
18	Chemical controls used (a.i.)	Not known	Metalaxyl, fosetylal, calcium sulphate, phosphites	Metalaxyl, mancozeb, trichomix-HV, essential oils	Metalaxyl, Fosetyl-Al, copper, phosphites, zoxamide, azoxystrobin, hydrogen peroxide, trichodex, crop rotation
19	Other control techniques	Not known	Biological control with <i>Trichoderma viride</i> and <i>Pseudomonas fluorescens</i> , Binab T, Gliomix, Mycostop, solarization	Biological control with <i>Bacillus</i> , fluorescent <i>Pseudomonas</i> , <i>Rhizobacteria</i> , <i>Streptomyces</i> , solarization	Biological control with <i>Bacillus</i> spp. and <i>Streptomyces</i>
20	Notes	Previously misidentified as <i>P. megasperma</i>	Widespread in nursery and natural environments in Mediterranean regions. Species	Widespread in agricultural crops	

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	Trait	<i>Phytophthora</i> spp.			
		<i>P. gonapodyides</i>	<i>P. gregata</i>	<i>P. inundata</i>	<i>P. sp. kelmania</i>
1	Scopus Citations	51	11	18	5
2	Clade (per Martin et al. 2014)	6 (subclade 2 within Clade 6)	6 (subclade 2)	6 (subclade 1)	8a
3	Sporangial caducity	No	No	No	No
4	Breeding system	Heterothallic (self-sterile, silent A1)	Homothallic	Heterothallic (sterile, A1 or A2)	Heterothallic
5	Both Mating types	Not known	No	Not known	Not known
6	Sexual reproduction	n/a	n/a	n/a	n/a
7	T opt. (°C)	25-<30	25	28-30	n/a
8	T max. (°C)	30-<35	32.5-35	35-37	n/a
9	T min. (°C)	5	Not known	n/a	n/a
10	pH	n/a	Not known	n/a	n/a
11	Host range	Very large, angiosperms, ornamental and fruit plants	Angiosperms and conifers, woody plants	Angiosperms, woody and herbaceous plants	Very large, conifers and angiosperms.
12	Geographic Range	Worldwide	Worldwide	Worldwide	North America, Spain, Japan, Italy
13	In nurseries and gardens	Yes	Yes	Yes	Yes
14	In wildlands	Yes	Yes	Yes	No
15	Plant parts affected	Root, root collar, stem, seedlings	Root and collar rot	Root and collar rot, stem cankers	Root and collar rot
16	Genetic variation	Assemblage of multiple species	n/a	n/a	n/a
17	Number of genetically distinct groups	n/a	n/a	n/a	n/a
18	Chemical controls used (a.i.)	Not known	n/a	n/a	Not known
19	Other control techniques	Not known	n/a	Entomopathogenic fungus, <i>Metarhizium</i> spp.	Not known
20	Notes	Hybrids with relatives;	Hybridizes with relatives	Common in riparian	Species not yet formally

		Common in riparian ecosystems and aquatic habitats		ecosystems and aquatic habitats	described, closely related to <i>P. cryptogea</i> .
	Trait	<i>Phytophthora</i> spp.			
		<i>P. lacustris</i>	<i>P. megasperma</i>	<i>P. plurivora</i>	<i>P. quercetorum</i>
1	Scopus Citations	17	404	61	3
2	Clade (per Martin et al. 2014)	6 (subclade 2)	6 (subclade 2 within Clade 6)	2c	4
3	Sporangial caducity	No	No	No	No
4	Breeding system	Heterothallic (self-sterile, silent A1)	Homothallic	Homothallic	Homothallic
5	Both Mating types	Not known	n/a	n/a	n/a
6	Sexual reproduction	n/a	n/a	n/a	n/a
7	T opt. (°C)	28-33	25	25-28	22.5
8	T max. (°C)	37	30-32.5	32	32.5
9	T min. (°C)	2-4	5	3	5
10	pH	n/a	5-7	3.5-7.2	n/a
11	Host range	Angiosperms, fruit trees and ornamental plants	Very large, angiosperms and conifers, woody and herbaceous plants	Very large, conifers and angiosperms	Angiosperms ( <i>Quercus</i> spp.)
12	Geographic Range	Worldwide	Worldwide	Worldwide	Unites States, Europe
13	In nurseries and gardens	Yes	Yes	Yes	Yes
14	In wildlands	Yes	Yes	Yes	Yes
15	Plant parts affected	Root and collar rot, fruit rot	Root, root collar, stem lesion	Root, stem, flowers, leaves, fruits, seedling	Root rot
16	Genetic variation	Low genetic variability	AFLP genotypes all different. Assemblage of multiple species.	n/a	n/a
17	Number of genetically distinct groups	n/a	n/a	n/a	n/a
18	Chemical controls used (a.i.)	n/a	Metalaxyl, mefenoxan	Phosphite (preventive), mefenoxam, methyl bromide, methyl iodide	Not known
19	Other control	n/a	Biofumigation	Resistance,	Not known

	techniques		with <i>Brassica</i> spp.	<i>Bacillus</i> , <i>Phialocephala</i> , <i>Brassica</i> <i>juncea</i> (biofumigation).	
20	Notes	Species previously known as <i>Phytophthora</i> taxon PgChlamydo, Common in riparian ecosystems, hybrids with relatives	Hybrids with relatives; Species complex	Chlamydospores rare. Infested water and soil as inoculum. Tolerance to mefenoxam in CA. Aerial cankers common. Snails and ants local vectors.	Oak specific pathogen

	Trait	<i>Phytophthora</i> spp.			
		<i>P. riparia</i>	<i>P. tentaculata</i>		
1	Scopus Citations	2	8		
2	Clade (per Martin et al. 2014)	6 (subclade 2)	1b		
3	Sporangial caducity	No	Yes		
4	Breeding system	Sexually sterile	Homothallic		
5	Both Mating types	n/a	n/a		
6	Sexual reproduction	n/a	n/a		
7	T opt. (°C)	25-30	15-25		
8	T max. (°C)	40	34		
9	T min. (°C)	5	7		
10	pH	Not known	Not known		
11	Host range	n/a	Angiosperms, woody and herbaceous plants (not fully determined)		
12	Geographic Range	United States	Germany, Italy, Spain, China and North America – production areas – not wildlands		
13	In nurseries and gardens	No	Yes		
14	In wildlands	Yes	No		
15	Plant parts affected	n/a	Root and collar rot		



16	Genetic variation	n/a	n/a		
17	Number of genetically distinct groups	n/a	n/a		
18	Chemical controls used (a.i.)	n/a	Not known		
19	Other control techniques	n/a	Not known		
20	Notes	Species recently described, common in rivers and aquatic environments, hybridizes with relatives			

<sup>1</sup> AFLP stands for Amplified Fragment Length Polymorphisms. It is an approach to generate a large number of genetic markers that can be used for DNA fingerprinting and population genetic studies.

- 1)-Number of Scopus citations: Scopus (Elsevier publishing) is one of the largest abstract and citation databases of peer-reviewed literature: scientific journals, books and conference proceedings.
- 2)-Phylogenetic clade based on Martin et al. 2014 (Martin FN, Blair JE, Coffey MD. 2014. A combined mitochondrial and nuclear multilocus phylogeny of the genus *Phytophthora*. Fungal Genet Biol 66:19–32). A “clade” includes closely related species that share a common ancestor.
- 3)-Sporangial caducity: sporangia are the main infectious propagules of Phytophthoras: they are defined as caducous if they easily detach from the cell that bears them.
- 4)-Breeding system: homothallic (hermaphroditic) or heterothallic (outcrossing), mating occurs between individuals carrying different mating types (defined as A1 and A2).
- 5)-Both mating types co-mingled: individuals carrying A1 mating type and individuals carrying A2 mating type co-exist in the same site.
- 6)-Evidence for sexual reproduction: direct through observation of the formation of oospores or indirect through population genetics analyses.
- 7)-Growth temperature optima: optimal temperature for growth.
- 8)-Growth temperature maxima: temperature over which all growth is stopped.
- 9)-Growth temperature minima: temperature under which all growth is stopped.
- 10)-pH preferences: ideal acidity of soil, pH=6 is considered neutral. Soils with values over 6 are considered basic, soils with values under 6 are considered acidic.
- 11)-Host range (single plant family/multiple families): list of plants it can infect.
- 12)-Geographic range: area in which the pathogen is known to be present. Please note that absence in any given region may often be due to lack of surveying in that region.
- 13)-Detections in commercial nurseries or gardens.

14)-Wildland detections.

15)-Plant part affected (root, root collar, stem, foliage, seedling, and fruit).

16)-Intraspecific genetic variation (presence or absence): presence of populations of individuals within the species that have evolved in isolation and thus are genetically and phenotypically distinct (e.g. they may have different host range, different aggressiveness, different optimal temperature, etc.).

17)-Number of genetically distinct groups: see point 16 above.

18)-Chemical control. Active ingredient or a.i. used: list of chemical treatment options that have been used against that specific *Phytophthora*.

19)-Other disease control approaches such as biological control, silvicultural treatments, use of heat or steam, etc.

20)-Additional relevant information.