

Phellinus hippophaëicola (Hymenochaetaceae) IS NOT RARE IN POLAND: FINDINGS FROM THE POBRZEŻE SZCZECIŃSKIE COASTLAND

STEFAN FRIEDRICH

Abstract. The occurrence of *Phellinus hippophaëicola* H. Jahn, a fungal pathogen of *Hippophaë rhamnoides* L., on the Pobreże Szczecińskie coastland, NW Poland, was surveyed during 2015–2016. Altogether 59 localities of *Phellinus hippophaëicola* were recorded, including the first Polish inland localities on cultivated plants of *Hippophaë rhamnoides*. The localities are from 18 ATPOL grid squares, including 43 localities on the Baltic Sea coast. *Phellinus hippophaëicola* occurred at 74% of all the localities of *Hippophaë rhamnoides* examined, and at ca 84% of the plant's natural sites. These findings, and also the status of *Hippophaë rhamnoides* as a protected species occurring in protected habitats in Natura 2000 sites, mean that *Phellinus hippophaëicola* is not a rare and endangered species in Poland. In total, 69 localities located in 28 ATPOL grid squares, including the localities reported here, are currently known from Poland.

Key words: distribution, *Elaeagnus angustifolia*, *Hippophaë rhamnoides*, *Phellinus hippophaëicola*, Pobreże Szczecińskie coastland, Poland

Stefan Friedrich, Department of Botany and Nature Protection, West Pomeranian University of Technology, Slowackiego 17, 71-434 Szczecin, Poland; e-mail: Stefan.Friedrich@zut.edu.pl

INTRODUCTION

The basidiomycete fungus *Phellinus hippophaëicola* H. Jahn belongs to the diverse genus *Phellinus* s.l. classified within the order Hymenochaetales and family Hymenochaetaceae (Robert *et al.* 2005). It is a parasite and a causal agent of white rot of *Hippophaë rhamnoides* L. (rarely *Elaeagnus angustifolia* L.), though less frequently it also lives as a saprotroph. The fruitbodies of the fungus appear on trunks and branches (Jahn 1976). *Phellinus hippophaëicola* is widespread in Europe and eastwards towards Central Asia. Its range is closely related to that of *Hippophaë rhamnoides*; it occurs in all of its thickets with old shrubs (Jahn 1976). In Europe it is known from Great Britain (England, Scotland, Wales), France, Belgium, Holland, Denmark, Germany, Poland, Norway, Sweden, Finland, Lithuania, Switzerland, Austria, Italy, Bulgaria, Luxembourg, Turkey and the southern part of European Russia (Domański *et al.* 1967; Mazelaitis 1976; Michael *et al.* 1981; Breitenbach & Kränzlin

1986; Kreisel 1987, 2009; Krieglsteiner 1991, 2000; Ryvardeen & Gilbertson 1994; Griecius & Matelis 1996; Niemelä 1997, 2001; Gyosheva *et al.* 2006; Sesli & Denchev 2009; Denchev & Assyov 2010; Ghobad-Nejhad 2011; Kunttu *et al.* 2011; Garnier-Delcourt *et al.* 2013). In Asia it has been recorded in Russia (Western Siberia), Kazakhstan, Georgia, Azerbaijan, Uzbekistan, China, India and Thailand (Bondartsev 1953; Shvartsman 1964; Dai 2010, 2012; Chandrasrikul *et al.* 2011; Ghobad-Nejhad 2011; Ranadive *et al.* 2011; Vlasenko 2013).

In Poland, *Phellinus hippophaëicola* was rarely reported previously; 16 localities of this fungus were reported earlier, scattered exclusively along the coast of the Baltic Sea between the towns of Międzyzdroje and Krynica Morska (Wojewoda 2002, 2003; Wilga & Wantoch-Rekowski 2013). This study presents the results of detailed surveys of the occurrence of *Ph. hippophaëicola* on the Pobreże Szczecińskie coastland in northwest

Poland. Based on the newly acquired data, the current distribution and threat status of the fungus in Poland are discussed.

MATERIAL AND METHODS

To examine the occurrence of *Phellinus hippophaëicola* on the Pobrzeże Szczecińskie coastland, localities of its hosts, *Hippophaë rhamnoides* and *Elaeagnus angustifolia*, were first identified. *Hippophaë rhamnoides* is a under partial legal protection but its fruits may be collected outside of dune and cliff habitats provided that the shrubs are not damaged. It was under full protection between 1983 and 2014, and its occurrence is registered in documentary publications and nature protection studies.

The data on the occurrence of *Hippophaë rhamnoides* on the Pobrzeże Szczecińskie coastland are based on the *Distribution Atlas of Vascular Plants in Poland* (Zajac & Zajac 2001), the distribution atlas of protected and endangered species of vascular plants in Zachodniopomorskie (West Pomerania) Province (Jasnowska *et al.* 2009), and my research. The data on *H. rhamnoides* sites specifying exact locations in the latter atlas proved especially useful. That information was based on nature inventories of local administrative units and nature reserve protection plans. Also invaluable were the resources of the Nature Conservation Agency in Szczecin from 1996–2009. My detailed survey of the occurrence of *Phellinus hippophaëicola* in 2015–2016 also includes the results of sporadic observations from 2003–2014 which I repeated in 2015–2016.

Localities of *Hippophaë rhamnoides* with known geographical coordinates were identified in the field using a GPS recorder. Areas for which there was no information about its occurrence were searched on foot. I also searched for *Elaeagnus angustifolia*, as there were no available data on its occurrence in the study area. After finding prospective host plants, their living and dead shoots were checked exhaustively to find fruitbodies of *Phellinus hippophaëicola*. The range of individual localities of *H. rhamnoides* and *E. angustifolia* as well as *Ph. hippophaëicola* was pinpointed using a GPS device and described with geographical coordinates. The survey includes general notes on the topography of the locality, the manner of shrub occurrence, vegetation accompanying *H. rhamnoides*, and the abundance of fruitbodies of *Ph. hippophaëicola*.

I attempted to establish exact figures for the number of fruitbodies of *Phellinus hippophaëicola* and the number of *Hippophaë rhamnoides* individuals infected

by it, but in many cases had to estimate the numbers due to difficult field conditions. Vegetation patches on steep cliff walls were often inaccessible, dense thickets of thorny shrubs formed impenetrable barriers, and access to some areas was limited due to protection of the sea coastline and restrictions at military facilities and on private land.

A three-degree scale was used to describe the number of shrubs inhabited by fruitbodies of *Ph. hippophaëicola*, which could be treated as the number of individuals of *Ph. hippophaëicola* (1 – on 1 shrub, 2 – on 2–10 shrubs, 3 – on more than 10 shrubs). This scale does not include the number of fruitbodies on individual shrubs, which is related to mycelium maturity and host infection degree. There may have been more shrubs hosting *Ph. hippophaëicola* which could not be noted due to the obstacles described above. The localities are documented by photographs. The fruitbodies are deposited in the herbarium of the West Pomeranian University of Technology, Szczecin.

The study area is the Pobrzeże Szczecińskie coastland macroregion, which covers *ca* 8000 km² and is part of the Pobrzeże Południowobałtyckie coastland subprovince (Kondracki 2002). The search for localities of *Ph. hippophaëicola* was conducted mostly in two mesoregions (Uznam and Wolin, Wybrzeże Trzebiatowskie coast) along coastline stretching over 100 km but also at all the localities of *Hippophaë rhamnoides* and *Elaeagnus angustifolia* known previously or found in the present study inland in five mesoregions (Równina Wkrzańska plain, Wzgórza Szczecińskie hills, Wzgórza Bukowe hills, Równina Pyrzycko-Stargardzka plain, Równina Nowogardzka plain). To complete the examination of square Bb–00, a small section of the Wybrzeże Słowińskie coast mesoregion in the Pobrzeże Koszalińskie coastland macroregion was also investigated.

Localities of *Phellinus hippophaëicola* on *Hippophaë rhamnoides* growing individually or in small clusters were pinpointed with a GPS device exactly at the site of their occurrence. For *Ph. hippophaëicola* living on shrubs growing close to each other or within long linear localities of *H. rhamnoides*, the weighted center of the locality was considered a locality. If such field localities of *Ph. hippophaëicola* were up to 500 apart, they were merged for mapping purposes and treated as one locality.

I analyzed the occurrence of *Phellinus hippophaëicola* in relation to the distribution of its host, *Hippophaë rhamnoides*. The number of host localities confirmed in this study, taken as 100%, was used to examine the occurrence of the fungus in order to capture the actual distribution of both organisms.

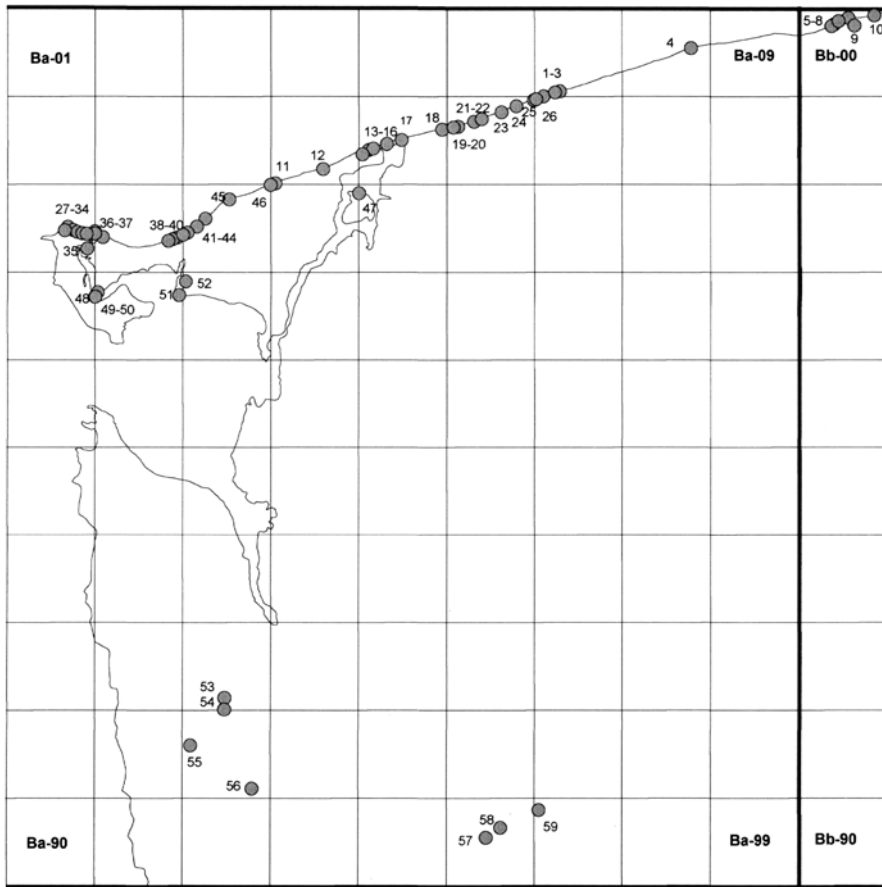


Fig. 1. Distribution of *Phellinus hippophaëicola* H. Jahn on the Pobrzeże Szczecińskie coastland. Ba-01 – Bb-90 – ATPOL grid square numbers, 1–59 – number of localities.

The results are presented as a cartogram of ATPOL grid squares and an ATPOL grid topogram (Zajac 1978) in the mycological modification by Wojewoda (2000). Mapping was automated using MapSource 6.13.7 and MapInfo Professional 6.5 SCP.

RESULTS

A total of 59 localities of *Phellinus hippophaëicola* were recorded in the study. All numbered localities in 10×10 km squares are listed below in an east-west belt of ATPOL grid squares. The following information is given for each locality: name of macro- and mesoregion, nearest village, town or city, geographical coordinates, characteristic features of the locality of *Hippophaë rham-*

noides, abundance of *Phellinus hippophaëicola*, and observation date. The numbering of localities corresponds to the numbering in figure 1.

Ba-07 – POBRZEŻE SZCZECIŃSKIE COASTLAND, Wybrzeże Trzebiatowskie coast: 1 – vicinity of Śliwina, 54°05'22.668036"N, 15°02'23.531856"E, individual specimens of *Hippophaë rhamnoides* on edge of gentle cliff, 2, 17 May 2014; 2 – Niechorze, 54°05'39.30018"N, 15°03'34.847928"E, *Hippophaë rhamnoides* of varying density on cliff slope and top along ca 500 m, 3, 19 Sept. 2007, 4 Apr. 2010, 17 May 2014; 3 – Niechorze, 54°05'44.375856"N, 15°04'04.835712"E, *Hippophaë rhamnoides* shrubs and trees scattered in thick thickets overgrowing tall cliff along ca 400 m directly neighboring locality no. 2, 3, 19 Sept. 2007, 4 Apr. 2010, 17 May 2014.

Ba-08 – POBRZEŻE SZCZECIŃSKIE COASTLAND, Wybrzeże Trzebiatowskie coast: 4 – Mrzeżyno, 54°08'50.028"N, 15°17'27.599712"E, probably a locality reported by Wojewoda (2002), spaced clusters of *Hippophaë rhamnoides* shrubs near *Elaeagnus angustifolia* and *Rosa rugosa* on edge of tall cliff, on margin of coniferous forest, 1, 18 May 2015.

Bb-00 – POBRZEŻE SZCZECIŃSKIE COASTLAND, Wybrzeże Trzebiatowskie coast: 5 – Kołobrzeg, 54°10'39.036"N, 15°32'01.032072"E, cluster of ample *Hippophaë rhamnoides* over low dune cliff, 2, 13 Feb. 2016; 6 – Kołobrzeg, 54°10'44.760036"N, 15°32'16.583928"E, thickets of *Hippophaë rhamnoides* and *Rosa rugosa* over low dune cliff, 2, 13 Feb. 2016; 7 – Kołobrzeg, 54°10'58.360152"N, 15°32'42.300024"E, individual specimens of *Hippophaë rhamnoides* along 100 m section on low dune cliff secured by boulders, 2, 13 Feb. 2016; POBRZEŻE KOSZALIŃSKIE COASTLAND, Wybrzeże Słowińskie coast: 8 – Kołobrzeg, by pier, 54°11'11.400144"N, 15°33'43.811892"E, locality observed since 2003, in 2015 mostly removed during land development, 15 pruned *Hippophaë rhamnoides* shrubs persisted, previously 3, at present 1, 12 Feb. 2003, 14 Feb. 2008, 7 Feb. 2009, 16 Feb. 2010, 11 Feb. 2011, 13 Feb. 2012, 14 Feb. 2013, 12 Feb. 2014, 16 Feb. 2015, 12 Feb. 2016; 9 – Kołobrzeg, Skwer Pionierów square, 54°10'44.6907"N, 15°34'23.863548"E, one *Hippophaë rhamnoides* tree in square (anthropogenic locality), cut down in 2010, 1, 11 Feb. 2008; 10 – Kołobrzeg, 54°11'25.57968"N, 15°36'24.105132"E, escarpment of grey dune overgrown with *Hippophaë rhamnoides* trees and shrubs along 300 m, with species such as *Rosa rugosa*, *R. canina*, *Prunus spinosa*, *Salix* sp. as admixture, 3, 17 Feb. 2014, 16 Feb. 2016.

Ba-14 – POBRZEŻE SZCZECIŃSKIE COASTLAND, Uznam and Wolin, 11 – Wolin National Park, S. Jarosz Reserve, 53°59'02.795928"N, 14°35'03.839244"E, probably a locality reported by Wojewoda (2002), cluster of *Hippophaë rhamnoides* on edge of tall cliff, on margin of beech wood, 2, 20 Apr. 2015; 12 – Międzywodzie, 54°00'06.675624"N, 14°39'56.097144"E, spaced cluster of *Hippophaë rhamnoides* on grey dune along ca 200 m, individual shrubs growing in coniferous forest, 2, 11 May 2015.

Ba-15 – POBRZEŻE SZCZECIŃSKIE COASTLAND, Uznam and Wolin: 13 – Dziwnów, 54°01'10.056072"N, 14°43'54.551568"E, *Hippophaë rhamnoides* cluster among boulders reinforcing left bank of Dziwna River, 2, 11 May 2015; Wybrzeże Trzebiatowskie coast: 14 – Dziwnów, 54°01'27.739668"N, 14°44'32.752104"E, densely shrubbed escarpment of grey dune between beach and promenade along ca 500 m section (*Hip-*

poppaë rhamnoides, *Elaeagnus angustifolia*, *Rosa rugosa*, *Pinus sylvestris*, *Caragana arborescens*, *Acer platanoides*, *Cornus mas*), 3, 11 May 2015; 15 – Dziwnów, 54°01'33.672036"N, 14°44'58.919532"E, vegetation similar to that at adjacent locality no. 14, 2, 11 May 2015; 16 – Dziwnów, 54°01'53.321592"N, 14°46'22.850868"E, dense *Hippophaë rhamnoides* thickets among *Rosa rugosa* and *Salix daphnoides*, on grey dune along 500 m section, buried by sand in many places, 3, 11 May 2015; 17 – Dziwnówek, 54°02'11.328036"N, 14°47'53.447388"E, *Hippophaë rhamnoides* thickets with *Salix daphnoides* on escarpment of grey dune on margin of coniferous forest, along ca 400 m section, 3, 11 May 2015; 18 – Łukęcin, 54°02'58.226604"N, 14°52'00.368832"E, thickets of *Hippophaë rhamnoides* of varying density on slope and top of cliff crumbling in some places, along ca 300 m section, 2, 11 May 2015.

Ba-16 – POBRZEŻE SZCZECIŃSKIE COASTLAND, Wybrzeże Trzebiatowskie coast: 19 – Łukęcin, 54°03'08.603892"N, 14°53'09.81582"E, *Hippophaë rhamnoides* thickets of varying density on slope of overgrowing and crumbling tall cliff and along its edge on forest margin, along ca 300 m section, 2, 11 May 2015; 20 – Łukęcin, 54°03'13.032144"N, 14°53'38.975568"E, *Hippophaë rhamnoides* thickets on entire slope of tall cliff, 2, 11 May 2015; 21 – Pobierowo, 54°03'34.380108"N, 14°55'16.283856"E, probably this is locality no. 21 or no. 22 as reported by Wojewoda (2002), thickets of ample *Hippophaë rhamnoides* on slope of overgrown dead cliff (*Sorbus aucuparia*, *Betula pendula*, *Populus tremula*, *Viburnum opulus*, *Salix caprea*), covered by sand at bottom, along ca 400 m section, 2, 6 June 2015; 22 – Pobierowo, 54°03'45.33822"N, 14°56'03.556212"E, clusters of *Hippophaë rhamnoides* on tall grey dune reinforced with boulders, 2, 6 June 2015; 23 – Pustkowo, 54°04'14.508228"N, 14°58'03.004932"E, probably a locality reported by Wojewoda (2002), scattered shrubs of *Hippophaë rhamnoides* on tall edge, 2, 6 June 2015; 24 – Trzęsacz, 54°04'40.115928"N, 14°59'35.339748"E, larger and smaller *Hippophaë rhamnoides* thickets on slope and top of cliff of varying height, along ca 500 m section, 2, 6 June 2015; 25 – Rewal, 54°05'06.36"N, 15°01'22.943856"E, trimmed shrubs in *Hippophaë rhamnoides* thickets on developed cliff beneath viewing deck, 2, 17 May 2014.

Ba-17 – POBRZEŻE SZCZECIŃSKIE COASTLAND, Wybrzeże Trzebiatowskie coast: 26 – Rewal, 54°05'10.140108"N, 15°01'37.379604"E, *Hippophaë rhamnoides* cluster on slope of dead cliff, 2, 17 May 2014.

Ba-21 – POBRZEŻE SZCZECIŃSKIE COASTLAND,

Uznam and Wolin: 27 – Świnoujście, Bałtycka Street, 53°55'19.452072"N, 14°13'29.9631"E, *Hippophaë rhamnoides* clump among *Acer platanoides* and *Carpinus betulus* saplings, by pavement, 1, 30 Apr. 2016; 28 – Świnoujście, 53°55'32.739204"N, 14°13'47.525088"E, *Hippophaë rhamnoides* thickets of varying density on shrubbed grey dune along ca 300 m section, 3, 3 May 2014, 30 Apr. 2016; 29 – Świnoujście, 53°55'22.778148"N, 14°14'21.877656"E, *Hippophaë rhamnoides* thickets of varying density on margin of tree plantation along promenade, merges with locality no. 30, 3, 1 May 2007, 2 May 2008, 29 Apr. 2012, 3 May 2014, 2 May 2015, 30 Apr. 2016; 30 – Świnoujście, 53°55'16.976136"N, 14°14'49.737696"E, *Hippophaë rhamnoides* thickets of varying density on edge of tree plantation along promenade, merges with locality no. 29, 3, 3 May 2014, 2 May 2015; 31 – Świnoujście, 53°55'13.565316"N, 14°15'20.527236"E, *Hippophaë rhamnoides* thickets of varying density on edge of tree plantation along promenade, along ca 500 m section, 3, 3 May 2014, 2 May 2015, 30 Apr. 2016; 32 – Świnoujście, east side of Interferie Street, 53°55'12.107964"N, 14°15'48.923136"E, scattered clusters of dying *Hippophaë rhamnoides* shrubs in pine coniferous forest, 3, 30 Apr. 2016; 33 – Świnoujście, north of Uzdrowskowa Street, 53°55'12.972072"N, 14°16'15.022992"E, vast thickets of *Hippophaë rhamnoides* in glade and in spaced tree stand of pine forest, 3, 30 Apr. 2016; 34 – Świnoujście, east end of Uzdrowskowa Street, 53°55'22.70208"N, 14°16'40.163304"E, vast thickets of *Hippophaë rhamnoides* on grey dune and in pine forest, 3, 30 Apr. 2016; 35 – Świnoujście, Dworcowa Street, 53°54'18.575928"N, 14°15'59.434848"E, four specimens of *Hippophaë rhamnoides* between train station and bus station (anthropogenic locality), 1, 20 June 2012, 30 June 2015.

Ba-22 – POBRZEŻE SZCZECIŃSKIE COASTLAND, Uznam and Wolin: 36 – Świnoujście, 53°55'15.262536"N, 14°16'42.58164"E, single shrubs of *Hippophaë rhamnoides* among thickets on left bank of Świna River, 1, 29 Apr. 2012; 37 – Świnoujście, 53°55'04.223964"N, 14°17'32.135172"E, spaced thickets of *Hippophaë rhamnoides* on both sides of Ku Morzu Street along ca 150 m section, 2, 29 Apr. 2011, 02 May 2014, 30 June 2015, 30 Apr. 2016; 38 – Międzyzdroje, 53°55'07.58334"N, 14°24'21.701736"E, spaced thickets of *Hippophaë rhamnoides* on grey dune among *Pinus sylvestris* along ca 500 m section, merges with locality no. 39, 3, 16 Apr. 2016; 39 – Międzyzdroje, 53°55'13.975644"N, 14°24'48.088944"E, spaced thickets of *Hippophaë rhamnoides* on grey dune and dead cliff along ca 500 m section, merges with locali-

ties no. 38 & 40, 3, 20 Apr. 2015; 40 – Międzyzdroje, 53°55'21.324144"N, 14°25'13.619136"E, spaced thickets of *Hippophaë rhamnoides* on grey dune and dead cliff, along ca 400 m section, merges with locality no. 39, 3, 20 Apr. 2015.

Ba-23 – POBRZEŻE SZCZECIŃSKIE COASTLAND, Uznam and Wolin: 41 – Międzyzdroje, 53°55'33.165804"N, 14°25'51.00492"E, spaced thickets and single shrubs of *Hippophaë rhamnoides* on grey dune along ca 400 m section, 1, 16 Apr. 2016; 42 – Międzyzdroje, 53°55'41.807892"N, 14°26'17.843424"E, spaced thickets of *Hippophaë rhamnoides* on grey dune in gaps of *Pinus sylvestris* thickets, 1, 16 Apr. 2016; 43 – Międzyzdroje, 53°56'06.252"N, 14°27'14.68746"E, individual scattered shrubs of *Hippophaë rhamnoides* on grey dune among *Rosa canina* and *Pinus sylvestris*, 1, 16 Apr. 2016; 44 – Międzyzdroje, 53°56'36.630024"N, 14°28'04.029312"E, individual shrubs of *Hippophaë rhamnoides* in lower part of slope of living cliff, 2, 20 Oct. 2008, 23 March 2014; 45 – Wolin National Park, Z. Czubiński Reserve, 53°57'54.020844"N, 14°30'24.224508"E, probably a locality reported by Wojewoda (2002), individual shrubs of *Hippophaë rhamnoides* on top of cliff, 2, 20 Apr. 2015; 46 – Wolin National Park, Wiselka, 53°58'56.784"N, 14°34'34.427388"E, thick thickets of *Hippophaë rhamnoides* in lower and middle part of cliff slope, 1, 20 Apr. 2015.

Ba-25 – POBRZEŻE SZCZECIŃSKIE COASTLAND, Wybrzeże Trzebiatowskie coast: 47 – Buniewice (Wyspa Chrząszczewska), 53°58'46.091964"N, 14°43'47.207532"E, small cluster of *Hippophaë rhamnoides* among thickets of *Crataegus monogyna*, *Rosa canina* and *Sambucus nigra*, on tall edge of Zalew Kamieński lagoon neighboring with meadow communities, 1, 10 June 2015.

Ba-31 – POBRZEŻE SZCZECIŃSKIE COASTLAND, Uznam and Wolin: 48 – Karsibór, Półwysep Mielinek peninsula on Stara Świna River, 53°51'23.219928"N, 14°17'06.395208"E, thickets of *Hippophaë rhamnoides*, *Rosa canina*, *Salix caprea*, *Betula pendula*, *Populus tremula* and *Lonicera periclymenum*, on edge of wet dock, 3, 10 June 2015.

Ba-32 – POBRZEŻE SZCZECIŃSKIE COASTLAND, Uznam and Wolin: 49 – Karsibór, Mielinek peninsula on Stara Świna River, 53°51'23.687964"N, 14°17'09.671208"E, individual shrubs of *Hippophaë rhamnoides* on bank of Stara Świna River, 2, 10 June 2015; 50 – Karsibór, 53°51'40.643964"N, 14°17'22.163172"E, *Hippophaë rhamnoides* thickets on fringe of riparian willow forest, spreading onto xerothermic grassland, along Mostowa Street along ca 100 m section, 2, 10 June 2015; 51 – Lubin, 53°51'50.430708"N, 14°25'51.400704"E,

Hippophaë rhamnoides shrubs among thickets of *Rosa canina*, *Prunus spinosa*, *Crataegus monogyna* and *Corylus avellana*, on steep cliff on Zalew Szczeciński lagoon, 2, 13 Apr. 2015.

Ba-33 – POBRZEŻE SZCZECIŃSKIE COASTLAND, Uznam and Wolin: 52 – Wapnica, 53°52'42.361392"N, 14°26'26.43666"E, probably a locality reported by Wojewoda (2002), pruned *Hippophaë rhamnoides* thickets among thickets of *Rosa canina*, *Prunus spinosa* and *Crataegus monogyna*, on escarpment on northern shore of Jezioro Turkusowe lake, along ca 300 m section, 3, 13 Apr. 2015.

Ba-73 – POBRZEŻE SZCZECIŃSKIE COASTLAND, Wzgórza Szczecińskie hills: 53 – Szczecin, Przyjaciół Żolnierza Street, 53°27'17.855892"N, 14°33'17.099604"E, on shrubs of *Hippophaë rhamnoides* planted on south-facing escarpment (anthropogenic locality), 2, 28 March 2015; 54 – Szczecin, Ofiar Oświęcimia Street, 53°26'35.285568"N, 14°33'19.45638"E, on shrubs and small trees of *Hippophaë rhamnoides* planted on small escarpment along pavement (anthropogenic locality), 2, 25 July 2015.

Ba-83 – POBRZEŻE SZCZECIŃSKIE COASTLAND, Wzgórza Szczecińskie hills: 55 – Szczecin, Południowa Street by Rondo Uniwersyteckie traffic circle, 53°24'15.649884"N, 14°30'06.889176"E, thick shrub plantation of *Hippophaë rhamnoides* planted on lawn along street on ca 50 m section (anthropogenic locality), 2, 26 Aug. 2015; Wzgórza Bukowe hills: 56 – Szczecin, Morwowa Street, 53°21'51.410052"N, 14°36'39.179556"E, cluster of *Hippophaë rhamnoides* shrubs along side of street (anthropogenic locality), 1, 26 Aug. 2015.

Ba-96 – POBRZEŻE SZCZECIŃSKIE COASTLAND, Równina Pyrzycko-Stargardzka plain: 57 – Stargard, Spokojna Street, 53°19'42.492"N, 15°00'52.127856"E, three shrubs of *Hippophaë rhamnoides* within allotments, among tall herb vegetation of *Calamagrostis epigeios*, *Agropyron repens*, *Urtica dioica*, *Solidago canadensis* and *Phalaris arundinacea* (anthropogenic locality), 2, 8 July 2015; 58 – Stargard, Św. Jana Chrzcziciela Street near Plac Wolności square, 53°20'21.984072"N, 15°02'16.58364"E, three trees of *Hippophaë rhamnoides* on margin of Bolesław Chrobry Park (anthropogenic locality), 2, 8 July 2015.

Ba-97 – POBRZEŻE SZCZECIŃSKIE COASTLAND, Równina Nowogardzka plain: 59 – Kiczarowo, near Ozy Kiczarowskie Reserve, 53°21'34.883856"N, 15°06'07.595712"E, cluster of *Hippophaë rhamnoides* shrubs and trees in vicinity of *Prunus spinosa* and *Sambucus nigra* on margin of tree plantation along road, 3, 22 July 2015.

DISCUSSION

A total of 142 localities of *Hippophaë rhamnoides* in the Pobrzeże Szczecińskie coastland are reported in the distribution atlas of protected and endangered vascular species in West Pomerania Province (Jasnowska *et al.* 2009). When 500 m was taken as the size of localities for my present study, the number of localities decreased to 120. Using a GPS device, 64 of these localities were sought. Twenty-five of them were discovered; the other 39 were not found despite searching at least within a 100 m radius of the reported site. Conditions for the occurrence of *H. rhamnoides* were not observed at many of these sites, suggesting that not all the data derived from nature inventories of administrative districts are reliable.

I also applied the route method to look for new localities of *H. rhamnoides*, especially in areas where data were not provided and the known localities were more than 2 km distant from each other. In total, a section stretching over 50 km of coastline was thoroughly penetrated, yielding 55 newly identified localities of *H. rhamnoides*. The entire accessible coastline along ca 8 km was thoroughly investigated in square Ba-09, but *H. rhamnoides* was not found there.

The investigations covered 16 contiguous ATPOL grid squares along the coastline and eleven scattered localities inland. *Hippophaë rhamnoides* was found in 21 squares at a total of 80 localities. Twenty-one of the 80 localities should be treated as anthropogenic, where the species was planted for ornamental purposes or to reinforce escarpments. These results were used to examine the spread of *Phellinus hippophaëicola* parasitizing *Hippophaë rhamnoides*. *Phellinus hippophaëicola* was observed in 18 squares at a total of 59 merged 500 m localities, that is, 113 field localities. It was not observed in only three squares where *H. rhamnoides* occurred (Ba-46, Ba-53, Ba-84). An analysis of the occurrence of *Ph. hippophaëicola* relative to the distribution of its host shows that *Ph. hippophaëicola* occurred at ca 74% of the studied localities of *H. rhamnoides*. As many as ca 85% of the *Ph. hippophaëicola* localities were noted at natural sites of *H. rhamnoides*, but at only ca 43% of the anthro-

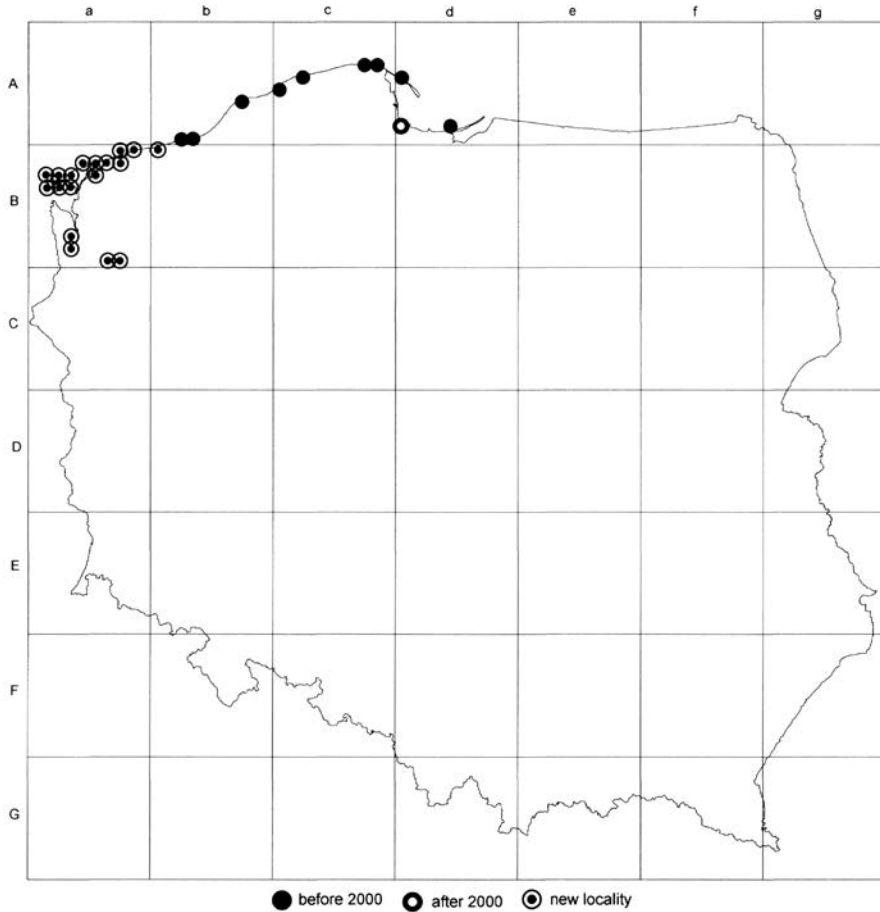


Fig. 2. Distribution of *Phellinus hippophaëicola* H. Jahn in Poland.

pogenic sites. I observed signs of shrub cutting for maintenance and sanitation at anthropogenic sites in the towns of Szczecin, Stargard and Świnoujście; maintenance measures may have included removal of infected shrubs or parts of them containing *Phellinus hippophaëicola* fruitbodies. Anthropogenic localities in Szczecin and Stargard, situated in grid squares Ba-73, Ba-83 and Ba-84 at distances of 52 and 78 km from the Baltic Sea shore, are the first inland observations of *Ph. hippophaëicola*. The synanthropic occurrence of *Ph. hippophaëicola* in botanical gardens has been referred to by other authors including Kreisel (1979) in Greifswald and Bresinsky and Besl (1999) in northern Bavaria.

An analysis of the occurrence of *Phellinus hippophaëicola* only along the Baltic coastline

shows a total of 43 localities, one locality per 2.3 km section of the coastline on average. The density of localities was greatest on Uznam Island (square Ba-21), where seven consecutively contiguous localities were noted along a 3.5 km long section. *Hippophaë rhamnoides* infected by *Ph. hippophaëicola* occurs in this area as a belt up to 150 m long. This large locality continues beyond Poland's western border (my observations). Larger gaps in the continuity of the spread of *Ph. hippophaëicola* can be seen in the eastern section of the Pobrzeże Szczecińskie coastland in squares Ba-07, Ba-08 and Ba-09. Localities 3, 4 and 5 are ca 16 km distant from each another.

Phellinus hippophaëicola was not found on *Elaeagnus angustifolia* in field searches.

Elaeagnus angustifolia was observed in seven squares (Ba-07, Ba-08, Ba-15, Ba-22, Ba-73, Ba-83, Ba-96) and at 14 localities, including four localities (4, 14, 15, 34) where it co-occurred with *Hippophaë rhamnoides*. Jahn (1976) reported *Ph. hippophaëicola* on *E. angustifolia* but the site location was not specified. *Elaeagnus angustifolia* as a host of *Ph. hippophaëicola* is reported in keys and atlases (Jülich 1984; Breitenbach & Kränzlin 1986; Ryvarde & Gilbertson 1994; Wojewoda 2002, 2003; Bernicchia 2005). In the available literature I found only one report of the occurrence of *Ph. hippophaëicola* on *E. angustifolia* in Sichuan Province in central China (Dai 2010).

Together with the new localities described in this study, a total of 69 localities in 28 10 × 10 km ATPOL grid squares are known from Poland (Fig. 2). The six sites reported by Wojewoda (2002) for the Pobrzeże Szczecińskie coastland seem to have been confirmed in this study, as the locations given in those records were only approximate and their descriptions are similar to the present records.

Due to the number of the localities of the fungus and their high occurrence at the localities of *Hippophaë rhamnoides*, *Phellinus hippophaëicola* seems to be a common species on the Pobrzeże Szczecińskie coastland, and not endangered. The same may hold true for the remaining coastal area of Poland. Its localities are indirectly covered by partial protection of *H. rhamnoides*, which it parasitizes, and by their status as Natura 2000 sites (vegetated sea cliffs – 1230, sea dunes with *H. rhamnoides* – 2160) where localities of *H. rhamnoides* occur naturally (Council Directive 92/43/EEC of 21 May 1992).

The *Phellinus hippophaëicola* fruitbodies observed in this study fully agreed with the morphological and microscopic features given in the species description (Jahn 1976) as well as in keys and atlases. White webs of insect larvae were often seen on the fruitbodies. The development of *Lepidoptera* larvae of *Morphaga chloragella* D. & Sch. and *Scardia tessulatella* Z. in fruitbodies of *Phellinus hippophaëicola* has been reported (Burmman 1983). *Morphaga chloragella* is

a frequent insect whose development takes place in fruitbodies of many other wood-inhabiting fungi such as *Bjerkandera adusta* (Willd.) P. Karst., *Ganoderma applanatum* (Pers.) Pat., *Phellinus robustus* (P. Karst.) Bourdot & Galzin and *Trametes gibbosa* (Pers.) Fr. (Jaworski *et al.* 2011). Algae belonging to *Chlorophyta* (*Chlorococcum* sp.) develop on the upper surface of old fruitbodies (Dr. W. Kowalski, pers. comm.).

ACKNOWLEDGEMENTS. We thank the anonymous reviewers for helpful remarks on the manuscript. This study was financed from the UPB fund of the Department of Botany and Nature Protection, West Pomeranian University of Technology in Szczecin.

REFERENCES

- BERNICCHIA A. 2005. *Polyporaceae s.l. Fungi Europaei*. 10. Edizioni Candusso, Alasio.
- BONDARISEV A. S. 1953. *Trutovye griby evropejskoj chasti SSSR i Kavkaza*. Izdatel'stvo Akademii Nauk SSSR, Moskva – Leningrad.
- BREITENBACH J. & KRÄNZLIN F. 1986. *Pilze der Schweiz*. 2. *Heterobasidiomycetes, Aphyllophorales, Gastromycetes*. Verlag Mykologia, Luzern.
- BRESINSKY A. & BESL H. 1999. *Regensburger Mycologische Schriften*. 9(1). Verlag der Gesellschaft, Regensburg.
- BURMANN K. 1983. Beiträge zur Microlepidopteren-Fauna Tirols. V. Tineidae (Lepidoptera). *Ber. Naturwiss.-Med. Vereins Innsbruck* 70: 199–213.
- CHANDRASRIKUL A., SUWANARIT P., SANGWANIT U., LUMYONG S., PAYAPANON A., SANOAMUNG N., PUKAHUTA C., PETCHARAT V., SARSDUD U., DUENGKAE K., KLINHOM U., THONGKANTHA S. & THONGKLAM S. 2011. *Checklist of Mushrooms (Basidiomycetes) in Thailand*. Office of Natural Resources and Environmental Policy and Planning, Bangkok.
- DAI Y. C. 2010. Hymenochaetaceae (Basidiomycota) in China. *Fungal Diversity* 45: 131–343.
- DAI Y. C. 2012. Polypore diversity in China with an annotated checklist of Chinese polypores. *Mycoscience* 53: 49–80.
- DENCHEV C. M. & ASSYOV B. 2010. Checklist of the larger basidiomycetes in Bulgaria. *Mycotaxon* 111: 279–282.
- DOMAŃSKI S., ORŁOŚ H. & SKIRGIELLO A. 1967. Grzyby (Mycota). 3. Państwowe Wydawnictwo Naukowe, Warszawa.
- GARNIER-DELICOURT M., MARSON G., RECKINGER C., SCHULTHEIS B. & THOLL M. T. 2013. Notes mycologiques luxembourgeoises. VII. *Bull. Soc. Nat. Luxemb.* 114: 35–54.

- GHOBAD-NEJHAD M. 2011. Updated checklist of corticioid and poroid basidiomycetes of the Caucasus region. *Mycotaxon* **117**: 508 (Abstract) + 70 pp. <http://www.mycology-of-iran/basidiomycota/caucasus-region/checklists>.
- GRICIUS A. & MATELIS A. 1996. Afiloforečiai 2 (Aphyllophorales). In: A. MINKEVIČIUS & J. MAZELAITIS (eds), *Lietivos Grybai – Mycota Lithuaniae* **6**(2): 1–232 (in Lithuanian with English summary).
- GYOSHEVA M. M., DENCHEV C. M., DIMITROVA E. G., ASSYOV B., PETROVA R. D. & STOICHEV G. T. 2006. Red List of fungi in Bulgaria. *Mycologica Balcanica* **3**: 81–87.
- JAHN H. 1976. *Phellinus hippophaëicola* H. Jahn, a new species. *Mem. New York Bot. Gard.* **28**(1): 105–108.
- JASNOWSKA J., ZIARNEK K. & ZIARNEK M. 2009. Atlas rozmieszczenia chronionych i zagrożonych gatunków roślin naczyniowych w województwie zachodniopomorskim. CD version. Biuro Konserwacji Przyrody, Szczecin.
- JAWORSKI T., HILSZCZAŃSKI J. & PLEWA R. 2011. New records of saproxylic Tineidae and Oecophoridae (Lepidoptera) in Poland. *Wiadomości Entomologiczne* **30**(4): 229–236 (in Polish with English summary).
- JÜLICH W. 1984. *Die Nichtblätterpilze, Gallertpilze und Bauchpilze*. VEB Gustav Fischer Verlag, Jena.
- KONDRACKI J. 2002. *Geografia regionalna Polski*. Państwowe Wydawnictwo Naukowe, Warszawa.
- KREISEL H. 1979. *Die phytopathogenen Grosspilze Deutschland (Basidiomycetes mit Ausschluss der Rost- und Brandpilze)*. J. Cramer, Vanduz.
- KREISEL H. 1987. *Pilzflora der Deutschen Demokratischen Republik. Basidiomycetes (Gallert-, Hut- und Bauchpilze)*. VEB Gustav Fischer Verlag, Jena.
- KREISEL H. 2009. Beiträge zur Pilzflora von Mecklenburg-Vorpommern und Nordbrandenburg (Deutschland) 7. Folge. *Feddes Repert.* **120**(3–4): 250–270.
- KRIEGLSTEINER G. J. 1991. *Verbreitungsatlas der Grosspilze Deutschlands (West)*. 1: Ständerpilze, A: Nichtblätterpilze. Verlag Eugen Ulmer, Stuttgart.
- KRIEGLSTEINER G. J. (ed.). 2000. *Die Grosspilze Baden-Württembergs*. 1. Ständerpilze: Gallert-, Rinden-, Stachel- und Porenpilze. Verlag Eugen Ulmer, Stuttgart.
- KUNTU P., KULJU M., PENNANEN J., KOTIRANTA H. & HALME P. 2011. Additions to the Finnish aphyllophoroid fungi. *Folia Cryptog. Estonica* **48**: 25–30.
- MAZELAITIS J. 1976. The Aphyllophorales of the Lithuanian SSR. Izdatel'stvo Mokslas, Vilnius (in Lithuanian with English summary).
- MICHAEL E., HENNIG B., KREISEL H. 1981. *Handbuch für Pilzfreunde*. IV: Blätterpilze – Dunkelblätter. VEB Gustav Fischer Verlag, Jena.
- NIEMELÄ T. 1997. Phellinaceae. In: L. HANSEN & H. KNUDSEN (eds), *Nordic Macromycetes*. 3. *Heterobasidioid, Aphyllophoroid and Gastromycetoid Basidiomycetes*, pp. 326–331. Nordsvamp, Copenhagen.
- NIEMELÄ T. 2001. Polyporales of Finland and adjacent Russia. *Norrinia* **8**: 1–120.
- RANADIVE K. R., VAIDYA J. G., JITE P. K., RANADE V. D., BHOSALE S. R., RABBA A. S., HAKIMI M., DESHPANDE G. S., RATHOD M. M., FORUTAN A., KAUR M., NAIK-VAIDYA C. D., BAPAT G. S. & LAMROOD P. 2011. Checklist of Aphyllophorales from the Western Ghats of Maharashtra State, India. *Mycosphere* **2**(2): 91–114.
- ROBERT V., STEGEHUIS G. & STALPERS J. 2005. The MycoBank engine and related databases. [May 2016]. <http://www.mycobank.org>.
- RYVARDEN L. & GILBERTSON R. L. 1994. *European Polypores*. 2. *Meripilus – Tyromyces*. Fungiflora, Oslo.
- SESLI E. & DENCHEV C. M. 2009. Checklists of the myxomycetes, larger ascomycetes, and larger basidiomycetes in Turkey. *Mycotaxon* **106**: 65–67.
- SHVARTSMAN S. R. 1964. *Flora sporovykh rasteniy Kazakhstana*. 4. *Geterobazidial'nye (Auriculariales, Tremellales, Dacryomycetales) i avtobazidial'nye (Exobasidiales, Aphyllophorales) griby*. Izdatel'stvo Akademii Nauk Kazakhskoi SSR, Alma-Ata.
- WILGA M. S. & WANTOCH-REKOWSKI M. 2013. A new locality of *Phellinus hippophaëicola* H. Jahn (macromycetes) in Gdańsk. *Przegląd Przyrodniczy* **24**(1): 56–60 (in Polish with English summary).
- WOJEWODA W. (ed.) 2000. *Atlas of the geographical distribution of fungi in Poland*. 1. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków.
- WOJEWODA W. 2002. *Fomitoporia hippophaëicola* (H. Jahn) Fiasson & Niemelä. In: W. WOJEWODA (ed.), *Atlas of the geographical distribution of fungi in Poland*. 2: 55–59. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków.
- WOJEWODA W. 2003. *Checklist of Polish larger Basidiomycetes*. Biodiversity of Poland. 7. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków.
- VLASENKO V. A. 2013. Ecological characteristics of bracket fungi in the forest steppe of Western Siberia. *Contemporary Problems of Ecology*. **6**(4): 390–395.
- ZAJĄC A. 1978. Atlas of distribution of vascular plants in Poland (ATPOL). *Taxon* **27**: 481–484.
- ZAJĄC A. & ZAJĄC M. (eds) 2001. *Distribution Atlas of Vascular Plants in Poland*. Laboratory of Computer Chorology, Institute of Botany, Jagiellonian University, Cracow.