

## **PHLEOGENA FAGINEA (PUCCINIOMYCOTINA, ATRACTIELLALES) IN POLAND – NOTES ON ECOLOGY AND DISTRIBUTION**

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**Abstract.** The current distribution of *Phleogena faginea* (Fr.: Fr.) Link in Poland is presented, based on literature data as well as 19 new localities. Six tree species and one fungus as a new substrate for *P. faginea* in Poland are reported. These new records confirm the high ecological plasticity of the species, which the authors found in natural stands, managed forests and an urban park. The ecological preferences of the species are discussed. Wood of *Carpinus betulus* is the most frequent type of substrate for *P. faginea* in Poland. Based on the new distribution data for *P. faginea* in Poland, a change of its red list category is proposed.

**Key words:** *Phleogena faginea*, fungi, Atractiellales, Phleogenaceae, ecology, distribution, Poland

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### INTRODUCTION

*Phleogena faginea* (Fr.: Fr.) Link is the only member of the genus *Phleogena* Link, belonging to the sub-phylum Pucciniomycotina, class Atractiellomycetes, order Atractiellales and family Phleogenaceae (Bauer *et al.* 2006). It is widely distributed in the temperate and tropical climatic zones. It is known from Australia and New Zealand, South America, North America, Asia, and Europe. Its general distribution, taxonomy, morphology and ecology are described by Wojewoda and Komorowska (1997) and Wojewoda *et al.* (1999).

*Phleogena faginea* is a saprotroph growing on bark, in bark crevices, or directly on wood of stumps, trunks and branches of dying or dead (rarer on living) broadleaved, occasionally coniferous, trees and shrubs. In Poland it has been noted on *Acer platanoides*, *Alnus glutinosa*, *Betula pendula*, *Carpinus betulus*, *Corylus avellana*, *Fagus*

*sylvatica*, *Picea abies* and *Populus tremula*, and on basidiomes of the fungus *Fomes fomentarius* (Wojewoda 1977, 2003; Wojewoda & Komorowska 1997; Wojewoda *et al.* 1999). In other European countries it is also known from *Acer campestre*, *Betula pubescens*, *Carya* sp., *Fraxinus* sp., *Ilex* sp., *Populus* sp., *Prunus spinosa*, *Pyrus communis*, *Quercus* sp., *Salix cinerea* and *Ulmus* sp., and also from basidiomes of *Inonotus obliquus* (Kreisel 1987; Cook 1994; Wojewoda & Komorowska 1997; Holec 2003; Storey 2004). Beyond Europe it was observed also on *Dysoxylon spectabile*, *Ficus* sp., *Inga vera*, *Podocarpus dacrydioides* and *Salvadora oleoides* (McNabb 1964; Wojewoda & Komorowska 1997; López & García 2001). In Brazil it was collected on construction wood of *Cedrela* sp. (Möller 1895, after Oberwinkler & Bauer 1989).

Despite its wide distribution across the world

and its broad substrate spectrum, *P. faginea* is a rare species in many European countries. Only one locality is known from Slovenia (Jurc *et al.* 2005) and Norway (Anonymous), 11 localities from the Czech Republic (Holec 2003), 12 from western Germany (Krieglsteiner 1991), 13 from Slovakia (Ripková *et al.* 2004) and 15 from Denmark (Gøtzsche 1980). It is uncommon in Great Britain but probably overlooked (Cook 1994). In some countries such as Germany (Benkert *et al.* 1992; Schnittler 1996), Sweden (Gärdenfors 2000) and Poland (Wojewoda & Ławrynowicz 1986, 1992, 2006) the fungus is on the red list of threatened fungi.

#### MATERIAL AND METHODS

The current distribution of *P. faginea* in Poland is described and mapped on the basis of literature data as well as unpublished information we gathered. In areas of the frequent occurrence of *P. faginea* (within the borders of one forest complex), a forest section is considered a single locality. To characterize the substrate of *P. faginea* and to determine whether the species prefers older (thicker) trees, the circumference of standing tree trunks colonized by the fungus was measured at 1.3 m height, and that of lying trees at the site of basidiomes. Specimen descriptions are based on the collected material. Basidiomes were measured fresh, and spores and basidia were taken from dried specimens (WAML 203, 211, 217, 220, 224, 228, 229; MW 1614) and measured in 5% KOH. Acronyms of herbaria are according to Mirek *et al.* (1997). The following abbreviations are used for herbaria not mentioned by those authors: WAML – Herbarium of the Department of Mycology and Forest Phytopathology of the Warsaw University of Life Sciences – (SGGW), DK – private herbarium of Dariusz Karasiński, MW – private herbarium of Marek Wołkowycki.

Plant names are given after Mirek *et al.* (2002), and the names of geographic regions used in the list of Polish localities follow Kondracki (2002).

#### DESCRIPTION OF SPECIMENS AND LOCALITIES

##### *Phleogena faginea* (Fr.: Fr.) Link

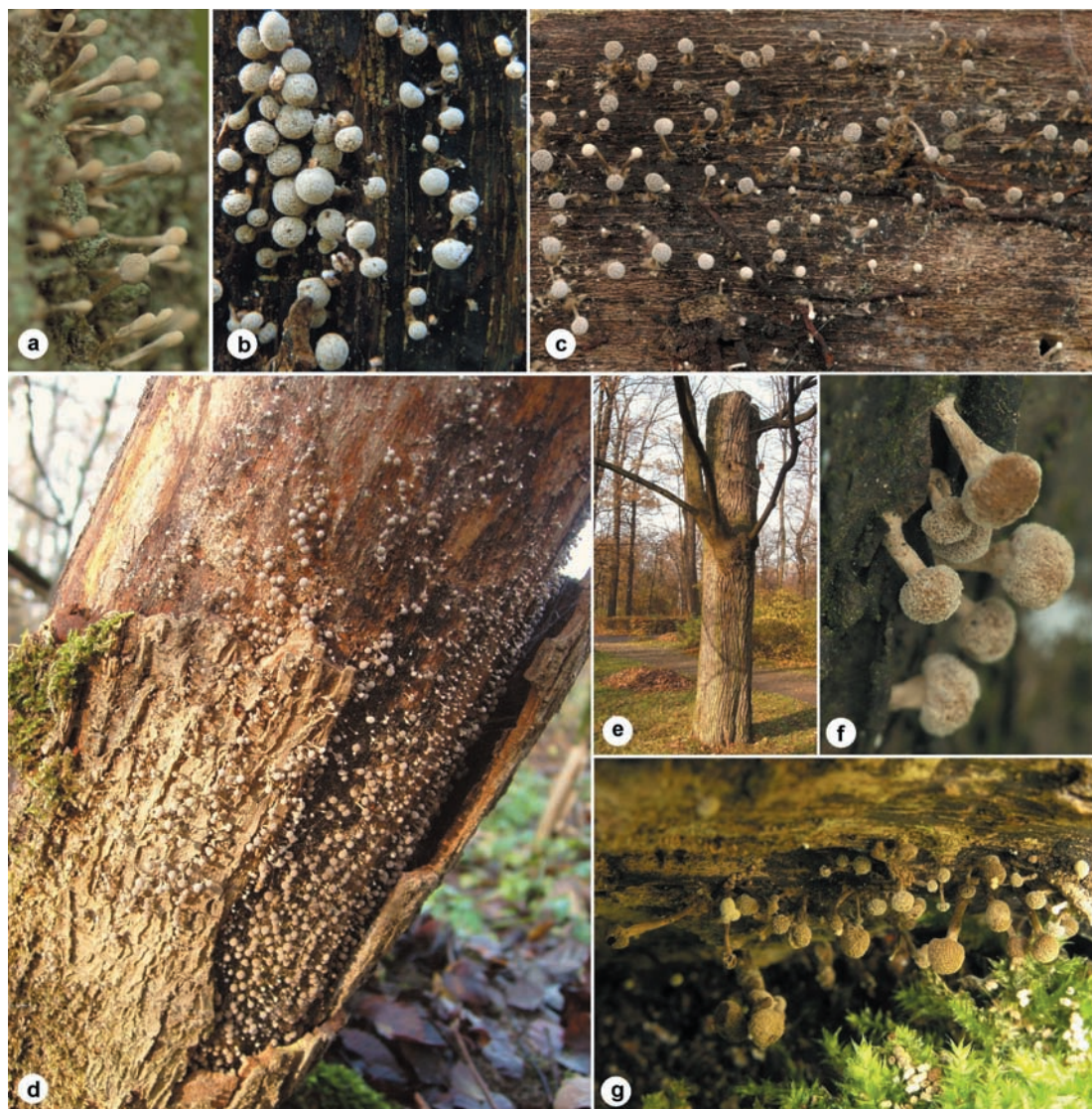
Figs 1a–d, f & g; Table 1

Handb. Gewächse 3(1): 396. 1833.

Basidiomes typically grow in rows or form irregular aggregations of even several hundred

individuals; small, up to 12 mm tall, with head and stalk resembling the sporangia of some myxomycetes. Young basidiomes club-shaped with weakly differentiated head and stalk. Head 1–5 mm in diameter, ± circular, spherical, sometimes slightly flattened, less often phaseoliform, whitish, ochraceous, greyish, and in mature specimens brownish. Stalk up to 8 mm long and 1.5 mm thick, whitish, becoming brown to blackish with age. Context elastic, then dry with a distinct smell resembling lovage or maggi sauce persisting also in herbarium specimens. Basidia cylindrical and partitioned by 1–4 transversal septa, 16–40 × 2.5–5 µm. Spores spherical or ± spherical, thick-walled, smooth, ochraceous to light brown in mass, 4–11 × 4–10 µm.

NEW LOCALITIES. POJEZIERZE POŁUDNIOWOPOMORSKIE LAKELAND: Zielona Góra Reserve near Wyrzysk, Kaczory forest district, sect. 99 (53°07'N/17°15'E), *Galio sylvatici-Carpinetum*, on log of deciduous tree (*Quercus* sp. or *Carpinus betulus*), 07 Oct. 2006, leg. R. Puciata (WAML 227). POBRZEŻE GDAŃSKIE OUTSKIRTS: Zajęcze Wzgórze Reserve, Gdańsk forest district, Sopot forest range, sect. 47 (54°26'N/18°33'E), *Luzulo pilosae-Fagetum*, on barkless fragment of *Fagus sylvatica* log, 7 Jan. 2007, leg. W. Póltorak (WAML 228); Gdańsk forest district, Renuszewo forest range, sect. 118, Zielona Dolina valley (54°23'N/18°33'E), *Stellario holosteeae-Carpinetum betuli*, on rotten log of *Carpinus betulus*, 25 Aug. 2006, leg. M. S. Wilga (WAML 230), on dead standing trunk of *Fagus sylvatica*, 16 Feb. 2007, leg. M. S. Wilga; Gdańsk forest district, Matemblewo forest range, sect. 121c, Samborowo valley (54°23'N/18°33'E), *Stellario holosteeae-Carpinetum betuli*, on barkless dead standing trunk of *Quercus robur* (Fig. 1b), Sept. 2006, leg. M. S. Wilga (WAML 229). WZNIESIENIA POŁUDNIOWOMAZOWIECKIE HEIGHTS: Rogów forest district, Popień forest part, sect. 171d (51°46'37"N/19°55'35"E), mixed forest, on fallen trunk of *Populus tremula*, 18 Sept. 2006, leg. A. Kujawa (WAML 201), on dead standing trunk of *Alnus glutinosa*, leg. J. Piętka (WAML 202), on log of *Alnus glutinosa*, leg. A. Szczepkowski (WAML 203) ([http://www.grzyby.pl/gatunki/Phleogena\\_faginea.html](http://www.grzyby.pl/gatunki/Phleogena_faginea.html)). BESKIDY ŚRODKOWE MTS: Magurski National Park, SE slope of Góra Żydowska Mt. (49°27'45.6"N/021°31'41.2"E, alt. 573 m), *Dentario glandulosae-Fagetum*, on wood and bark of dead standing *Ulmus glabra* trunk, 28 Oct. 2005, leg. D. Karasiński (DK 051028/0712); SE slope of Kamień Mt. (49°31'09.6"N/021°32'23.8"E, alt.



**Fig. 1.** *Phleogena faginea* (Fr.: Fr.) Link. a – young club-shaped basidiomes on a trunk of *Carpinus betulus* in sect. 398 of the Białowieża National Park, b – well-developed basidiomes on trunk of a monumental dead oak in the Gdańsk forest district (WAML 229), c – basidiomes growing directly on wood of *Ulmus* sp. log and on rhizomorphs of *Armillaria* sp. in Hajnówka forest district, d – basidiomes growing on bark and directly on wood of a dead *Ulmus laevis* trunk, and on rhizomorphs of *Armillaria* sp. in the Morysin Reserve (WAML 220), e – *Acer platanoides* colonized by *P. faginea* in Łazienki Park, f – mature basidiomes in bark crevices on trunk of *Padus avium* in the Morysin Reserve (WAML 214), g – basidiomes growing directly on wood, on lower side of fallen *Carpinus betulus* log in Las Bielański Reserve (WAML 205). Photo: D. Majgier (a, f, g), M. Snowarski (c), A. Szczepkowski (d, e) and M. S. Wilga (b).

383 m), *Alnetum incanae*, on dead standing *Alnus incana* trunk, 11 Nov. 2006, leg. D. Karasiński (DK 061111/01) ([http://grzyby.strefa.pl/Phleogena\\_faginea.html](http://grzyby.strefa.pl/Phleogena_faginea.html)). NIZINA ŚRODKOWOMAZOWIECKA LOWLAND: Warsaw, Las Bielański Reserve, sect. 8 (52°17'38.4"N/20°57'57.2"E),

*Tilio-Carpinetum*, on trunk of dying *Carpinus betulus*, 29 Dec. 2006, leg. A. Szczepkowski (WAML 223), on remains of standing trunk of *Carpinus betulus*, 29 Dec. 2006, leg. A. Szczepkowski, on trunk of dying *Alnus glutinosa*, 29 Dec. 2006, leg. A. Szczepkowski, *Ficario-Ulmetum*

**Table 1.** Comparison of some characters of *Phleogena faginea* (Fr.: Fr.) Link from several descriptions.

Reference	Character	Basidiome dimensions [mm]			Basidiospores [ $\mu\text{m}$ ]	Basidia [ $\mu\text{m}$ ]
		total height	head	stalk		
Pilát 1956		3–6	1–3	–	6–8 × 5.5–7.5	26–30 × 5
McNabb 1964		4–7	1–3	–	8–10 × 7.5–9	25–37 × 4–5
Tallasch & Jahn 1970		2–5	1–3	2–3 × 0.2–0.3	6–8 × 5.5–7.5	–
Wojewoda 1977, 1981		2–11	1–4(–5)	2–8 × 0.2–1.5	4.5–10 × 4.5–10	16–37 × 4–5
Cook 1994		2–8	1–4	1–4 × 0.2–0.3	(4.5–)6–11 × (4–)5.5–7.5(–9)	(16–)18–27(–37) × (2.5–)3–4(–5)
Hansen & Knudsen 1997		3–6	–	1–3	8–10	25–30 × 4–5
Holec 2003		up to 7	1–3	1.5–4 × 0.2–1	5.5–8 × 5–6.5	30–40 × 4–5
Ripková <i>et al.</i> 2004		up to 8	1–4	1–4 × 0.2–1	4–7.5 × 4–8	–
Present studies		2–12	1–5	1–8 × 0.2–1.5	(5–)6–9(–10) × (4.5–)5–8(–9)	18–35 × 3–4.5

*minoris*, on stump of *Ulmus laevis*, 29 Dec. 2006, leg. A. Szczepkowski (WAML 224), on remains of stump of *Alnus glutinosa*, 29 Dec. 2006, leg. A. Szczepkowski (WAML 225); sect. 9 (52°17'17.7"N/20°58'12.4"E), *Tilio-Carpinetum*, on fallen trunk of *Carpinus betulus*, 21 Sept. 2006, leg. D. Majgier (WAML 205) (Fig. 1g), on two fallen trunks of *Carpinus betulus*, 29 Dec. 2006, leg. A. Szczepkowski (WAML 222), on two dead standing trunks of *Carpinus betulus*, 29 Dec. 2006, leg. A. Szczepkowski (WAML 221); sect. 12, *Tilio-Carpinetum*, on one dead standing *Carpinus betulus* trunk and on six fallen *Carpinus betulus* trunks, 21 Oct. 2006, leg. M. Kozłowski & A. Szczepkowski (WAML 226); Warsaw, Łazienki Park (52°12'46.1"N/21°01'59.3"E) on dead bark of living *Carpinus betulus* trunk, 17 Nov. 2006, leg. D. Majgier (WAML 206), on dead bark and wood of four living standing *Carpinus betulus* trunks, 18 Nov. 2006, leg. A. Szczepkowski (WAML 208), on dead bark of dying *Acer platanoides* trunk (Fig. 1e), 17 Nov. 2006, leg. A. Szczepkowski (WAML 207); Warsaw, Morysin Reserve (52°10'34"N/21°55'35"E), *Ficario-Ulmetum minoris*, on decorticated branch of living *Alnus incana*, 17 Nov. 2006, leg. A. Szczepkowski (WAML 211), on trunks of three standing broken *Alnus incana*, 29 Nov. 2006, leg. A. Szczepkowski (WAML 216, 218), on four logs of *Alnus incana*, 17. Nov. 2006, leg. A. Szczepkowski (WAML 212, 213), 29 Nov. 2006, leg. A. Szczepkowski (WAML 219), on dead bark of living standing *Ulmus laevis* trunk, 17 Nov. 2006, leg. A. Szczepkowski (WAML 210), on dead standing *Ulmus laevis* trunk, 17 Nov. 2006, leg. A. Szczepkowski (WAML

209), on dead bark and wood of standing trunk of *Ulmus laevis* and also on rhizomorphs of *Armillaria* sp., 29 Nov. 2006, leg. A. Szczepkowski (WAML 220), on dead standing broken *Ulmus laevis* trunk, 17 Nov. 2006, leg. A. Szczepkowski (WAML 215), on dead standing *Padus avium* trunk, 2 Nov. 2006, leg. D. Majgier (WAML 214) (Fig. 1f), on bark and wood of dead fallen *Padus avium* trunk, 29 Nov. 2006, leg. A. Szczepkowski (WAML 217). NIZINA PÓŁNOCNOPODLASKA LOWLAND: Puszcza Białowiecka primeval forest, Hajnówka forest district, sect. 272 (52°45'N/23°38'E), *Tilio-Carpinetum melittetosum*, on log of *Ulmus* sp., directly on wood and on rhizomorphs of *Armillaria* sp. (Fig. 1c), 26 Sept. 2006, leg. M. Snowarski, D. Karasiński & M. Piątek; sect. 412A (52°42'N/23°37'E), managed tree stand growing in *Ribeso nigri-Alnetum*, on dead branch of standing *Corylus avellana*, 20 Feb. 2002, leg. M. Wołkowycki (MW 2244); sect. 416C (52°42'N/23°41'E), managed tree stand growing in *Tilio-Carpinetum melittetosum*, on old stump of *Picea abies*, 25 Oct. 2006, leg. M. Wołkowycki (MW 3400); sect. 464D (52°41'N/23°39'E), managed tree stand growing in *Tilio-Carpinetum circaeetosum alpinae*, on dead lying branch of *Tilia cordata* and also on rhizomorphs of *Armillaria* sp., 2 Sept. 2001, leg. M. Wołkowycki (MW 1614); sect. 488C (52°40'N/23°41'E), managed tree stand growing in *Tilio-Carpinetum*, on dead, standing *Alnus glutinosa* trunk, 17 Nov. 2000, leg. M. Wołkowycki (MW 1767); sect. 516D (52°40'N/23°41'E), managed tree stand growing in *Quercu-Piceetum*, on log of *Betula pendula*, 11 Oct. 2001, leg. M. Wołkowycki (MW 2133); Sach-

arewo hamlet (52°41'N/23°39'E), on *Acer platanoides* wood for fuel, 10 Feb. 1998, leg. *M. Wolkowycy* (MW 1149); Białowieża National Park, Strict Protection Area, along educational trail in sect. 398, on fallen trunk of *Populus tremula*, 25 Sept. 2006, leg. *A. Szczepkowski* (WAML 204), on two standing trunks of *Carpinus betulus* (Fig. 1a), 25 Sept. 2006, leg. *A. Szczepkowski*, on two dead standing trunks of *Alnus glutinosa*, 25 Sept. 2006, leg. *A. Szczepkowski*.

LITERATURE DATA. POJEZIERZE ZACHODNIOPOMORSKIE LAKELAND: Perlówkowe Buki Reserve near Stargard Szczeciński, Sept. 1995, leg. *H. Komorowska* (KRAM-F) (Wojewoda & Komorowska 1997; Wojewoda *et al.* 1999; Wojewoda 2003). SUDETY ŚRODKOWE MTS: surroundings of Bystrzyca Kłodzka (Schröter 1889). NIZINA ŚLĄSKA LOWLAND: Wrocław – Strachocin (Schröter 1889). POJEZIERZE POLUDNIOWOPOMORSKIE LAKELAND: Bory Tucholskie forest, Cisy Staropolskie Reserve, Sept. 1995, leg. *H. Komorowska* & *Z. Heinrich* (KRAM-F) (Wojewoda & Komorowska 1997; Wojewoda *et al.* 1999; Wojewoda 2003). WZNIESIENIA POLUDNIOWOMAZOWIECKIE HEIGHTS: Rogów forest district, Popień forest part, sect. 171d (51°46'37"N/19°55'35"E), mixed forest, on dead standing trunk of *Populus tremula*, 21 Sept. 2004, leg. *J. Nita* (WAML 34) (Szczepkowski 2005). KOTLINA SANDOMIERSKA BASIN: Puszcza Niepołomnicka forest, Lipówka Reserve, Sept. 1984, leg. *H. Komorowska* (KRAM-F), Oct. 1994, leg. *Z. Heinrich* (KRAM-F), Oct. 1994, leg. *W. Wojewoda* (KRAM-F) (Komorowska 1991, 1995; Wojewoda & Komorowska 1997; Wojewoda *et al.* 1999; Wojewoda 2003). POJEZIERZE MAZURSKIE LAKELAND: Puszcza Borecka forest, surroundings of Węgorzewo, Aug. 1984, leg. *Z. Heinrich* (KRAM-F), Sept. 1984, leg. *B. Ginko* (KRAM-F) (Wojewoda *et al.* 1999; Wojewoda 2003). BESKIDY WSCHODNIE MTS: near Ustrzyki Dolne, Sept. 1980, leg. *W. Wojewoda* (KRAM-F) (Gumińska & Wojewoda 1988; Wojewoda & Komorowska 1997; Wojewoda *et al.* 1999; Wojewoda 2003). POLESIE ZACHODNIE: Czarny Las Reserve near Parczew, Sept. 1996, leg. *H. Komorowska* (KRAM-F), Sept. 1996, leg. *Z. Heinrich* (KRAM-F) (Wojewoda *et al.* 1999; Wojewoda 2003). POJEZIERZE LITEWSKIE LAKELAND: Puszcza Augustowska forest, Starożyn Reserve near Augustów, Sept. 1974, leg. *Z. Heinrich* (KRAM-F) (Wojewoda 1977, 1979, 2003; Wojewoda & Komorowska 1997; Wojewoda *et al.* 1999); Jezioro Kalejty Reserve near Augustów, Oct. 1995, leg. *H. Komorowska* (KRAM-F) (Wojewoda & Komorowska 1997; Wojewoda *et al.* 1999; Wojewoda 2003); Perkuć Reserve near Augustów, Oct. 1995, leg. *H. Komorowska* (KRAM-F) (Wojewoda & Komorowska 1997; Wojewoda

*et al.* 1999; Wojewoda 2003). ROZTOCZE: Roztoczański National Park, Nart near Zwierzyniec Reserve, Sept. 1986, leg. *M. Ławrynowicz* (KRA) (Sałata 1991; Wojewoda & Komorowska 1997; Wojewoda *et al.* 1999; Wojewoda 2003). NIZINA PÓLNOCNODOLSKA LOWLAND: Puszcza Białowieża primeval forest, Białowieża forest district, Pogorzelce Reserve, sect. 252D, on log of *Carpinus betulus*, 30 Aug. 2000, leg. *A. Bujakiewicz* & *A. Miśkiewicz* (KRAM-F) (Bujakiewicz 2003); Podolany Reserve, sect. 500A, on log of *Carpinus betulus*, 29 Aug. 2000, leg. *A. Bujakiewicz* & *A. Miśkiewicz* (KRAM-F) (Bujakiewicz 2003); Białowieża National Park, 13 Oct. 1950, leg. *A. Pilát* (PRM) (Pilát 1956; Wojewoda 1979; Wojewoda 2003); sect. 256, Sept. 1987, leg. *A. Bujakiewicz* & *B. Sadowska*, Oct. 1990, leg. *A. Bujakiewicz* (POZM) (Faliński *et al.* 1997; Wojewoda & Komorowska 1997; Wojewoda *et al.* 1999; Wojewoda 2003); sect. 283, Sept. 1973, leg. *V. Holubová* (KRAM-F) (Wojewoda & Komorowska 1997; Wojewoda *et al.* 1999; Wojewoda 1979; 2003); sect. 285, leg. *A. Skirgiello* (WA – no specimen in herbarium) (Wojewoda & Komorowska 1997; Wojewoda *et al.* 1999; Wojewoda 1979, 2003); sect. 314, Sept. 1977, leg. *W. Wojewoda* (KRAM-F) (Wojewoda & Komorowska 1997; Wojewoda *et al.* 1999; Wojewoda 2003); sect. 369, Aug. 1973, leg. *V. Holubová* (KRAM-F), Aug. 1973, leg. *W. Wojewoda* (KRAM-F) (Wojewoda 1977, 2003; Wojewoda & Komorowska 1997; Wojewoda *et al.* 1999); sect. 370, Aug. 1973, leg. *Z. Pouzar* (KRAM-F) (Wojewoda & Komorowska 1997; Wojewoda *et al.* 1999; Wojewoda 2003); sect. 399, Aug. 1973, leg. *Z. Heinrich* (KRAM-F) (Wojewoda 1979, 2003; Wojewoda & Komorowska 1997; Wojewoda *et al.* 1999).

## DISCUSSION

### COMPARISON OF SPECIMEN DIMENSIONS

We measured the basidiomes, spores and basidia recorded on eight tree species and on *Armillaria* rhizomorphs to calculate the size of individuals growing on different substrates and to compare its variability with literature data. No relationship between substrate type and the dimensions of any part was found. Measurement values generally were within the range of values given by other authors; only the upper-range values of basidiome measurements reported from Poland (Wojewoda 1977, 1981; this study) are higher than in the literature (Table 1).

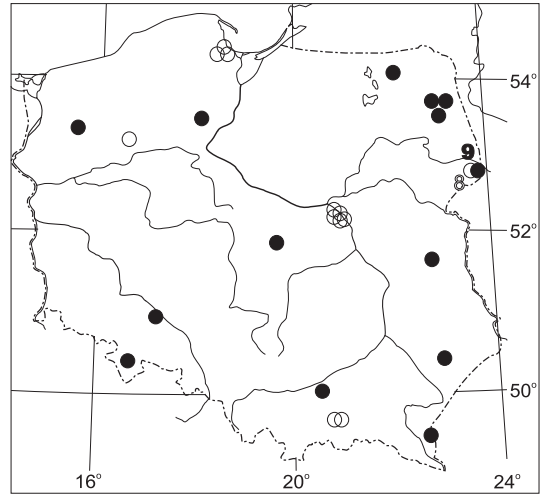


DISTRIBUTION OF *PHLEOGENA FAGINEA*  
IN POLAND

*Phleogena faginea* has been considered very rare in Poland except in the Białowieża National Park, where it was recorded from many forest sections. As few as six localities of *P. faginea* were known in 1979 (Wojewoda 1979): five in the Puszcza Białowieska primeval forest and one in the Puszcza Augustowska forest. Eleven new localities of the fungus were discovered twenty years later (Wojewoda *et al.* 1999). Wojewoda (2003) added two historical localities recorded by Schröter (1889) from Wrocław (Strachocin) and the surroundings of Bystrzyca Kłodzka. Bujakiewicz (2003) noted two more localities in the Puszcza Białowieska primeval forest, and Szczepkowski (2005) published the first record of the species from central Poland.

Recently we found 19 new localities of *P. faginea* in Poland. Three are located near Gdańsk, the northernmost localities in Poland, and five are in central Poland, that is, in the area from which this fungus was recorded only recently (Szczepkowski 2005). Another locality is in the Pojezierze Południowopomorskie lakeland in northwest Poland, eight in the Puszcza Białowieska primeval forest in the northeast, and the other two in the south in the Magurski National Park, where the fungus was found at its highest station in Poland, at 573 m a.s.l. The number of localities of *P. faginea* has doubled over the last three years. The records of new sites are most likely the result of heightened interest in macrofungi and the intensification of wide-ranging penetrative field studies which yield more data, and not from the spread of the fungus. The 19 new localities presented in this paper significantly increase the information on the distribution of the species in Poland, revealing that while still not common, the fungus occurs throughout Poland (Fig. 2).

So far, 41 localities of the fungus in Poland are known, mostly in natural plant communities protected as national parks or nature reserves. Of these, 11 are in national parks (Białowiecki, Magurski, Roztoczański), 18 in or very near nature reserves, 9 in better-preserved managed forests,



**Fig. 2.** Distribution of *Phleogena faginea* (Fr.: Fr.) Link in Poland (● – localities known from the literature, ○ – new localities); 9 – number of localities known from the literature in the Puszcza Białowieska primeval forest; 8 – number of new localities in the Puszcza Białowieska primeval forest.

including one tree which is a nature monument, and one in a historic urban park (Warsaw). Wojewoda *et al.* (1999) noted that no locality of this species in Poland had been found in forest plantations, parks, or wooded synanthropic habitats. This makes our new locality of *P. faginea* in Łazienki Park in the center of Warsaw (Fig. 1e) particularly noteworthy. It is the first record of the species in Poland in a habitat highly altered by human activity. Although the Park was established on the site of an ancient natural forest, systematic gardening has been carried out there for many years. Damage to some trees, including those colonized by *P. faginea*, has been treated with fungicides. The locality of the species in the center of a large city should encourage researchers to look actively for *P. faginea* in other urban agglomerations to establish whether the species can adapt to habitats transformed by human activity.

*Phleogena faginea* is red-listed as endangered (E) in Poland (Wojewoda & Ławrynowicz 1986, 1992, 2006). In light of the new data on its distribution presented here, we suggest that its threat category should be changed to 'vulnerable' (V), and we stress the need for further detailed studies on the its distribution and ecological range.

ECOLOGICAL REQUIREMENTS OF *PHLEOGENA FAGINEA*

The new records of *P. faginea* give information on additional substrates for it. We recorded the fungus on the following substrates not reported previously in the Polish literature: wood of *Alnus incana*, *Padus avium*, *Quercus robur*, *Tilia cordata*, *Ulmus glabra* and *U. laevis*, and rhizomorphs of *Armillaria* sp. The genus *Tilia* is also a new substrate record for Europe; rhizomorphs of *Armillaria* sp. were not recorded as its substrate in Europe, but were noted as such in North America (Barr & Bigelow 1968). We used available literature data and our own observations to characterize substrates suitable for *P. faginea* (Table 2) in Poland. Out of 13 species of deciduous trees, one coniferous tree and two fungi, constituting 37 records (trees) and accounting for ca 45% of all records, our analysis showed that wood of *Carpinus betulus* provided the most suitable substrate for *P. faginea*. Interestingly, that tree was most frequently mentioned as the substrate of *P. faginea* also in Slovakia (Ripková *et al.* 2004) and the Czech Republic (Holec 2003). The fungus was noted relatively often in Poland on *Alnus glutinosa* (13 records), *Alnus incana* (9), and *Populus tremula* (7); it was found only accidentally on basidiomes of *Fomes fomentarius* and on old rhizomorphs of *Armillaria* sp. In Poland, *P. faginea* was rarely found on *Fagus sylvatica* (3 records), while in some countries of Western Europe, such as, Germany, Denmark and Great Britain, that tree species is reported as the most frequent substrate colonized by this fungus (Göttsche 1980; Kreisel 1987; Cook 1994).

Hornbeam trees occur practically throughout Poland and are absent only from lower and upper montane forest, growing above 600 m only exceptionally, while beeches hardly ever occur in northeast Poland (Boratyńska & Boratyński 1990; Boratyńska 1993), from where more than half of the localities of *P. faginea* are known; this explains its more frequent records on *Carpinus betulus* than on *Fagus sylvatica* in Poland. Both tree species have similar ecological requirements but their life strategies differ. Hornbeam is a typical admixture species, encountered in different forest types

or forming lower layers in mixed stands where it dies earlier as a shorter-lived species than, for instance, beech (Dzwonko 1990; Faliński & Pawlaczyk 1993; Jaworski 1995), becoming available earlier as substrate for *P. faginea*.

On the other hand, the area covered by stands with beech dominant is ten times greater than that of hornbeam, and covers ca 366,000 ha in Polish forests, that is, 4.2% of the forest area in Poland, while hornbeam is reported from only 37,000 ha (0.4%) (Grzesiak *et al.* 2007). A more in-depth and broader search for this fungus in beech forests and in communities where both beech and hornbeam are present, might produce more records of the fungus on beech wood.

Analysis of the literature data on the vertical distribution of *P. faginea* in Europe shows that it occurs mainly in lowlands and foothills. Its locality from the Magurski National Park in Poland at 573 m is the highest site reported in print. Similar data are given from Slovakia (Ripková *et al.* 2004), where the highest site is located at 550 m. The highest locality in the Czech Republic is at only 350 m (Holec 2003) and in Austria at 340 m (Scheuer & Poelt 1995).

*Phleogenafaginea* is reported most often from protected areas and is therefore considered to be a relict of old-growth forests (Wojewoda 1999). We found the fungus growing on thick old trunks as well as thinner (younger) trees and shrubs. The circumference of the measured trunks and stumps ranged from 0.2 to 2.94 m (Table 2) and we could not identify any clear-cut tendency to colonize the oldest trees. It also seems that *P. faginea* has no preferences for a particular height on the trunk. On standing trees we observed the fungus growing from the root swelling up to as high as 3.5 m. It was even found growing on roots of *Prunus spinosa* in the Czech Republic (Holec 2003), and at 4–5 m above the ground on a broken trunk of *Fagus sylvatica* in Germany (Tallasch & Jahn 1970). On the other hand, we noticed that basidiomes of *P. faginea* on fallen trees, logs, and branches were on the lower side in most cases. The fungus was less often found growing laterally, and only accidentally on the upper side of the substrate.

**Table 2.** Characteristics of substrate of *Phleogena faginea* (Fr.: Fr.) Link from Polish localities.

Species	Number of trees	Circumference [m]	Form of substrate	References*
<i>Carpinus betulus</i>	37	0.95–2.80	dead standing trunk, trunk of dying tree, remains of standing trunk, fallen trunk, dead bark and wood of living standing tree, rotten log; dead bark of living standing tree, fissures of bark of living tree, dead fallen trunk, decayed fallen trunk, dead, fallen branch; dead bark of living standing tree, butt of trunk	1, 2, 3
<i>Alnus glutinosa</i>	13	0.40–1.95	dead standing trunk, log, remains of the stump, trunk of dying tree; dead bark of living standing tree, dead standing trunk, dead fallen trunk, decayed fallen trunk	1, 2
<i>Alnus incana</i>	9	0.20–1.15	dying tree; decorticated branch of living tree, trunk of standing broken tree, log	1
<i>Populus tremula</i>	7	0.45–1.20	dead standing tree, lying tree; dead fallen trunk, bark of decayed trunk	1, 2
<i>Ulmus laevis</i>	5	0.25–2.90	stump, dead bark of trunk of living tree, dead standing trunk, dead standing broken trunk	1
<i>Acer platanoides</i>	3	1.20–2.30	dead bark of trunk of dying tree, wood for fuel; standing trunk	1, 2
<i>Fagus sylvatica</i>	3	1.10	barkless log, dead standing trunk; decayed trunk	1, 2
<i>Corylus avellana</i>	2	0.40	dead standing branch; bark of dead branch	1, 3
<i>Padus avium</i>	2	0.25–0.35	dead standing, trunk; dead bark and wood of lying tree	1
<i>Picea abies</i>	2	2.80	old stump; dead standing trunk	1, 2
<i>Betula pendula</i>	2	1.90	log; dead standing trunk	1, 2
<i>Quercus robur</i>	1	2.49	dead, without bark, standing trunk	1
<i>Tilia cordata</i>	1	1.30	dead, fallen branch	1
<i>Ulmus glabra</i>	1	1.50	wood and bark of dead standing trunk	1
Unidentified trees	2	0.80	log; dead, fallen deciduous trunk	1, 2
<i>Fomes fomentarius</i>	–	–	basidiocarp growing on <i>Carpinus betulus</i>	2
<i>Armillaria</i> sp.	–	–	rhizomorphs growing on dead standing trunk and log of <i>Ulmus laevis</i> and on lying branch of <i>Tilia cordata</i>	1

\* 1 – present data; 2 – Wojewoda & Komorowska 1997; 3 – Wojewoda *et al.* 1999

According to Oberwinkler and Bauer (1989), *P. faginea* prefers angiosperm substrates of hard wood and bark on standing trees or only partly decayed lying logs. Tallasch and Jahn (1970) describe the occurrence of *P. faginea* on a trunk of *Fagus sylvatica* with *Bjerkandera adusta* and on a lying trunk of the same species colonized by *Pleurotus ostreatus*, *Trametes gibbosa* and *T. hirsuta*. We also observed that basidiomes of *P. faginea* could often be found on trees and logs

colonized by other fungi causing white wood rot (e.g., *Armillaria* sp., *Chondrostereum purpureum*, *Fomes fomentarius*, *Inonotus radiatus*, *Panellus serotinus*, *Phellinus* sp., *Pleurotus ostreatus*, *Schizophyllum commune*), as well as brown wood rot (*Fomitopsis pinicola*). The occurrence of *P. faginea* on various tree species of different ages and on other fungi, as well as its tolerance of wood decay of different degrees and types, shows high ecological plasticity and a high survival po-



tential in managed forests and other substitute habitats.

*Phleogena faginea* was observed in Poland from August to October (Wojewoda & Komorowska 1997; Wojewoda *et al.* 1999). We noted the occurrence of its fresh fruitbodies in November, December, January and February during an exceptionally mild autumn and winter. Similar phenological observations were reported from Slovakia, where the fungus was found from July to December (Ripková *et al.* 2004). Oberwinkler and Bauer (1989) suggest that its time of occurrence may be the reason for the rarity of collections. We observed that basidiomes of *P. faginea* could persist for a long period. In the localities in Warsaw, some basidiomes produced in 2006 were still observed in July 2007.

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