

Spatial distribution and host preferences of *Fomes fomentarius* and *F. inzegae* in Europe: A review

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Abstract

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Globally, wood-decay fungi are important ecological component of forests and woody plants. However, the traditional morphospecies, such as *Fomes fomentarius*, often show cryptic diversity. The traditional concept of the morphospecies comprises two delimited species, namely *F. fomentarius* s.str. and *F. inzegae*. In this review the spatial distribution and some ecological features of both species in Europe were characterized. In total, 259 records (139 *F. inzegae* and 120 *F. fomentarius* s.str., respectively) were analyzed from different localities in 29 countries. The two species are found almost all over Europe and there is no clear geographical segregation of these species, but the species show different host preferences. While *F. fomentarius* s.str. primarily colonizes *Fagus* and *Betula*, *F. inzegae* has a remarkably broad host range (*Abies*, *Acer*, *Aesculus*, *Alnus*, *Betula*, *Carpinus*, *Castanea*, *Fagus*, *Fraxinus*, *Juglans*, *Olea*, *Platanus*, *Populus*, *Prunus*, *Quercus*, *Salix*, *Sorbus*, and *Tilia*). *Acer*, *Alnus*, *Betula*, *Fagus*, and *Populus* are the five host genera common to both fungal species.

Keywords

Fomes, fungi, host preferences, spatial distribution

Introduction

The genus *Fomes* (Fr.) Fr., a taxon accepted in the Polyporaceae family (Polyporales, Agaricomycetes, Basidiomycota) is well characterized by its perennial basidiomes

with a conspicuous mycelial granular core. It was first proposed by FRIES (1849). Until recently, the genus consisted of one European species only, *Fomes fomentarius* s.l., also distributed in Asia, Africa and North America. This wood-rotting macrofungus was commonly known as

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the polyporous morphospecies that is widely distributed across whole Europe. It inhabits at least 150 woody plant species (GÁPER and GÁPEROVÁ, 2014) in numerous habitat types (GÁPER et al., 2013). The fungus causes decay in both living trees and dead wood, producing a white rot that is present in both sapwood and heartwood (ZÚBRİK et al., 2008; MIHÁL et al., 2009, 2011; JUHÁSOVÁ et al., 2011; KOBZA et al., 2022; PIRRONITTO et al., 2022; REINPRECHT et al., 2022). *Fomes fomentarius* s.l. was known to occur in soil (POVILATIENÉ et al., 2022; WYSZKOWSKA et al., 2022), and as a fungus that can establish itself in living woody plant tissues as an endophyte (BAUM et al., 2003).

Currently, the genus is found to consist of two validly described species, namely *Fomes fomentarius* s. str. and *Fomes inzengae*. *Fomes fomentarius* (L.) Fr. is the type species of the genus selected by DONK (1960) as *Polyporus fomentarius* L.:Fr. and accepted by all subsequent researchers. In contrast, *Fomes inzengae* (Ces. & De Not.) Cooke is a neglected sister species. It was for a long time regarded as a form, e.g., *Fomes fomentarius* f. *inzengae* (Ces. & De Not.) Lécuru (LÉCURU et al., 2019), or a cryptic sympatric subspecies evolved from *F. fomentarius* s.l. (BADALYAN et al., 2022), or a synonymum of *F. fomentarius*, or a variety, e.g., *Fomes fomentarius* var. *inzengae* (Ces. & de Not.) Heim. (GERAULT, 2005). GERAULT (2005) also found that the colour of the upper surface is paler, almost whitish and represents the most informative morphological character for delineating the variety. The basionym *Polyporus inzengae* Ces. & De Not. dates from the 1861 description as no. 636 in *Erbario Crittogamico Italiano* (SOCIETA CRITTOGAMOLOGICA ITALIANA, 1861). COOKE (1885) transferred the name to *Fomes* genus which is accepted by present researchers (PEINTNER et al., 2019; TOMŠOVSKÝ et al., 2023; KIRK, 2024).

Currently *F. fomentarius* and *F. inzengae* are well delimited species, according to Genealogical Concordance Phylogenetic Species Recognition, and gene flow between the two populations appears to be unlikely (TOMŠOVSKÝ et al., 2023). In taxonomic relation with morphology, PEINTNER et al. (2019) found that the morphological characters of basidiomes and mycelia including hymenophore pore diameter, diameter of skeletal hyphae, and basidiospore size are taxonomically valuable characters if measured from statistically relevant structures. By contrast, recent studies demonstrate that these morphological characters are not easily identifiable. Because the two species is difficult to separate morphologically, for their correct identification, DNA sequencing is necessary. The internal transcribed spacer (ITS) regions of fungal ribosomal DNA (rDNA) provide sufficient power to discriminate between the species (TOMŠOVSKÝ et al., 2023).

Using our own survey of both *F. fomentarius* s.str. and *F. inzengae* specimen/strain lists of all available data, we aimed to answer the following questions: (1) Is there a geographical segregation of these distinct species in Europe? (2) Can these sisters phytopathologically important species be found in different habitats? A better understanding of both geographic distribution and ecological features of these fungi could lead to its improved characterization and consistent identification as reflected by basidiomes.

So far, only partial studies on spatial distribution and

host range of these species have been published from Europe: in the Iberian Peninsula (GARRIDO-BENAVENT et al., 2020), in the South Moravian Region of Czechia (TOMŠOVSKÝ et al., 2023) and in the beech forests of the Ardennes of southern Belgium (PIRRONITTO et al., 2024) with several references from other European regions (DRESCH et al., 2015; PEINTNER et al., 2019). Habitat categories as well as substrate types have not been studied at all. So, this review combines more comprehensive view of distribution and some ecological traits of these two species in Europe.

Baseline data, their acquisition and processing

All available reliable data of the record lists of *F. fomentarius* s.str. and *F. inzengae* from Europe were processed. The attributes of the Fomes record lists of the two species are based on the following sources:

a) specimens collected and strains obtained from fresh basidiomata by us with ITS sequences with unique access numbers downloaded from GenBank: FJ865438–FJ865443, GQ184597–GQ184604, HQ189534, HQ189535, OK384694–OK384699

b) the other specimens and/or strains collected and/or isolated with ITS sequences with unique access numbers downloaded from GenBank by the end of May 2024: AY354213, AY849305, AY849306, EF155492–EF155499, EU162056, FR686552, GU062198, GU203514, JF340284, JF927720, JF927882, JQ901965–JQ901966, JX109860, KX449487, KJ857253–KJ857257, KJ857260, KM360125–KM360129, KM396269, LT629714–LT629715, MK184456–MK184459, MF109977, MF109978, MF109986, MF109979–MF109985, MF109987, MF782765, MG719671–MG719679, MH320560, MN065429, MN065430, MN065432–MN065453, MT821143, MW327504, MZ159490, MZ410696, OM422751, OP881542–OP881552, OQ474913–OQ474933, OR122498, OR610777, OR473259, OR473260, PP351390. The sequences were downloaded and aligned using clustalW algorithm implemented in MEGAX software, and the entries were classified as *F. fomentarius* s.str. (lacking 7bp indel) or *F. inzengae* (possessing 7 bp indel) in ITS1 region. Majority of strains have been isolated from basidiomata, few studies have focused on basidiospores, wood or tree sucker. The vouchers Erb. critt. Ital. no 636, no 977 (PEINTNER et al., 2019) were also included. In cases where the reliable data were not available (mainly habitat categories, but also many other data), published studies (LYGIS et al., 2004; PILOTTI et al., 2005; VOLKENANT, 2007; ARHIPOVA et al., 2011, 2012; FRANCINI et al., 2012; SCHMIDT et al., 2012; BADALYAN et al., 2015; DRESCH et al., 2015; MARCHICA et al., 2017; PÉREZ-IZGUIERDO et al., 2017; PEINTNER et al., 2019; ILIĆ et al., 2021; COSTA et al., 2021; CARTABIA et al., 2022; TOMŠOVSKÝ et al., 2023; PIRRONITTO et al., 2024), map data, data from culture collections/or herbaria and/or personal communications with specimen/strain collectors and authors of publications were used.

c) published studies without unique access numbers but with genetically verified identification (FRIESS et al., 2019; KRISAI-GREILHUBER, 2020; SABOR, 2020; CAÑESTRO, 2022; VELASCO et al., 2023; HEBERT, 2024; KRISAI-GREILHUBER and FRIEBES, 2024).

Habitats of *Fomes* spp. were divided into four categories according to the location and function they have: forests, wetland ecosystem, quasi-natural habitats associated with engineered features (“quasi-natural habitats” hereafter), and public urban spaces. The following types of forests have been recognized: virgin forests, other unmanaged forests, and managed forests (HOLEC et al., 2015; FRIESS et al., 2019).

Virgin forest is almost unaffected by humans, it is typical by natural tree species composition, natural regeneration, multi-aged structure, long continuity (never completely cut), no selective cutting of individual trees for more than 100 years, no removal of fallen trunks for more than 50 years. Other unmanaged forests include natural forests and near-natural forests. They have been influenced/formed by human impact. Managed forests are under permanent influence of conventional forest management (silvicultural interventions), this also includes plantations having a completely unnatural tree species composition (HOLEC et al., 2015).

Quasi-natural habitats include areas outside the city/town/village: forest parks; arboretums; spa parks; educational trails; open spaces near hotels; transport corridor verges: roadsides; small woodlands or windbreak within the farmland; water margins: riversides; orchards; and public spaces on the urban fringe: garden settlements, hunting lodges, shooting range.

Public urban spaces are located inside the built-up (intra-villan) or outside the built-up areas (extra-villan) of a city/town/village. They include urban forests; public parks;

open spaces near schools and hotels; communal public/semi-public gardens; transport corridor verges: roadsides; water margins: riversides; non-paved squares; planted streets; and pockets of greenery.

The substrate is of two types: living tree and dead wood. Living tree includes living tree trunk and/or living branches. Dead wood includes dead trees, dead tree trunk, fallen branches, laying logs, and stumps.

The spatial distribution map of *Fomes* records was constructed with ArcGIS 10.8. using a digital European elevation model EU DEM 1.1 with resolution 25 m (Copernicus data <https://land.copernicus.eu>) and global elevation model the GMTED2010 [the U.S. Geological Survey (USGS) and the National Geospatial-Intelligence Agency (NGA), <https://earthexplorer.usgs.gov/>] for places outside Europe in the Fig. 1, using the data of World Countries Generalized (Esri©; Garmin International, Inc.; U.S. Central Intelligence Agency (The World Factbook); National Geographic Society) and World Physical Map (US National Park Service©) for the administrative boundaries obtained from ArcGIS Online (Esri©).

Occurrences of *Fomes* records were created from latitude and longitude data using the Add XY Coordinates tool of ArcGIS 10.8. Altitudes were extracted from the digital European elevation model EU DEM 1.1 with resolution 25 m (Copernicus data <https://land.copernicus.eu>) in ArcGIS 10.8. In the case of missing coordinates, we used the coordinates of the center of the relevant municipality, city, province, forest, plantation, nature reserve, mountain range, region (Bryansk region) and, exception-

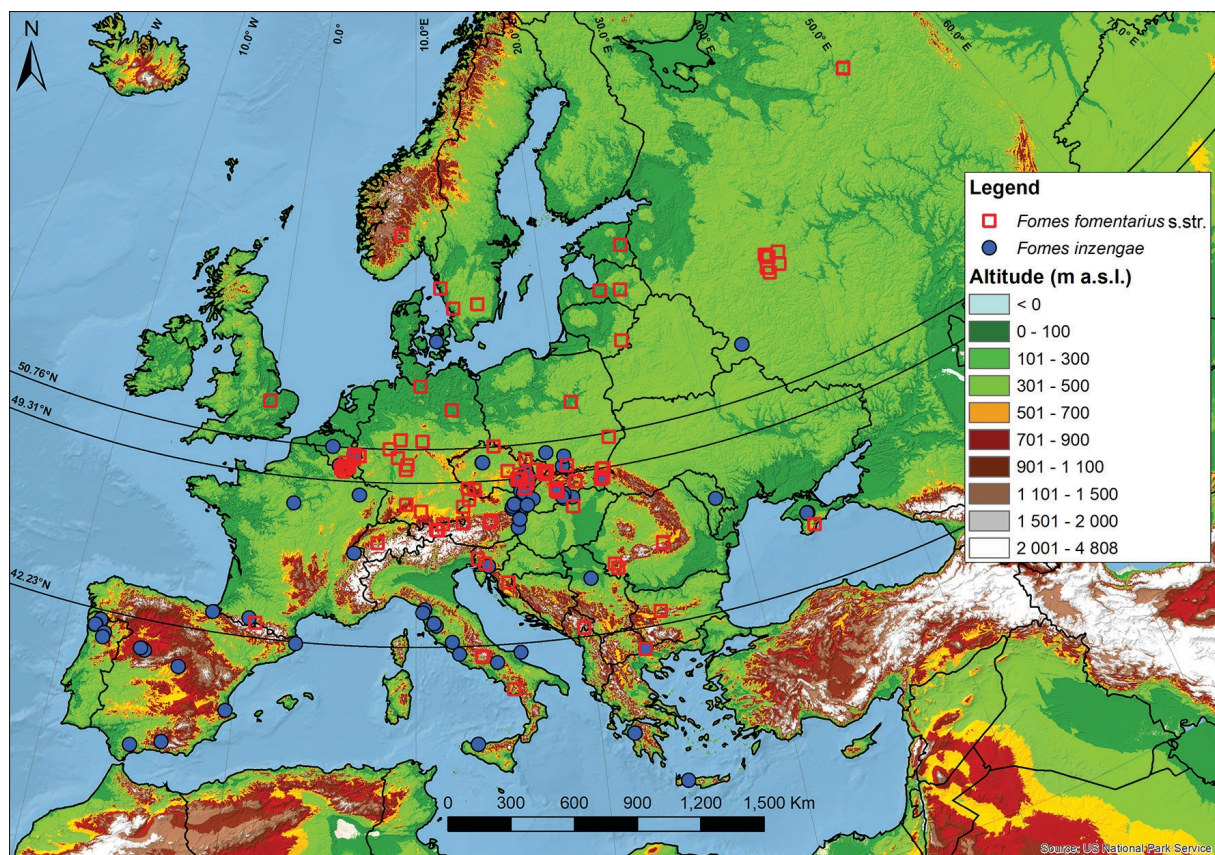


Fig. 1. Colour-coded altitude map of Europe with distribution of *Fomes* spp. records.

ally, the state (Moldova). Such coordinates are written in parentheses.

Interdependence between localities of *Fomes* records and geographic variables (latitude, longitude and altitude) were evaluated using Decision Trees (classification) model. Decision Trees are a non-parametric supervised learning method used for classification and regression. Instead of fitting a model to the data, tree-based models recursively partition the data into increasingly homogenous groups based on values that minimize a loss function [such as Sum of Squared Errors (SSE) for regression or Gini Index for classification] (JAMES et al., 2013). We used Rpart package (THERNEAU and ATKINSON, 2019) for generating Classification Trees model in R (version 4.3.0, R Core Team 2023).

In total, 259 records (139 *Fomes inzegae* and 120 *Fomes fomentarius* s.str., respectively) were analyzed from different localities in 29 countries of Europe. Based on these data, two sets were created in this study (for details, see Supplementary material List S1 and List S2).

Nomenclature and authorities are from Index Fungorum (KIRK, 2024) for fungi and IPNI (2024) for woody plants.

Geographical distribution of *Fomes fomentarius* and *F. inzegae* in Europe

The two species are found almost all over Europe and there is no clear geographical segregation of these species (Fig. 1). They are distributed together mainly through Central-western Europe and Central Europe, including Belgium, Czechia, Slovakia, southern Poland, and Austria. While *F. fomentarius* s.str. was found to have here wide

altitudinal range (178–1,300 m asl, record FF31 and FF09, respectively), *F. inzegae* occurs in narrower altitudinal range from 138 to 670 m asl (record FI106 and FI108, respectively).

F. inzegae gradually dominates towards the south, while *F. fomentarius* s.str. gradually rises to north of Europe. The occurrence of *F. inzegae* on European beech in the Pyrenees (record FI53), Greece (FI56–FI58) and southern Italy (FI61) in southern Europe at high altitudes (726–1,336 m asl), as well as in Belgium (FI16–FI18), Poland (FI77) and Denmark (FI52) in northern Europe is a very interesting, unexpected result. The record (FI52) from Suserup Skov in Denmark even represents one of the best examples of a semi-natural beech *Fagus sylvatica* dominated forest in northern Europe (HEILMAN-CLAUSEN et al., 2007).

F. inzegae was found primarily in places (Figs 1–2):

1. The southernmost areas of Europe, typically up to 42.23° north latitude (records FI56–FI63, FI79–FI91, FI110–FI115, FI117–FI125)
2. Southern and central areas between 42.23° and 49.31° north latitude, with the altitudes of primarily up to 533 m asl (records FI01–FI15, FI19–FI25, FI28–FI38, FI40–FI42, FI44–FI49, FI51, FI54–FI55, FI64–FI66, FI75, FI93–FI107, FI126–FI134)
3. Central and western areas between 49.31° and 50.76° north latitude and mostly up to 253 m asl (records FI16, FI26, FI27, FI39, FI50, FI76).

F. fomentarius s.str. was found primarily in places (Figs 1–2):

1. Northern areas above 50.76° north latitude (records FF36, FF49, FF55, FF60–FF71, FF77–FF80, FF82, FF83, FF91–FF104, FF115–FF117, FF120)

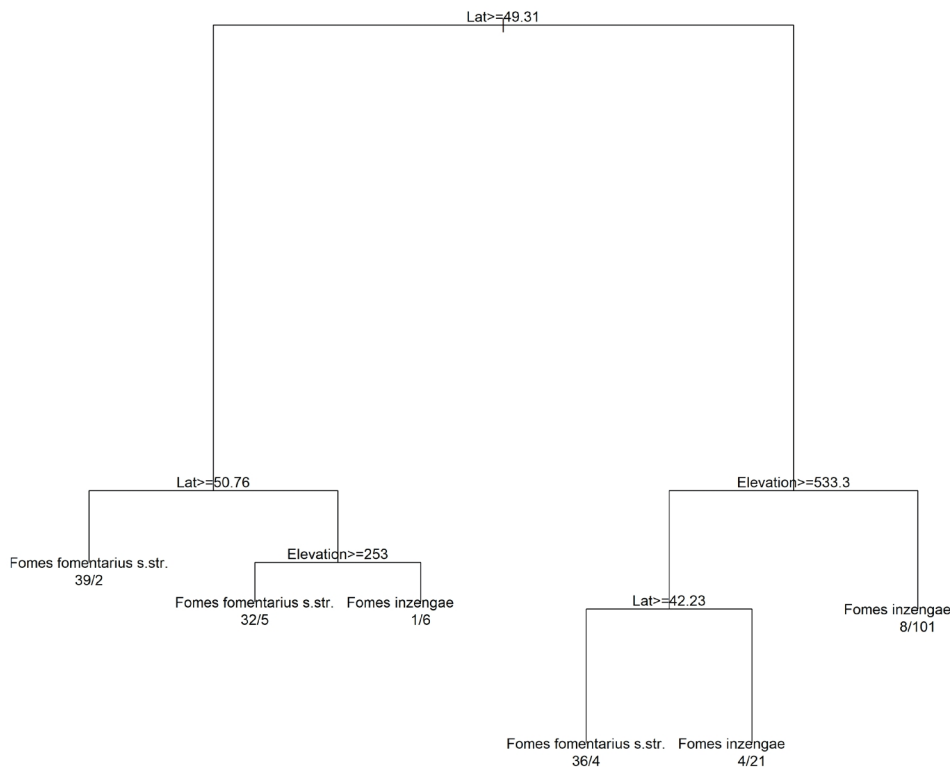


Fig. 2. Regression tree showing two factors (latitude and altitude) influencing *Fomes* spp. distribution in Europe.

2. Central and western areas between 49.31° and 50.76° north latitude with the elevations of mostly above 253 m asl (records FF11–FF24, FF32–FF35, FF37–FF42, FF45–FF48, FF56, FF58, FF59, FF81)
3. Southern and central areas between 42.23° and 49.31° north latitude with the elevation of mostly above 533.3 m asl (records FF01–FF03, FF06–FF09, FF25–FF28, FF43, FF50–FF53, FF57, FF73, FF84, FF85, FF87–FF90, FF105–FF107, FF110–FF114, FF118, FF119).

Woody plants as hosts

Results clearly delimited the host preferences of the two species in Europe. While *F. fomentarius* s.str. primarily colonizes *Fagus* and *Betula*, *F. inzengae* has a remarkably broad host range (*Abies*, *Acer*, *Aesculus*, *Alnus*, *Betula*, *Carpinus*, *Castanea*, *Fagus*, *Fraxinus*, *Juglans*, *Olea*, *Platanus*, *Populus*, *Prunus*, *Quercus*, *Salix*, *Sorbus*, and *Tilia*). *Acer*, *Alnus*, *Betula*, *Fagus*, and *Populus* are the five host genera common to both fungal species (Table 1).

Table 1. Tree genera composition of *Fomes fomentarius* s.str. and *F. inzengae* across Europe. The number of observations are given in parentheses.

Host tree genera		
<i>Fomes fomentarius</i> s.str.	Common to both species	<i>Fomes inzengae</i>
		<i>Abies</i> (1)
	<i>Acer</i> (1 vs. 7)	<i>Aesculus</i> (6)
	<i>Alnus</i> (3 vs. 1)	<i>Carpinus</i> (1)
	<i>Betula</i> (22 vs. 2)	<i>Castanea</i> (1)
	<i>Fagus</i> (82 vs. 20)	<i>Fraxinus</i> (6)
		<i>Juglans</i> (5)
		<i>Olea</i> (1)
<i>Picea</i> (4)		<i>Platanus</i> (7)
	<i>Populus</i> (5 vs. 21)	<i>Prunus</i> (1)
		<i>Salix</i> (3)
		<i>Sorbus</i> (1)
		<i>Quercus</i> (30)
		<i>Tilia</i> (7)

F. inzengae was found in the geographical locations:

1. The southernmost areas of Europe, mostly in the vegetation zones of Mediterranean forest and shrubland, where it was recorded up to 42.23° north latitude. In both the lower and middle elevations (3–381 m asl), *F. inzengae* is associated here with oaks (*Quercus* sp., *Quercus suber*, *Quercus frainetto*), poplars (*Populus* sp., *Populus alba*, *Populus canadensis*, *Populus nigra*), *Acer platanoides*, *Fraxinus angustifolia*, *Platanus acerifolia*, *Salix alba* and others. Contrariwise, in both the middle and higher elevations (764 and 1,168–1,336 m asl) it is associated here with beech, *F. sylvatica* (records FI61 and FI56–FI58) which is also the dominant host of *F. fomentarius* s.str. (Table 1).

2. Southern and central part of the continent (including several localities in France, Ukraine and Moldova), mostly in the vegetation zone of mixed forest between 42.23° and 49.31° north latitude. Up to 533 m asl, *F. inzengae* is associated here with the oak species of temperate climatic zone (*Quercus cerris*, *Quercus petraea*, allochthonous *Quercus rubra* and indetermined species of *Quercus*), poplars (*P. alba*, *P. nigra*, *Populus tremula*, allochthonous *P. canadensis* and indetermined species of *Populus*), *A. platanooides*, *Aesculus hippocastanum*, *Alnus glutinosa*, *Betula pendula*, *F. sylvatica*, *Fraxinus excelsior*, plane trees (*Platanus* sp., *P. acerifolia*), willows (*S. alba*, *Salix fragilis*), *Sorbus aucuparia*, limes (*Tilia cordata*, *Tilia* sp.), and unknown coniferous tree. At the higher elevations (670–850 m asl) it is also associated with *Abies alba* (record FI109), *F. sylvatica* (FI53) and *Prunus avium* (FI108).

3. Central and western regions in the vegetation zone of mixed forest, above 49.31° up to 50.76°. Up to altitude 253 m asl, *F. inzengae* is associated with maples (*A. platanooides*, *Acer* sp.), *F. sylvatica*, *Platanus hispanica*, and *Populus* sp. At higher elevations (319–1,043 m asl) it is also associated with *F. sylvatica* (records FI17, FI18, FI43, FI77).

F. fomentarius s.str. was found in the geographical locations:

1. Northern, north-western and north-eastern regions of Europe above 50.76° north latitude, near to the northern border of the vegetation zone of mixed forest. *F. fomentarius* s.str. is here typically associated with alders (*Alnus incana*, *A. glutinosa*), birches (*B. pendula*, *Betula* sp.), *F. sylvatica*, and *Populus* sp.

2. Central and western regions in the vegetation zone of mixed forest, between 49.31° and 50.76° north latitude in altitudes typically above 253 m asl, where *F. fomentarius* s.str. is associated with *Betula* sp., *F. sylvatica*, and *Picea abies*.

3. Southern and central parts of Europe (including records from Pyrenees and Crimea), mostly in the vegetation zone of mixed forest between 42.23° and 49.31° north latitude. At an altitude of above 533.3 m asl, *F. fomentarius* s.str. is here associated with *F. sylvatica* and *P. abies*. At lower elevations (178–416 m asl) it is also associated with *Alnus* sp. (record FF29), *B. pendula* (FF30, FF31), and *Acer negundo* (FF108).

While both species were reported mostly from deciduous trees in all habitats, here we noticed a few specimens of these species on conifers [records FI55, FI109 and FF06–FF08, FF48 (GÁPER et al., 2023), respectively]. The host preference for *F. fomentarius* s.str. is primarily determined by host availability in a habitat, namely living beech trees (*F. sylvatica*) and/or the presence of beech dead wood. Because beech forest ecosystems provide such a suitable environment, it is most abundantly present in them (Table 2). Its occurrence in the (spruce)-(fir)-beech virgin forests (FF26, FF32, FF33, FF43, FF55, FF62–FF70, FF107) could confirm the opinions of some authors (BLASCHKE et al., 2009; LANGER, 2018), that *F. fomentarius* s.str. is one of the fungi considered as nature value indicators if a high abundance is given. On the other hand, the species has been found to infect trees in habitats influenced by man, mainly in managed forests. As stated previously, *F. inzengae* is a species that has a disproportionally wider range of hosts, mainly in non forest areas. It does not seem

Table 2. Host tree species and the number of *Fomes* spp. records in Europe within habitat categories (A: *Fomes fomentarius* s.str.; B: *Fomes inzegae*)

Host tree species	Habitat status									
	Virgin forest		Other unmanaged forest		Managed forest		Quasi-natural habitat		Public urban space	
	A	B	A	B	A	B	A	B	A	B
<i>Abies alba</i>						1				
<i>Acer</i> sp.								1		
<i>Acer negundo</i>									1	
<i>Acer platanoides</i>								2		4
<i>Aesculus hippocastanum</i>										6
<i>Alnus</i> sp.					1					
<i>Alnus glutinosa</i>					1					1
<i>Alnus incana</i>					1					
<i>Betula</i> sp.			1					6	1	
<i>Betula pendula</i>			5		3					1
<i>Carpinus betulus</i>				1						
<i>Castanea sativa</i>				1						
<i>Fagus sylvatica</i>	15		33	8	28	4	2	6	2	
<i>Fraxinus angustifolia</i>								2		
<i>Fraxinus excelsior</i>						1				2
<i>Olea europaea</i>								1		
<i>Picea abies</i>			3					1		
<i>Platanus</i> sp.										1
<i>Platanus × acerifolia</i>										4
<i>Platanus hispanica</i>										1
<i>Populus</i> sp.				1			5	1		3
<i>Populus alba</i>								5		1
<i>Populus canadensis</i>								4		1
<i>Populus nigra</i>								2		1
<i>Populus tremula</i>								1		
<i>Prunus avium</i>				1						
<i>Quercus</i> sp.				3		4		3		2
<i>Quercus cerris</i>				1		3		1		2
<i>Quercus frainetto</i>				1						2
<i>Quercus ilex</i>										1
<i>Quercus petraea</i>										1
<i>Quercus pubescens</i>				1						
<i>Quercus rubra</i>						1				
<i>Quercus suber</i>										3
<i>Salix alba</i>								2		1
<i>Salix fragilis</i>								1		
<i>Sorbus aucuparia</i>								1		1
<i>Tilia</i> sp.										3
<i>Tilia cordata</i>										3

to prefer any woody plant (Table 2).

The geographical trends of the two *Fomes* species occurrence in Europe are in agreement with recent regional studies (PEINTNER et al., 2019; GARRIDO-BENAVENT et al., 2020; TOMŠOVSKÝ et al., 2023) indicating that *F. fomentarius* s.str. dominates within colder woodlands and *F. inzegae* dominates in the Mediterranean. It is known that the two species in Central Europe occur sympatrically. JÚDOVÁ et al. (2012) revealed both species at some localities in the natural forest reserves in Vihorlat Mts. (East Slovakia), GÁPER et al. (2013) within the Central Slovak Region, and finally, TOMŠOVSKÝ et al. (2023) in the South Moravian region in Czechia within the Křtiny Arboretum, where the fungal diversity can be influenced by cultivation of allochthonous woody plants. We confirmed these two species (records FI56–FI58 and FF72, respectively)

at only one locality in the forest dominated by beech *F. sylvatica* in the Northern Greece in the Mediterranean in highest elevation.

Fomes fomentarius s.str. occurs mostly on beech *F. sylvatica* and birch trees (*Betula* spp.), less often on *Acer*, *Alnus*, *Picea*, and *Populus* in Europe. These data are in partial agreement with those from the Ural regions in Russia and North Kazakhstan (MUKHIN et al., 2018; ZHUYKOVA and MUKHIN, 2022) and from Armenia (BADALYAN et al., 2022). *F. fomentarius* s.str. on *Prunus*, *Quercus*, *Salix*, and *Sorbus* has not yet been recorded in Europe.

On the other hand, *F. inzegae* grows on *Abies*, *Acer*, *Aesculus*, *Carpinus*, *Castanea*, *Fagus*, *Juglans*, *Platanus*, *Populus*, *Prunus*, *Quercus*, *Salix*, and *Tilia* in Europe. Host spectrum of *F. inzegae* correspond with those of the Ural regions of Russia, North Kazakhstan, and Armenia (BADA-

LYAN et al., 2022; ZHUYKOVA and MUKHIN, 2022).

In accordance with the results of TOMŠOVSKÝ et al. (2023), it is apparent that the host spectrum of *F. inzen-gae* follows the local diversity of woody plants including allochthonous, so, the occurrence of this species is not determined by specific host taxa, but by environmental conditions. In contrast with this statement, we believe that host spectrum of *F. fomentarius* s.str. follows beech-dominated forests (*F. sylvatica*), so the occurrence of the species is primarily determined by the presence of specific host taxon. This assumption is in agreement with a previous study of Friess and his co-authors (FRIESS et al., 2019) which analyzed a total of 35 samples of living basidiomes of the two *Fomes* species obtained from beech-dominated forest sites across the distributional range of *F. sylvatica* in Europe. However, intraspecific genetic variation among sites was very low and *F. inzen-gae* (referred to as genotype B) occurred only at five of their sites widely spread over the sampling area. The samples from the other thirty sites belonged to the species *F. fomentarius* s.str.

***Fomes fomentarius* and *F. inzen-gae* can live as endophytes and they can survive in different substrates**

As mentioned earlier, *F. inzen-gae* is found in almost all habitats and a broad range of woody plant host while it also act as an asymptomatic endophyte. It survives in healthy plant tissues without producing any visible signs of disease [(MOUHAMADOU et al., 2011; DOLATABAD et al., 2017, GHOLAMI et al., 2019; PIRRONITTO et al., 2024) as well as records FI120 (COSTA et al., 2021) and FI126–FI134], in composted potted soils, leaf litters and decaying wood (GenBank Accession Nos. OP038671, OP038672), in environmental DNA samples (OGÓREK, 2018), in the arthropod cadavers (TROYÃO et al., 2013; JABER et al., 2016), and even in the living animals (GenBank Accession Nos. OW988516, OU989364). In agreement with GARRIDO-BENAVENT et al. (2020) we believe that the fact that *F. inzen-gae* has also been detected in environmental DNA samples, in the arthropod cadavers, and in the living animals could partially explain its wide geographical distribution mediated by long-distance dispersion. Similarly, *F. fomentarius* s.str. is found in all habitats but a narrower range of woody plants. It is also known as a fungus that can establish itself in living woody plants as an endophyte (SMITH et al., 2017).

Conclusions

Several morphospecies of phytopathologically important wood-decaying fungi have recently been shown to actually encompass several genetically isolated lineages. *Fomes fomentarius* s.l. is no exception. It had been considered a homogeneous species until 2012, when the existence of two genotypes was discovered (JÚDOVÁ et al., 2012). Currently, the morphospecies is found to consist of two validly described species, namely *F. fomentarius* s. str. and *F. inzen-gae* that are widely distributed in both European forests and non-forest areas but differ by a relative distinct host preference in different habitats. These data may be

important for the future, especially in terms of sustainable both forest and urban management.

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List of abbreviations

BRNM	Herbarium, Moravian Museum, Brno, Czechia
Erb. critt. Ital.	Mycotheca Universalis, Siena, Italy
FB	Herbarium, University of Freiburg, Germany
GB	Herbarium, University of Gothenburg, Sweden
HMIPC	Herbarium, University of Agriculture, Kraków, Poland
IB	Herbarium, University of Innsbruck, Austria
IPAE	Herbarium, Institute of Plant and Animal Ecology, Yekaterinburg, Russia
ITS	internal transcribed spacer
JA-CUSSTA	Herbarium, Andalusian Mycology Center, Priego de Córdoba, Spain
K(M)	Herbarium, Royal Botanic Gardens, Kew, U.K.
LAZA	Mycotheca, Salamanca Mycological Society, Spain
MUM	Mycotheca, University of Minho, Braga, Portugal
O-F	Herbarium, Natural History Museum, University of Oslo, Norway
pers. comm.	personal communication
s.l.	sensu lato
s.str.	sensu stricto
WU	Herbarium, University of Vienna, Austria

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Supplementary material

List S1. The list of *Fomes inzengae* records included in this study

country/code; locality; coordinates; habitat; host; substrate type; altitude [m a.s.l.]; data evidence: GenBank Accession number (ITS identification), or Friess's genetic analyses (FRIESS et al., 2019) as the Supporting information Appendix S1 (from now on called "genetic analyses"), and/or database resource, and/or voucher specimen number, and/or personal communication; (N.A. - not available).

Austria

- FI01; Heiligenkreuz; 48.05129 N, 16.14184 E; managed forest; *Quercus* sp.; N.A.; 445; <https://pilzdaten-austria.eu/#tax/1000056>
- FI02; Prellenkirchen; 48.10047 N, 16.95145 E; managed forest; *Quercus rubra* Rugel ex A.DC.; N.A.; 280; <https://pilzdaten-austria.eu/#tax/1000056>
- FI03; Oberwart; 47.21978 N, 16.42698 E; managed forest; *Quercus cerris* L.; living tree; 330; <https://pilzdaten-austria.eu/#tax/1000056>
- FI04; Vienna-Liesing; 48.15141 N, 16.24377 E; shooting range; *Quercus* sp.; N.A.; 367; <https://pilzdaten-austria.eu/#tax/1000056>
- FI05; Vienna-Liesing; 48.19270 N, 16.23779 E; managed forest; N.A.; dead wood; 271; <https://pilzdaten-austria.eu/#tax/1000056>
- FI06; Vienna; 48.14080 N, 16.21848 E; managed forest; *Quercus* sp.; dead wood; 305; <https://pilzdaten-austria.eu/#tax/1000056>
- FI07; Horitschon; 47.56578 N, 16.56562 E; managed forest; *Quercus cerris* L.; N.A.; 263; <https://pilzdaten-austria.eu/#tax/1000056>
- FI08; Vienna-Währing; 48.24042 N, Lon 16.30214 E; public park; *Quercus* sp.; dead wood; 334; <https://pilzdaten-austria.eu/#tax/1000056>
- FI09; Vienna-Ottakring; 48.21987 N, 16.27012 E; forest park; *Quercus cerris* L.; N.A.; 422; <https://pilzdaten-austria.eu/#tax/1000056>
- FI10; Vienna-Ottakring; 48.21833 N, 16.27946 E; roadside; *Quercus cerris* L.; N.A.; 374; <https://pilzdaten-austria.eu/#tax/1000056>
- FI11; Breitenfurt at Vienna; 48.12300 N, 16.16141 E; managed forest; *Quercus* sp.; living tree; 455; <https://pilzdaten-austria.eu/#tax/1000056>
- FI12; Breitenfurt at Vienna; 48.12297 N, 16.16514 E; managed forest; *Quercus* sp.; living tree; 388; <https://pilzdaten-austria.eu/#tax/1000056>
- FI13; Vienna-Ottakring; 48.22076 N, Lon 16.28185 E; managed forest; *Quercus cerris* L.; N.A.; 360; <https://pilzdaten-austria.eu/#tax/1000056>
- FI14; Neusiedl am See; 48.09524 N, 16.98117 E; small forest within the farmland; *Fraxinus excelsior* L.; N.A.; 247; <https://pilzdaten-austria.eu/#tax/1000056>
- FI15; Vienna-Ottakring; 48.21788 N, 16.28217 E; open space near hotel; *Quercus cerris* L.; N.A.; 353; <https://pilzdaten-austria.eu/#tax/1000056>

Belgium

- FI16; Waterloo; 50.7509 N, 4.4192 E; other unmanaged forest; *Fagus sylvatica* L.; living tree; 127; genetic analyses;
- FI17; Ardennes; 49.960556 N, 4.9275 E; managed forest; *Fagus sylvatica* L.; dead wood; 346; OR473260, Pirronitto (pers. comm.);
- FI18; Ardennes; 50.483333 N, 5.866667 E; managed forest; *Fagus sylvatica* L.; living tree; 319; OR473259, Pirronitto (pers. comm.);

Czech Republic

- FI19; Dražůvky; 49.0385103 N, 17.0215947 E; roadside; *Populus nigra* L.; N.A.; 198; BRNM 840303;
- FI20; Černovický hájek Nature Reserve; 49.1634722 N, 16.6448014 E; urban forest; *Populus* sp.; N.A.; 207; N.A.;
- FI21; Černovický hájek Nature Reserve; 49.1635178 N, 16.6451983 E; urban forest; *Alnus glutinosa* (L.) Gaertn.; N.A.; 202; OQ474918, BRNM 840286;
- FI22; Černovický hájek Nature Reserve; 49.1622200 N, 16.6435569 E; urban forest; *Fraxinus excelsior* L.; N.A.; 199; BRNM 840285;
- FI23; Brno; 49.2025708 N, 16.6133453 E; public park; *Acer platanoides* L.; N.A.; 213; BRNM 840284;
- FI24; Brno; 49.2081119 N, 16.6066264 E; public park; *Aesculus hippocastanum* L.; N.A.; 219; BRNM 840282;
- FI25; Brno; 49.2074319 N, 16.6109447 E; public park; *Acer platanoides* L.; N.A.; 214; BRNM 840281;
- FI26; Prague; 50.1060583 N, 14.4119692 E; public park; *Acer platanoides* L.; N.A.; 190; OQ474922, BRNM 840301;
- FI27; Prague; 50.1051597 N, 14.4271636 E; public park; *Platanus hispanica* Ten.; N.A.; 203; BRNM 840302;
- FI28; Strážnice; 48.8890525 N, 17.2760239 E; riverside; *Salix alba* L.; N.A.; 170; BRNM 840300;
- FI29; Slavkov u Brna; 49.1551722 N, 16.8679675 E; public park; *Sorbus aucuparia* L.; N.A.; 218; BRNM 840299;
- FI30; Slavkov u Brna; 49.1548669 N, 16.8693728 E; public park; *Fagus sylvatica* L.; N.A.; 217; BRNM 840298;
- FI31; Slavkov u Brna; 49.1555853 N, 16.8647781 E; roadside; *Aesculus hippocastanum* L.; N.A.; 216; OQ474920, BRNM 840289;
- FI32; Slavkov u Brna; 49.1559386 N, 16.8642228 E; roadside; *Aesculus hippocastanum* L.; N.A.; 217; BRNM 840288;
- FI33; Brno-Štýřice; 49.1817794 N, 16.5833306 E; urban forest; *Betula pendula* Roth; N.A.; 253; OQ474919, BRNM 840287;
- FI34; Březinka Nature Reserve; 49.2835603 N, 16.7371178 E; other unmanaged forest; *Fagus sylvatica* L.; N.A.; 505;

BRNM 840293;
 FI35; Kroměříž; 49.3041200 N, 17.3975414 E; public park; *Tilia cordata* Mill.; N.A.; 192; BRNM 840291;
 FI36; Kroměříž; 49.3027206 N, 17.3978900 E; public park; *Fraxinus excelsior* L.; N.A.; 193; OQ474921, BRNM 840292;
 FI37; Kroměříž; 49.3037914 N, 17.3947303 E; public park; *Platanus* sp.; N.A.; 196; BRNM 840290;
 FI38; Buchlovice; 49.1065328 N, 17.3072206 E; educational trail; *Fagus sylvatica* L.; N.A.; 452; BRNM 840317;
 FI39; Olomouc-Černovír; 49.6200969 N, 17.2682089 E; forest park; *Acer* sp.; N.A.; 218; BRNM 840304;
 FI40; Adamov; 49.2970886 N, 16.6564175 E; roadside; *Fagus sylvatica* L.; N.A.; 290; OQ474917, BRNM 840280;
 FI41; Brno-Útěchov; 49.2857133 N, 16.6218222 E; roadside; *Tilia* sp.; N.A.; 449; BRNM 840279;
 FI42; Brno-Útěchov; 49.2822292 N, 16.6337158 E; roadside; *Fagus sylvatica*; N.A.; 472; OQ474914, BRNM 840274;
 FI43; Křtiny; 49.3213444 N, 16.7390136 E; arboretum; *Fagus sylvatica* L.; N.A.; 506; N.A.;
 FI44; Brno-Královo Pole; 49.2390869 N, 16.5921158 E; roadside; *Quercus petraea* (Matt.) Liebl.; N.A.; 235; OQ474913, BRNM 840273;
 FI45; Brno-Horní Heršpice; 49.1642322 N, 16.6240594 E; roadside; *Populus canadensis* Moench; N.A.; 198; OQ474916, BRNM 840278;
 FI46; Brno-Komárov; 49.1739728 N, 16.6190747 E; riverside; *Salix alba* L.; N.A.; 200; BRNM 840276;
 FI47; Valtice; 48.7470261 N, 16.7918550 E; hunting lodge; *Quercus* sp.; N.A.; 212; BRNM 840277;
 FI48; Valtice; 48.7477653 N, 16.7885122 E; hunting lodge; *Quercus* sp.; N.A.; 207; OQ474915, BRNM 840275;
 FI49; Hodonínská Důbrava forest; 48.873869 N, 17.075663 E; other unmanaged forest; *Quercus* sp.; dead wood; 176; MN065442;
 FI50; Zástudánčí National Nature Reserve; 49.396248 N, 17.311109 E; other unmanaged forest; *Populus* sp.; dead wood; 200; MN065441;
 FI51; Ranšpurk National Nature Reserve; 48.6783903 N, 16.9466828 E; virgin forest; N.A.; dead wood; 168; BRNM 840308;

Denmark
 FI52; Suserup Skov National Forest; 55.3780 N, 11.5670 E; other unmanaged forest; *Fagus sylvatica* L.; living tree; 32; genetic analyses;

France
 FI53; Bulan; 43.0448 N, 0.2744 E; managed forest; *Fagus sylvatica* L.; living tree; 726; genetic analyses;
 FI54; France, Champenoux; (48.742055 N, 6.346867 E); managed forest; N.A.; dead wood; ca 238; KX449487;
 FI55; Pithiviers-le-Vieil - Orme; (48.186330 N, 2.204334 E); small forest within the farmland; coniferous tree; dead wood; ca 127; GU731551, M. Haon (pers. comm.);

Greece
 FI56; Ano Poroia; 41.319653 N, 23.038642 E; other unmanaged forest; *Fagus sylvatica* L.; living tree; 1168; MN065432;
 FI57; Ano Poroia; 41.322541 N, 23.037245 E; other unmanaged forest; *Fagus sylvatica* L.; dead wood; 1319; MN065434;
 FI58; Ano Poroia; 41.323163 N, 23.037851 E; other unmanaged forest; *Fagus sylvatica* L.; dead wood; 1336; MN065435;
 FI59; Foloji Natural reserve; 37.789226 N, 21.774978 E; other unmanaged forest; *Quercus frainetto* Ten.; N.A.; 685; MN065429;
 FI60; Crete, Vryses; 35.3765600 N, 24.2016353 E; planted streets and pockets of greenery; *Populus alba* L.; N.A.; 57; MN065430;

Italy
 FI61; Vico del Gargano; 41.8246 N, 15.9937 E; roadside; *Fagus sylvatica* L.; living tree; 764; genetic analyses;
 FI62; Rome; 41.888346 N, 12.493219 E; public park; *Platanus × acerifolia* (Aiton) Willd.; living tree; 47; AY849305;
 FI63; Rome; 41.888346 N, 12.493219 E; public park; *Platanus × acerifolia* (Aiton) Willd.; living tree; 47; AY849306;
 FI64; Lucca; 43.841338 N, 10.512643 E; communal public/semi-public garden; *Tilia* sp.; dead wood; 16; MN065431;
 FI65; Pisa; 43.710000 N, 10.407222 E; communal public/semi-public garden; *Platanus × acerifolia* (Aiton) Willd.; living tree; 6; LT629714;
 FI66; Pisa; 43.710000 N, 10.407222 E; communal public/semi-public garden; *Platanus × acerifolia* (Aiton) Willd.; living tree; 9; LT629715;
 FI67; Pisa; (43.710869 N, 10.405758 E); non-paved square; *Quercus ilex* L.; living tree; ca 6; JF927882;
 FI68; Viterbo; (42.422219 N, 12.106185 E); managed forest; *Fagus sylvatica* L.; N.A.; ca 340; OM422751;
 FI69; Riserva Naturale di Tocchi; (43.138415 N, 11.182617 E); other unmanaged forest; *Carpinus betulus* L.; N.A.; ca 338; MK184457, IB20160351;
 FI70; Riserva Naturale di Tocchi; (43.136900 N, 11.179978 E); other unmanaged forest; *Castanea sativa* Mill.; N.A.; ca 352; MK184456, IB20160349;
 FI71; Riserva Naturale Cornocchia; (43.255871 N, 11.050300 E); other unmanaged forest; *Quercus cerris* L.; N.A.; ca 376; MK184458, IB20160343;
 FI72; Riserva Naturale Cornocchia; (43.253511 N, 11.042822 E); other unmanaged forest; *Quercus pubescens* Willd.; living tree; 500; KM360129, IB20130033;
 FI73; Palermo; (37.959255 N, 13.356700 E); N.A.; *Populus nigra* L.; N.A.; ca 844; Erb. critt. Ital. no 636;
 FI74; San Giuliano dal Sanno; (41.456801 N, 14.641485 E); public urban space; *Quercus* sp.; N.A.; ca 654; Erb. critt. Ital. no 977;

Moldova
 FI75; N.A.; (47 N, 28.916667 E); N.A.; N.A.; 80-430; PP351390;

Poland
 FI76; Gliwice; 50.288333 N, 18.686389 E; public park; N.A.; living tree; 223; OR610777;

FI77; Suwarki forest; 49.635083 N, 19.658161 E; other unmanaged forest; *Fagus sylvatica* L.; living tree; 1043; MF782765; FI78; Kraków, (50.056036 N, 19.847575 E); forest park; *Betula* sp.; dead wood; 341; MH320560, HMIPC No 5237, M. Ruminowicz-Stefaniuk (pers. comm.);

Portugal

FI79; Peneda-Gerês National Park; 41.80219869 N, -8.13351452 E; other unmanaged forest; *Quercus* sp.; dead wood; 708; MF109977;

FI80; Peneda-Gerês National Park; 41.802196 N, -8.133517 E; other unmanaged forest; *Quercus* sp.; dead wood; 708; MF109978;

FI81; Braga; 41.551707 N, -8.357569 E; roadside; *Quercus suber* L.; living tree; 444; MF109986, MUM 17.19;

FI82; Braga; 41.542724 N, -8.381989 E; N.A.; urban forest; broadleaf tree; dead wood; 393; MF109979;

FI83; Braga; 41.542668 N, -8.381978 E; urban forest; broadleaf tree; dead wood; 394; MF109980, MUM 17.15;

FI84; Braga; 41.542612 N, -8.381978 E; urban forest; broadleaf tree; dead wood; 394; MF109981;

FI85; Braga; 41.551699 N, -8.374001 E; urban forest; *Quercus suber* L.; living tree; 472; MF109982;

FI86; Braga; 41.5517556 N, -8.37400138 E; urban forest; *Quercus suber* L.; living tree; 471; MF109983, MUM 17.16;

FI87; Braga; 41.55165925 N, -8.35696936 E; urban forest; *Quercus frainetto* Ten.; living tree; 439; MF109984, MUM 17.17;

FI88; Braga; 41.551683 N, -8.357669 E; urban forest; *Quercus frainetto* Ten.; living tree; 444; MF109985, MUM 17.18;

FI89; Braga; 41.55483655 N, -8.3791472 E; urban forest; broadleaf tree; dead wood; 350; MF109987;

FI90; Silvela; 41.279766 N, -7.770126 E; roadside; *Acer platanoides* L.; living tree; 462; MN065436;

FI91; Lamego; 41.094178 N, -7.813335 E; roadside; *Populus* sp.; living tree; 522; MN065437;

Russia

FI92; Bryansk Oblast; (53.005143 N, 33.525907 E); N.A.; *Quercus robur* L.; N.A.; 50-280; OL764369;

Serbia

FI93; Avala Mts. Nature Reserve; (44.689166 N, 20.516243 E); other unmanaged forest; *Fagus sylvatica* L.; living tree; ca 480; MW327504;

Slovakia

FI94; Gemerské Dechtáre; 48.255583 N, 20.036778; riverside; *Salix fragilis* L.; dead wood; 225; OK384695;

FI95; Ružindol; 48.371083 N, 17.497750 E; roadside; *Tilia cordata* Mill.; living tree; 167; OK384694;

FI96; Banská Bystrica; 48.747564 N, 19.120633 E; garden settlements; *Acer platanoides* L.; living tree; 417; FJ865438;

FI97; Horný Tisovník; 48.416712 N, 19.361984 E; roadside; *Populus* sp.; dead wood; 417; FJ865439;

FI98; Dolná Strehová; 48.248479 N, 19.491632 E; public park; *Aesculus hippocastanum* L.; dead wood; 180; FJ865441;

FI99; Dolná Strehová; 48.248479 N, 19.491632 E; public park; *Aesculus hippocastanum* L.; living tree; 180; GQ184601;

FI100; Banská Bystrica; 48.750503 N, 19.112281 E; forest park; *Fagus sylvatica* L.; living tree; 471; FJ865442;

FI101; Banská Bystrica; 48.749231 N, 19.114547 E; forest park; *Fagus sylvatica* L.; dead wood; 428; GQ184602;

FI102; Mýtina; 48.464786 N, 19.561011 E; roadside; *Populus alba* L.; living tree; 260; GQ184604;

FI103; Senné; 48.317222 N, 19.403056 E; roadside; *Populus tremula* L.; living tree; 249; GQ184600;

FI104; Kováčová; 48.608056 N, 19.101944 E; spa park; *Tilia* sp.; dead wood; 308; FJ865443;

FI105; Bratislava; 48.134722 N, 17.110833 E; public park; *Acer platanoides* L.; living tree; 161; GQ184597;

FI106; Slovakia, Bratislava; 48.135833 N, 17.109444 E; N.A.; public park; *Tilia* sp.; living tree; 138; GQ184599;

FI107; Banská Bystrica; 48.731667 N, 19.144167 E; roadside; *Tilia cordata* Mill.; living tree; 352; GQ184598;

FI108; Vihorlat Mts.; 48.866833 N, 22.025361 E; other unmanaged forest; *Prunus avium* (L.) L.; dead wood; 670; HQ189535;

Slovenia

FI109; Notranjska; 45.640000 N, 14.440000 E; managed forest; *Abies alba* Mill.; living tree; 969; AM981233, N. Radić (pers. comm.);

Spain

FI110; Cabrerizos; 40.976784 N, -5.581153 E; riverside; *Populus canadensis* Moench; dead wood; 781; MN065444;

FI111; Cabrerizos; 40.977478 N, -5.579092 E; riverside; *Fraxinus angustifolia* Vahl; living tree; 784; MN065445;

FI112; Cabrerizos; 40.977204 N, -5.577877 E; riverside; *Populus alba* L.; living tree; 782; MN065446;

FI113; Huerta; 40.971639 N, -5.472440 E; riverside; *Salix alba* L.; living tree; 788; MN065447;

FI114; Naharros del Río; 40.973002 N, -5.596777 E; riverside; *Populus nigra* L.; dead wood; 780; MN065448;

FI115; Cinc Claus; 42.139083 N, 3.100556 E; windbreak; *Populus alba* L.; living tree; 3; MN065449;

FI116; Ezkurra; 43.079028 N, -1.854278 E; managed forest; *Fraxinus excelsior* L.; living tree; 850; MN065450;

FI117; Xàtiva; 38.932236 N, -0.427064 E; small forest within the farmland; *Populus canadensis* Moench; living tree; 163; MN065451;

FI118; Benigànim; 38.932336 N, -0.427064 E; small forest within the farmland; *Populus canadensis* Moench; living tree; 164; MN065452;

FI119; Alcalá de Henares; 40.505611 N, -3.337897 E; open space near school; *Populus* sp.; dead wood; 596; MN065453;

FI120; Granada; (37.171472 N, -3.574383); orchard; *Olea europaea* L.; living tree; ca 870; MT821143;

FI121; Ronda; 36.799176 N, -5.218256 E; small forest within the farmland; *Populus nigra* L.; dead wood; 796; JA-CUSSTA: 9622;

FI122; Alconada; Lat 40.910960 N, -5.363129 E; windbreak within the farmland; *Populus canadensis* Moench; N.A.; 831; LAZA 6131;

FI123; Cabrerizos; 40.978023 N, -5.581691 E; riverside; *Populus alba* L.; living tree; 796; LAZA 6143;

FI124; Cabrerizos; 40.978023 N, -5.581691 E; riverside; *Fraxinus angustifolia* Vahl; living tree; 796; LAZA 6141;

FI125; Cabrerizos; 40.978023 N, -5.581691 E; riverside; *Populus alba* L.; living tree; 796; LAZA 6150;

Switzerland

FI126–FI134; Cologny; (46.217690 N, 6.182875 E); public urban space; *Aesculus hippocastanum* L.; living tree; ca 446; MG719671 – MG719679;

Ukraine

FI135–FI139; Crimea; 45.291389 N, 34.126667 E; N.A.; *Juglans regia* L.; N.A.; N.A.; OP881548 – OP881552, Fomes-IP-AE-51 – Fomes-IPAE-55;

List S2. The list of *Fomes fomentarius* s.str. records included in this study

country/code; locality; coordinates; habitat; host; substrate type; altitude [m a.s.l.]; data evidence: GenBank Accession number (ITS identification), or Friess's genetic analyses (FRIESS et al., 2019) as the Supporting information Appendix S1 (from now on called "genetic analyses"), and/or database resource, and/or voucher specimen number, and/or personal communication; (N.A. - not available).

Albania

FF01; Accursed Mts.; 42.6294 N, 19.7341 E; N.A.; managed forest; *Fagus sylvatica* L.; living tree; 1271; genetic analyses;

Austria

FF02; Ennstal Alps Mts.; 47.5327 N, 14.6397 E; N.A.; other unmanaged forest; *Fagus sylvatica* L.; living tree; 1171; genetic analyses;

FF03; Ennstal Alps Mts.; 47.6096 N, 14.7307 E; N.A.; other unmanaged forest; *Fagus sylvatica* L.; living tree; 665; genetic analyses;

FF04; Oberer Weilhart Forst; (48.100000 N, 12.867000 E); other unmanaged forest; N.A.; N.A.; 400-500; WU-26842;

FF05; Alps; (47.266667 N, 11.400000 E); managed forest; *Betula* sp.; N.A.; ca 582; KM396269, P74908;

FF06; Alps; 47.278289 N, 11.369422 E; other unmanaged forest; *Picea abies* (L.) H. Karst.; dead wood; 820; KM360128, IB20130022;

FF07; Alps; 47.277208 N, 11.369644 E; other unmanaged forest; *Picea abies* (L.) H. Karst.; dead wood; 817; KM360126, IB20130016;

FF08; Alps; 47.276969 N, 11.382250 E; other unmanaged forest; *Picea abies* (L.) H. Karst.; dead wood; 817; KM360125, IB20130011;

FF09; Alps; 47.284294 N, 11.283414 E; other unmanaged forest; *Fagus sylvatica* L.; living tree; 1300; KM360127, IB20130019;

FF10; Alps; (47.529874 N, 11.702783 E); other unmanaged forest; *Fagus sylvatica* L.; N.A.; ca 938; MK184459, IB20170012;

Belgium

FF11; Ardennes; 49.948208 N, 5.396876 E; managed forest; *Fagus sylvatica* L.; N.A.; 571; Pirronitto (pers. comm.);

FF12; Ardennes; 49.948208 N, 5.396876 E; managed forest; *Fagus sylvatica* L.; N.A.; 571; Pirronitto (pers. comm.);

FF13; Ardennes; 49.728333 N, 5.241667 E; managed forest; *Fagus sylvatica* L.; N.A.; 313; Pirronitto (pers. comm.);

FF14; Ardennes; 50.116667 N, Lon 5.333333 E; managed forest; *Fagus sylvatica* L.; N.A.; 374; Pirronitto (pers. comm.);

FF15; Ardennes; 50.116667 N, 5.333333 E; managed forest; *Fagus sylvatica* L.; N.A.; 374; Pirronitto (pers. comm.);

FF16; Ardennes; 49.883333 N, 5.083333; managed forest; *Fagus sylvatica* L.; N.A.; 442; Pirronitto (pers. comm.);

FF17; Ardennes; 50.483333 N, 5.866667 E; managed forest; *Fagus sylvatica* L.; N.A.; 320; Pirronitto (pers. comm.);

FF18; Ardennes; 50.483333 N, 5.866667 E; managed forest; *Fagus sylvatica* L.; N.A.; 320; Pirronitto (pers. comm.);

FF19; Ardennes; 50.483333 N, 5.866667 E; managed forest; *Fagus sylvatica* L.; N.A.; 442; Pirronitto (pers. comm.);

FF20; Ardennes; 50.433333 N, 6.2 E; managed forest; *Fagus sylvatica* L.; N.A.; 563; Pirronitto (pers. comm.);

FF21; Ardennes; 49.85011 N, 5.0679; managed forest; *Fagus sylvatica* L.; N.A.; 395; Pirronitto (pers. comm.);

FF22; Ardennes; 50.633333 N, 6.33333 E; managed forest; *Fagus sylvatica* L.; N.A.; 516; Pirronitto (pers. comm.);

FF23; Ardennes; 50.283333 N, 5.9 E; managed forest; *Fagus sylvatica* L.; N.A.; 414; Pirronitto (pers. comm.);

FF24; Ardennes; 49.916667 N, 5.583333 E; managed forest; *Fagus sylvatica* L.; N.A.; 441; Pirronitto (pers. comm.);

Bulgaria

FF25; Boatin Biosphere Reserve; 42.8168 N, 24.2638 E; other unmanaged forest; *Fagus sylvatica* L.; living tree; 924; genetic analyses;

Croatia

FF26; Plitvice Lakes National Park, Čorkova uvala; 44.8891 N, 15.5535 E; beech-fir virgin forest; *Fagus sylvatica* L.; living tree; 831; genetic analyses;

Czech Republic

FF27; Holý kopec Nature Reserve; 49.1036108 N, 17.2899364 E; other unmanaged forest; *Fagus sylvatica* L.; N.A.; 542; BRNM 840315;

FF28; Holý kopec Nature Reserve; 49.1035336 N, Lon 17.2880697 E; other unmanaged forest; *Fagus sylvatica* L.; N.A.; 551; BRNM 840316;

FF29; Olšany; 49.257957 N, 16.880298 E; managed forest; *Alnus* sp.; dead wood; 416; MN065438;

FF30; Hodonínská dубrava forest; 48.87076 N, 17.096739 E; other unmanaged forest; *Betula pendula* Roth; dead wood; 186; MN065439;

FF31; Hodonínská dубrava forest; 48.874718 N, 17.09114 E; other unmanaged forest; *Betula pendula* Roth; dead wood; 178; MN065440;

FF32; Salajka virgin forest; 49.4018592 N, 18.4158751 E; beech-fir virgin forest; *Fagus sylvatica* L.; N.A.; 809; OQ474931, BRNM 840312;

FF33; Salajka virgin forest; 49.401501 N, 18.417447 E; beech-fir virgin forest; *Fagus sylvatica* L.; dead wood; 795; MN065443;

FF34; Malý Smrk Mt.; 49.5056549 N, 18.3946141 E; other unmanaged forest; *Fagus sylvatica* L.; N.A.; 1030; BRNM 840311;

FF35; Podolánky; 49.4790808 N, 18.3781449 E; managed forest; *Fagus sylvatica* L.; N.A.; 735; N.A.;

FF36; Jedlový důl Nature Reserve; 50.7877778 N, 15.2427778 E; other unmanaged forest; *Fagus sylvatica* L.; N.A.; 668; OQ474930, BRNM 840310;

FF37; Býčí skála Nature Reserve; 49.3086353 N, 16.6855086 E; other unmanaged forest; *Fagus sylvatica* L.; N.A.; 322; OQ474928, BRNM 840307;

FF38; Skály Nature Reserve; 49.4881533 N, 16.7978892 E; other unmanaged forest; *Fagus sylvatica* L.; N.A.; 701; BRNM 840297;

FF39; Křižánky; 49.6787314 N, 16.0551575 E; other unmanaged forest; *Fagus sylvatica* L.; N.A.; 654; OQ474928, BRNM 840307;

FF40; Habrůvecká bučina Nature Reserve; 49.3189342 N, 16.6857678 E; other unmanaged forest; *Fagus sylvatica* L.; N.A.; 395; OQ474927, BRNM 840306;

FF41; Habrůvecká bučina Nature Reserve; 49.3238572 N, 16.7035883 E; other unmanaged forest; *Fagus sylvatica* L.; N.A.; 524; N.A.;

FF42; Odra river; 49.6184656 N, 17.9358994 E; educational trail; *Betula* sp.; N.A.; 283; OQ474926, BRNM 840305;

FF43; Boubínský prales virgin forest; 48.9637697 N, 13.8123331 E; beech-spruce virgin forest; *Fagus sylvatica* L.; N.A.; 998; BRNM 840296;

FF44; Coufávká Nature Reserve; 49.2927275 N, 16.6406547 E; other unmanaged forest; *Fagus sylvatica* L.; N.A.; 443; BRNM 840295;

FF45; Rakovec Nature Reserve; 49.3192822 N, 16.7956436 E; other unmanaged forest; *Fagus sylvatica* L.; N.A.; 549; OQ474925, BRNM 840294;

FF46; Skalní potok Nature Reserve; 50.1282694 N, 17.2943781 E; other unmanaged forest; *Fagus sylvatica* L.; N.A.; 767; OQ474924, BRNM 840283;

FF47; Arboretum of Mendel University in Brno; 49.3232678 N, 16.7417628 E; arboretum; *Betula* sp.; N.A.; 459; OQ474923;

FF48; Horní Lomná; 49.514417 N, 18.626694 E; open space near hotel; *Picea abies* (L.) H. Karst.; dead wood; 661; OK384699;

Estonia

FF49; Igavere; 58.544240 N, 26.840422 E; managed forest; *Betula pendula* Roth; living tree; 55; OR122498;

France

FF50; Pyrenees Mts.; 42.8719 N, 0.6648 E; managed forest; *Fagus sylvatica* L.; living tree; 1346; genetic analyses;

Germany

FF51; Gomadingen; 48.3826 N, 9.3824 E; managed forest; *Fagus sylvatica* L.; living tree; 775; genetic analyses;

FF52; Berchtesgaden National Park; 47.5475 N, 12.9635 E; other unmanaged forest; *Fagus sylvatica* L.; living tree; 639; genetic analyses;

FF53; Bavarian Forest National Park; 49.0220 N, 13.3870 E; other unmanaged forest; *Fagus sylvatica* L.; living tree; 1109; genetic analyses;

FF54; Passau; 48.5507 N, 13.4224 E; managed forest; *Fagus sylvatica* L.; living tree; 398; genetic analyses;

FF55; Haimich virgin forest; 51.1007 N, 10.4552 E; beech virgin forest; *Fagus sylvatica* L.; living tree; 364; genetic analyses;

FF56; Flörsbachtal; 50.0970 N, 9.4620 E; roadside; *Fagus sylvatica* L.; living tree; 297; genetic analyses;

FF57; Oberschöneegg; 48.0917 N, 10.3446 E; other unmanaged forest; *Fagus sylvatica* L.; living tree; 661; genetic analyses;

FF58; Wölfersheim; 50.3944 N, 8.8036 E; planted streets and pockets of greenery; *Fagus sylvatica* L.; living tree; 168; genetic analyses;

FF59; Rohrbrunner Forst; 49.8902 N, 9.3507 E; N.A.; other unmanaged forest; *Fagus sylvatica* L.; living tree; 392; genetic analyses;

FF60; Dillenburg; 50.7630 N, 8.2370 E; managed forest; *Fagus sylvatica* L.; living tree; 334; genetic analyses;

FF61; Kröppelshagen; 53.480544 N, 10.338624 E; planted streets and pockets of greenery; *Betula* sp.; N.A.; 79; FR686552;

FF62; Kellerwald virgin forest; (51.153889 N, 8.977778 E); beech virgin forest; *Fagus sylvatica* L.; dead wood; 450; EF155492, Langer (pers. comm.);

FF63; Kellerwald virgin forest; (51.153889 N, 8.978056 E); N.A.; beech virgin forest; *Fagus sylvatica* L.; dead wood; 450; EF155493, Langer (pers. comm.);

FF64; Kellerwald virgin forest; (51.154167 N, 8.978333 E); beech virgin forest; *Fagus sylvatica* L.; dead wood; 450; EF155491, Langer (pers. comm.);

FF65; Kellerwald virgin forest; (51.154167 N, 8.978056 E); beech virgin forest; *Fagus sylvatica* L.; dead wood; 450; EF155494, Langer (pers. comm.);

FF66; Kellerwald virgin forest; (51.154167 N, 8.977778 E); beech virgin forest; *Fagus sylvatica* L.; dead wood; 450; EF155495, Langer (pers. comm.);

FF67; Kellerwald virgin forest; (51.154444 N, 8.977778 E); beech virgin forest; *Fagus sylvatica* L.; dead wood; 450; EF155496, Langer (pers. comm.);

FF68; Kellerwald virgin forest; (51.154167 N, 8.977222 E); beech virgin forest; *Fagus sylvatica* L.; dead wood; 445;

EF155497, Langer (pers. comm.);
 FF69; Kellerwald virgin forest; (51.154167 N, 8.977500 E); beech virgin forest; *Fagus sylvatica* L.; dead wood; 450;
 EF155498, Langer (pers. comm.);
 FF70; Kellerwald virgin forest; (51.154167 N, 8.976944 E); beech virgin forest; *Fagus sylvatica* L.; dead wood; 438;
 EF155499, Langer (pers. comm.);
 FF71; Berlin - Brandenburg; (52.407717 N, 12.512629 E); forest park; N.A.; *Betula* sp.; dead wood; 32; FF-FB;

Greece
 FF72; Ano Poroia; 41.323097 N, 23.040384 E; other unmanaged forest; *Betula pendula* Roth; dead wood; 1290; MN065433;

Hungary
 FF73; Mátra Protected Landscape Area; 47.8743 N, 20.0054 E; other unmanaged forest; *Fagus sylvatica* L.; living tree; 992;
 genetic analyses;

Italy
 FF74; Central Apennines; 41.7520 N, 13.8163 E; managed forest; *Fagus sylvatica* L.; living tree; 1536; genetic analyses;
 FF75; Central Apennines; 41.7861 N, 13.7711 E; managed forest; *Fagus sylvatica* L.; living tree; 1282; genetic analyses;
 FF76; Parco del Cilento; 40.280678 N, 15.459553 E; other unmanaged forest; *Fagus sylvatica* L.; N.A.; 1379; MK295658,
 IB20140121;

Latvia
 FF77; Daugmale; (56.813192 N, 24.390588 E); managed forest; *Alnus incana* (L.) Moench; living tree; ca 45; GU062198;
 FF78; Junkalsvana; (56.683000 N, 25.967000 E); managed forest; *Alnus glutinosa* (L.) Gaertn.; living tree; ca 95; JF340284;

Lithuania
 FF79; Kaišialakiai; (54.532125 N, 25.192922 E); managed forest; *Betula pendula* Roth; dead wood; ca 154; AY354213;

Norway
 FF80; Atrå; 59.989 N, 8.779 E; other unmanaged forest; N.A.; N.A.; 228; O-F-260063;

Poland
 FF81; Roztocze National Park; 50.578250 N, 23.008694 E; other unmanaged forest; *Fagus sylvatica* (L.); dead wood; 299;
 MZ410696, Rosa-Gruszecka (pers. comm.);
 FF82; Kampinos National Park; 52.322306 N, 20.824833 E; other unmanaged forest; *Betula pendula* Roth; dead wood; 97;
 OK384696;
 FF83; Kampinos National Park; 52.323411 N, 20.824133 E; other unmanaged forest; *Betula pendula* Roth; dead wood; 94;
 OK384697;
 FF84; Bieszczady Mts.; 49.2800 N, 22.3003 E; managed forest; *Fagus sylvatica* L.; living tree; 627; genetic analyses;
 FF85; Bieszczady Mts.; 49.2747 N, 22.1854 E; managed forest; *Fagus sylvatica* L.; living tree; 761; genetic analyses;
 FF86; unknown carpathian forest; (49.650278 N, 19.963556 E); N.A.; *Fagus sylvatica* L.; living tree; ca 765; JF927720,
 Grzywnowicz (pers. comm.);

Romania
 FF87; Făgăraș Mts.; Lat 45.6676 Lon 25.1705; other unmanaged forest; *Fagus sylvatica* L.; living tree; 1042; genetic analyses;
 FF88; Făgăraș Mts.; 44.9572 N, 22.2126 E; other unmanaged forest; *Fagus sylvatica* L.; living tree; 827; genetic analyses;
 FF89; Semenic - Cheile Carasului National Park; 45.1616 N, 22.0654 E; other unmanaged forest; *Fagus sylvatica* L.; living
 tree; 1410; genetic analyses;
 FF90; Făgăraș Mts.; 45.6970 N, 25.1670 E; other unmanaged forest; *Fagus sylvatica* L.; living tree; 651; genetic analyses;

Russia
 FF91; Troitsk; 55.479722 N, 37.307778 E; N.A.; public space on the urban fringe; *Populus* sp.; N.A.; ca 190; KJ857260;
 FF92; Troitsk; 55.479444 N, 37.305278 E; public space on the urban fringe; *Populus* sp.; dead wood; ca 188; KJ857257;
 FF93; Moscow suburbs; (55.650598 N, 38.249704); forest park; *Betula* sp.; living tree; ca 147; JQ901966, Shnyreva (pers.
 comm.);
 FF94; Moscow suburbs; (55.706111 N, 37.241667 E); forest park; *Populus* sp.; N.A.; ca 204; JQ901965, Shnyreva (pers.
 comm.);
 FF95; Moscow region; (56.241111 N, 37.492778 E); forest park; *Populus* sp.; N.A.; ca 184; KJ857253;
 FF96; Moscow region; (56.163056 N, 38.512500 E); forest park; *Betula* sp.; N.A.; ca 155; KJ857254;
 FF97; Moscow region; (56.094444 N, 37.670833 E); forest park; *Betula* sp.; N.A.; ca 181; KJ857255;
 FF98; Moscow region; (56.146111 N, 37.492778 E); forest park; *Populus* sp.; N.A.; ca 197; KJ857256;
 FF99–FF104; Styktyvar; (61.666667 N, 50.816667 E); N.A.; N.A.; N.A.; ca 143; OP881542–OP881547, Fomes-IPAE-56–
 Fomes-IPAE-61;

Slovakia
 FF105; Kremnické vrchy Mts.; 48.6419 N, 19.0642 E; managed forest; *Fagus sylvatica* L.; living tree; 604; genetic analyses;
 FF106; Slovenský raj National Park; 48.9220 N, 20.3920 E; other unmanaged forest; *Fagus sylvatica* L.; living tree; 1002;
 genetic analyses;
 FF107; Badínsky prales virgin forest; 48.682769 N, 19.053492 E; beech-fir virgin forest; *Fagus sylvatica* L.; dead wood;
 828; EU162056, Holdenrieder (pers. comm.);
 FF108; Zvolen; 48.569723 N, 19.118681 E; N.A.; roadside; *Acer negundo* L.; living tree; 281; FJ865440;
 FF109; Starohorské vrchy Mts.; 48.750603 N, 19.112167 E; forest park; *Fagus sylvatica* L.; living tree; 471; GQ184603;
 FF110; Vihorlat Mts.; 48.861111 N, 22.021944 E; other unmanaged forest; *Fagus sylvatica* L.; dead wood; 681; HQ189534;
 FF111; Morské oko Nature Reserve; 48.9187000 N, 22.1915319 E; other unmanaged forest; *Fagus sylvatica* L.; N.A.; 687;

BRNM 840313;

FF112; Vihorlat Mts., Sninský kameň Nature Monument; 48.9287314 N, 22.1887856 E; other unmanaged forest; *Fagus sylvatica* L.; N.A.; 979; OQ474932, BRNM 840314;

Slovenia

FF113; Trnovski Gozd Plateau; 45.9894 N, 13.8109 E; managed forest; *Fagus sylvatica* L.; living tree; 1120; genetic analyses;

FF114; Dinaric Alps; (45.765817 N, 14.221647 E); managed forest; *Fagus sylvatica* L.; N.A.; 564; GU203514, Radić (pers. comm.);

Sweden

FF115; Fästampaåsens Utsiktsplats National Park; 56.8014 N, 12.8896 E; other unmanaged forest; *Fagus sylvatica* L.; living tree; 151; genetic analyses;

FF116; Gothenburg; 57.684333 N, 11.954964 E; urban forest; deciduous tree; dead wood; 37; JX109860, GB, Larsson and Sjökvist (pers. comm.);

FF117; Växjö; 56.939079 N, 14.794 E; N.A.; managed forest; *Betula pendula* Roth; living tree; 167; OK384698;

Switzerland

FF118; Reutigen; 46.7022 N, 7.6322 E; public urban space: riverside; *Fagus sylvatica* L.; living tree; 600; genetic analyses;

Ukraine

FF119; Crimea, Lavanda; 44.7417 N, 34.3417 E; managed forest; *Fagus sylvatica* L.; living tree; 839; genetic analyses;

United Kingdom

FF120; Woodwalton Fen in Huntingdonshire, 52.438932 N, -0.194481 E; wetland ecosystem; *Betula* sp.; dead wood; 8; MZ159490, K(M):189346, Ainsworth (pers. comm.);