

Phytophthora, *Nothophytophthora* and *Halophytophthora* diversity in rivers, streams and riparian alder ecosystems of Central Europe

Tamara Corcobado^{1,2}, Thomas L. Cech², Andreas Daxer², Henrieta Ďatková¹, Josef Janoušek¹, Sneha Patra^{1,3}, Daniella Jahn², Christine Hüttler², Ivan Milenković^{1,4}, Michal Tomšovský¹, Marília Horta Jung^{1,5}, Thomas Jung^{1,5*}

¹Phytophthora Research Centre, Faculty of Forestry and Wood Technology, Mendel University in Brno, Zemědělská 3, 61300 Brno, Czech Republic; tamara.corcobado@mendelu.cz (T.C.); xdatkova@mendelu.cz (H.D.); janousek.jose@gmail.com (J.J.); (I.M) marilia.jung@mendelu.cz (M.H.J.); ivan.milenkovic@mendelu.cz (I.M.); michal.tomsovsky@mendelu.cz (M.T.)

²Federal Research and Training Centre for Forests, Natural Hazards and Landscape, Unit of Phytopathology, Department of Forest Protection, Seckendorff-Gudent-Weg 8, 1131 Vienna, Austria. tamara.corcobado@bfw.gv.at (T.C.); thomas.cech@bfw.gv.at (T.L.C.); andreas.daxer@bfw.gv.at (A.D.); daniela.jahn13@gmail.com (D.J.); christine.huettler@bfw.gv.at (C.H.).

³Global Change Research Institute of the Czech Academy of Sciences, Belidla 986/4a, 603 00 Brno, Czech Republic; snehampatra@gmail.com (S.P.)

⁴University of Belgrade, Faculty of Forestry, Kneza Višeslava 1, 11030 Belgrade, Serbia;

⁵Phytophthora Research and Consultancy, Am Rain 9, 83131 Nußdorf, Germany.

Table S1. *Phytophthora*, *Halophytophthora* and *Nothophytophthora* taxa isolated between 2014 and 2019 from 68 watercourses and 151 sampling sites in Austria, the Czech Republic and Slovakia using six sampling techniques.

| River no. | River, state | Sample type, host species (year) | <i>Phytophthora</i> , <i>Halophytophthora</i> and <i>Nothophytophthora</i> spp. (site codes) ^{a, b} |
|-----------|---|--|--|
| R01 | Alvier, Seebach, tributary of river Ill; Vorarlberg | baiting raft (2014) | 0 (39) |
| R02 | Danube, Lower Austria, Upper Austria | Bark canker <i>A. incana</i> (2014) | ×MUL (4) |
| | | Baiting raft (2014) | HYD, LAC (4) |
| | | Fine roots (2014) | LAC (4) |
| | | Baiting raft (2014) | GON, LAC (5) |
| | | Water filtration (2015) | 0 (6) |
| | | Baiting raft (2015) | LAC (7) |
| | | Baiting raft (2015) | LAC (8) |
| | | Baiting raft (2015) | LAC (9) |
| | | Baiting raft (2015) | 0 (10) |
| | | Water filtration (2016) | 0 (1) |
| R03 | Drau, tributary of river Danube; Salzburg | Water filtration (2016) | LAC, RIP (2) |
| | | Water filtration (2016) | LAC (3) |
| R04 | Einödgrabenbach, tributary of river Drau; Salzburg | Baiting raft (2015) | GON, LAC (15) |
| | | Baiting raft (2015) | 0 (16) |
| | | water filtration (2015) | 0 (16) |
| | | Rhizosphere soil <i>A. incana</i> , <i>A. glutinosa</i> (2019) | GON, LAC (12) |
| | | Floating fallen leaves (2019) | GON (13) |
| R05 | Enns, tributary of river Danube; Styria | Floating fallen leaves (2019) | 0 (14) |
| R05 | Enns, tributary of river Danube; Styria | Bark canker <i>A. incana</i> (2015) | 0 (19) |
| | | Bark canker <i>A. incana</i> (2015) | UNI (20) |
| | | Rhizosphere soil <i>A. incana</i> (2015) | PLU (20) |
| | | Rhizosphere soil <i>A. incana</i> (2015) | 0 (21) |
| | | Baiting raft (2015) | ×CHL, LAC (22) |
| | | Baiting raft (2015) | LAC (23) |
| | | Baiting raft (2015) | GON, LAC, PLU (24) |
| | | Baiting raft (2015) | GON, LAC, PLU (25) |
| | | Water filtration (2015) | 0 (26) |
| | | Rhizosphere soil <i>A. incana</i> (2019) | PLU, SYR (27) |
| R06 | Fugnitz, tributary of river Thaya; Lower Austria | Floating fallen leaves (2019) | GON, LAC (27) |
| | | Rhizosphere soil <i>A. glutinosa</i> (2015) | 0 (117) |
| R07 | Gschnitzbach, tributary of Inn; Tyrol | Rhizosphere soil <i>A. glutinosa</i> (2015) | 0 (118) |
| | | Baiting raft (2014) | 0 (46) |
| | | Rhizosphere soil <i>A. incana</i> (2014) | 0 (46) |
| | | Rhizosphere soil <i>A. incana</i> (2014) | UNI (49) |
| | | Bark canker <i>A. incana</i> (2014) | 0 (49) |
| | | Bark canker <i>A. incana</i> (2014) | 0 (51) |
| | | Bark canker <i>A. incana</i> (2014) | 0 (52) |
| | | Bark canker <i>A. incana</i> (2014) | 0 (53) |

| River no. | River, state | Sample type, host species (year) | <i>Phytophthora, Halophytophthora and Nothophytophthora</i> spp. (site codes) ^{a, b} |
|-----------|---|--|--|
| R08 | Gurk, tributary of Drau; Carinthia | Baiting raft (2015) Baiting raft (2015) | GON (29) 0 (30) |
| R09 | Ill, Voralberg | Baiting raft (2014) Baiting raft (2014) | 0 (41) 0 (42) |
| R10 | Inn, tributary of river Danube; Upper Austria, Tyrol | Baiting raft (2014) Baiting raft (2014) Rhizosphere soil <i>A. incana</i> (2014) Rhizosphere soil <i>A. incana</i> (2014) Bark canker <i>A. incana</i> (2014) Bark canker <i>A. incana</i> (2014) Water filtration (2015) Water filtration (2015) Water filtration (2016) | GON, LAC, UNI (47) 0 (48) GON (48) PLU (50) xALN (50) UNI (54) GON, LAC (43) GON (44) LAC (45) |
| R11 | Iisel, tributary of river Drau; Tyrol | Rhizosphere soil <i>A. incana</i> (2014) Bark canker <i>A. incana</i> (2014) | PLU (11) 0 (11) |
| R12 | Jaudlingbach, tributary of river Thaya; Lower Austria | Rhizosphere soil <i>A. incana</i> | PLU (121) |
| R13 | Kamp,tributary of Danube; Lower Austria | baiting raft (2014) Rhizosphere soil <i>A. glutinosa</i> (2014) Rhizosphere soil <i>A. glutinosa</i> (2014) Rhizosphere soil <i>A. glutinosa</i> (2014) Water filtration (2015) Rhizosphere soil <i>A. glutinosa</i> (2015) Rhizosphere soil <i>A. glutinosa</i> (2015) Water filtration (2016) Rhizosphere soil <i>A. glutinosa</i> (2019) Floating fallen leaves (2019) | LAC, PLU, xRIP (55) 0 (55) 0 (56) 0 (57) 0 (58) 0 (58) 0 (59) LAC (60) PLU (61) BIL, FLU, GON, LAC (61) |
| R14 | Krumme Steyerling, tributary of river Enns; Upper Austria | Baiting raft (2015) Rhizosphere soil riparian <i>A. incana</i> , <i>Populus</i> sp. and <i>Salix</i> sp. (2015) Baiting raft (2015) | CHL, GON, LAC, PLU, xRIP (31) CAC (31) GON (32) |
| R15 | Lafnitz, tributary of river Raab; Burgenland | Baiting raft (2014) Rhizosphere soil <i>A. glutinosa</i> (2014) | LAC (100) PLU (100) |
| R16 | Lainsitz, tributary of Elbe; Lower Austria | Rhizosphere soil <i>A. glutinosa</i> (2015) | PLU (120) |
| R17 | Lammer, tributary of river Salzach; Salzburg | Floating fallen leaves (2019) | GON, LAC (104) |
| R18 | Laue, tributary of river Drau; Tyrol | Rhizosphere soil <i>A. incana</i> (2014) Bark canker <i>A. incana</i> (2014) | 0 (18) 0 (18) |
| R19 | Leutascher Ache, tributary of river Danube; Tyrol | Baiting raft (2015) Baiting raft (2015) | GON (33) 0 (34) |
| R20 | Liesing, tributary of river Mur; Styria | Baiting raft (2015) Rhizosphere soil <i>A. glutinosa</i> (2015) Baiting raft (2015) | GON (35) PLU (35) CHL, GON (36) |
| R21 | Lonka; tributary of river Mur; Salzburg | Baiting raft (2014) | 0 (91) |
| R22 | Lungitzer Loben, tributary of river Lafnitz; Styria | Rhizosphere soil <i>A. glutinosa</i> (2014) Bark canker soil <i>A. glutinosa</i> (2014) Baiting raft (2014) Fine roots soil <i>A. glutinosa</i> (2015) | 0 (131) xALN (131) GON, LAC, PLU (131) POL (131) |
| R23 | Lünitzbach, tributary of river Möll; Carinthia | Floating leaves (2019) | GON, LAC (75) |
| R24 | Lutz, Lägerzunbach, tributary of river Ill; Voralberg | Baiting raft (2014) | LAC (40) |
| R25 | Marbach, tributary of river Danube; Upper Austria | Bark canker soil <i>A. glutinosa</i> (2014) Fine roots soil <i>A. glutinosa</i> (2015) | xALN, UNI (129) 0 (129) |
| R26 | March, tributary of river Danube; Lower Austria | Rhizosphere soil <i>A. glutinosa</i> (2014) baiting raft (2014) Water filtration (2015) Water filtration (2016) Water filtration (2016) | 0 (63) LAC (63) LAC (65) LAC (66) LAC (67) |
| R26 | March, tributary of river Danube; Lower Austria | Floating leaves (2019) Rhizosphere soil <i>A. glutinosa</i> (2019) Floating fallen leaves (2019) Rhizosphere soil <i>A. glutinosa</i> (2019) | BIL2, LAC (68) 0 (68) GON, LAC (69) PLU (69) |

| River no. | River, state | Sample type, host species (year) | <i>Phytophthora, Halophytophthora and Nothophytophthora</i> spp. (site codes) ^{a, b} |
|-----------|---|--|--|
| R27 | Möll, tributary of river Drau; Carinthia | Baiting raft (2014) Rhizosphere soil <i>A. incana</i> (2015) Water filtration (2015) Bark canker <i>A. incana</i> (2015) Bark canker <i>A. incana</i> (2015) Floating fallen leaves (2019) Rhizosphere soil <i>A. glutinosa</i> (2019) Floating fallen leaves (2019) Baiting raft (2019) | 0 (72) 0 (76) 0 (77) 0 (78) 0 (79) GON, LAC (73) 0 (73) 0 (74) LAC (77) |
| R28 | Mur, tributary of river Danube; Salzburg, Styria | Baiting raft (2014) Baiting raft (2014) Baiting raft (2014) Bark canker <i>A. incana</i> (2014) Baiting raft (2014) Water filtration (2015) Water filtration (2016) Water filtration (2016) Floating fallen leaves (2019) Rhizosphere soil <i>A. glutinosa</i> (2019) | 0 (84) 0 (86) GON (88) 0 (89) 0 (90) 0 (81) LAC (82) GON, LAC (83) GON, LAC, ×RIP (93) 0 (95) |
| R29 | Raab, tributary of river Danube; Styria, Burgerland | Baiting raft (2014) Rhizosphere soil <i>A. glutinosa</i> (2014) Water filtration (2015) Water filtration (2016) Water filtration (2016) | LAC (99) 0 (99) LAC (96) 0 (97) CHL, LAC, PLU (98) |
| R30 | Raggabach, tributary of river Möll; Carinthia | Bark canker <i>A. incana</i> (2015) | 0 (80) |
| R31 | Reißbach, tributary of river Lainsitz; Lower Austria | Bark canker soil <i>A. glutinosa</i> (2014) Fine roots soil <i>A. glutinosa</i> (2015) | ×ALN, ×MUL (128) 0 (128) |
| R32 | Riegersburgerbach, tributary of river Thaya; Lower Austria | Water filtration (2015) | 0 (119) |
| R33 | Rosenbach, tributary of river Drau; Carinthia | Baiting raft (2015) | 0 (17) |
| R34 | Rötzbach, tributary of river Mur; Styria | Floating fallen leaves (2019) | GON, LAC (94) |
| R35 | Salzach, tributary of river Danube; Salzburg, Upper Austria | Baiting raft (2014) Baiting raft (2014) Baiting raft (2014) Bark canker <i>A. incana</i> (2014) Rhizosphere soil <i>A. incana</i> (2014) Bark canker <i>A. incana</i> (2014) Bark canker <i>A. incana</i> (2014) Rhizosphere soil <i>A. incana</i> (2014) Water filtration (2015) Water filtration (2016) Floating fallen leaves (2019) Rhizosphere soil <i>A. glutinosa</i> (2019) | 0 (106) 0 (107) GON (108) ×ALN (109) PLU (109) 0 (110) 0 (111) 0 (111) GON (101) GON, LAC (102) 0 (103) GON (105) |
| R36 | Sipbach, tributary of river Traun; Upper Austria | Fine roots soil <i>A. glutinosa</i> (2015) | 0 (130) |
| R37 | Stempfelbach, tributary of river March; Lower Austria | Floating fallen leaves (2019) | BIL, GON, LAC, ×LAC (70) |
| R38 | Stiefernbach, tributary of river Kamp; Lower Austria | Floating fallen leaves (2019) | BIL, GON, LAC (62) |
| R39 | Thaya, tributary of river March; Lower Austria | Water filtration (2015) Baiting raft (2015) Rhizosphere soil <i>A. glutinosa</i> (2015) Water filtration (2015) Water filtration (2016) Water filtration (2016) | 0 (114) LAC (115) 0 (116) LAC (116) LAC (112) LAC, ×RIP (113) |
| R40 | Thomatalerbach, tributary of river Mur; Salzburg | Baiting raft (2014) | GON (92) |
| R41 | Traun, tributary of river Danube; Upper Austria | Baiting raft (2014) Rhizosphere soil <i>A. incana</i> (2014) Baiting raft (2014) Rhizosphere soil <i>A. incana</i> (2014) Rhizosphere soil <i>A. glutinosa</i> (2014) Water filtration (2015) Floating fallen leaves (2019) | GON, LAC (122) 0 (122) RIP (123) 0 (123) PLU (124) LAC, PLU (125) GON, LAC (126) |
| R42 | Turrach, tributary of river Mur; Styria | Bark canker <i>A. incana</i> (2014) | UNI (87) |

| River no. | River, state | Sample type, host species (year) | <i>Phytophthora, Halophytophthora and Nothophytophthora</i> spp. (site codes) ^{a, b} |
|-----------|--|--|---|
| R43 | Weidenbach, tributary of river March; Lower Austria | Rhizosphere soil <i>A. glutinosa</i> (2019) | PLU (71) |
| R44 | Weißenbach, tributary of river Enns; Styria | Floating fallen leaves (2019) | GON (28) |
| R45 | Weizbach, tributary of river Raab; Styria | Baiting raft (2015) Rhizosphere soil riparian <i>A. glutinosa</i> , <i>Populus</i> sp. and <i>Salix</i> sp. (2015) Rhizosphere soil riparian <i>Alnus</i> sp and <i>Salix</i> sp. (2015) | GON, PLU (37) LAC, PLU (37) 0 (38) |
| R46 | Wölzerbach, tributary of river Mur; Styria | Baiting raft (2014) | 0 (85) |
| R47 | Zapfengraben, tributary of river March; Lower Austria | Baiting raft (2014) | LAC (64) |
| R48 | Zeller Ache, Ager, tributary of river Traun; Upper Austria | Floating fallen leaves (2019) Rhizosphere soil <i>A. glutinosa</i> (2019) | GON, LAC, ×LAC, ×RIP (127) PLU (127) |
| R49 | Šebrovka, tributary of river Danube; South Moravia | Floating fallen leaves (2018) | GON, LAC (132) |
| R50 | Punkva, tributary of river Danube; South Moravia | Floating fallen leaves (2018) | BIL, FLU, GAL, GON, LAC, SYR, NOT2 (133) |
| R51 | Kuřimka, tributary of river Danube; South Moravia | Floating fallen leaves (2018) | GON, LAC, BIL, GAL, RIP, ×LAC (134) |
| R52 | Bílý Potok, tributary of river Danube; South Moravia | Floating fallen leaves (2018) | GON, LAC (135) |
| R53 | Habřina, tributary of river Danube; South Moravia | Floating fallen leaves (2018) | GON, LAC (136) |
| R54 | Troubský potok x Bobrava, tributary of river Danube; South Moravia | Floating fallen leaves (2018) | GON, LAC (137) |
| R55 | Časný, tributary of river Danube; South Moravia | Floating fallen leaves (2018) | FLU, GON, LAC (138) |
| R56 | Říčka, tributary of river Danube; South Moravia | Floating fallen leaves (2018) | GAL, GON, LAC (139) |
| R57 | Rakovec, tributary of river Danube; South Moravia | Floating fallen leaves (2018) | GON, LAC (140) |
| R58 | Bílá voda, tributary of river Danube; South Moravia | Floating fallen leaves (2018) | GON, LAC (141) |
| R59 | Črchľový potok, tributary of river Danube; Žilina | Floating fallen leaves (2018) | BIL, GON, LAC (142) |
| R60 | Trstená, tributary of river Danube; Žilina | Floating fallen leaves (2018) | GON, LAC (143) |
| R61 | Predmieranka, tributary of river Danube; Kysuce | Floating fallen leaves (2018) | BIL, GON, LAC (144) |
| R62 | Unnamed tributary of Predmieranka; Žilina | Floating fallen leaves (2018) | GON (145) |
| R63 | No name, tributary of river Danube; Žilina | Floating fallen leaves (2018) | GON (146) |
| R64 | Lalíkov potok, tributary of river Danube; Žilina | Floating fallen leaves (2018) | 0 (147) |
| R65 | Hanzľov potok, tributary of river Danube; Žilina | Floating fallen leaves (2018) | GON (148) |
| R66 | No name, tributary of river Danube; Žilina | Floating fallen leaves (2018) | GON (149) |
| R67 | No name, tributary of river Danube; Žilina | Floating fallen leaves (2018) | GON (150) |
| R68 | No name, tributary of river Danube; Žilina | Floating fallen leaves (2018) | NOT1 (151) |

^a ×ALN = *P. ×alni*, BIL = *P. bilorbang*, BIL2 = *P. taxon bilorbang-like 2*, CAC = *P. cactorum*, CHL = *P. chlamydospora*, ×CHL = *P. chlamydospora* × *lacustris*, FLU = *Halophytophthora fluvialis*, GAL = *P. gallica*, GON = *P. gonapodyoides*, HYD = *P. hydropathica*, LAC = *P. lacustris*, ×LAC = *P. taxon ×lacustris*, ×MUL = *P. ×multiformis*, NOT1 = *Nothophytophthora* taxon 1, NOT2 = *Nothophytophthora* taxon 2, PLU = *P. plurivora*, POL = *P. polonica*, RIP = *P. riparia*, ×RIP = *P. taxon ×riparia*, SYR = *P. syringae*, UNI = *P. uniformis*.

^b Site codes in bold refer to the 17 riparian sites which were assessed more in detail.