

Volvariella bombycina (Schaeff.) Singer in Poland: Notes on Its Ecology, Distribution and Conservation Status

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Abstract

The basidiomycete *Volvariella bombycina* (Pluteaceae) is included in red lists of fungi in Poland and some other countries. Its distribution in Poland is presented, based on published data as well as 12 new locations. *Platanus × acerifolia* is reported for the first time as a host of this fungus. Another six tree species are new hosts for *V. bombycina* in Poland. These new data confirm the high ecological plasticity of the species. It is found in urban areas, forests, tree lines along roads, and a village park. Based on the new distribution data for *V. bombycina* in Poland, according to IUCN red-listed criteria it should be classified as LC (least concern).

Keywords: *Volvariella bombycina*, threatened fungi, red list, distribution, ecology

Introduction

Volvariella bombycina (Schaeff.) Singer is a member of the family Pluteaceae, order Agaricales, phylum Basidiomycota [1], and has a wide distribution range. The species has been reported in Europe, Africa, Asia, North and South America, and Australia [2-7]. In Europe, *V. bombycina* prefers lowlands (e.g. valleys of large rivers) and uplands. Thus in many mountainous countries of Europe it is a rare fungus. Natural habitats of the species in Europe are most probably open deciduous forests [8-12]. Since the late 19th century it has been recorded at synanthropic sites in urban areas and small settlements, where it colonizes trees growing in parks, woodlots, gardens, squares, urban and rural avenues, and solitary trees [3, 5, 9, 13].

V. bombycina has characteristic basidiomata, initially covered with a universal veil that ruptures during development but remains as a visible cup (volva) at the base of the stem. The initially egg-shaped but later spreading cap is white to cream-colored, usually reaching 5-20 cm in diameter. Its surface is covered with coarse, silky, cream-colored hairy scales that turn darker with time. Gills are free, broad, and crowded, initially white, turning salmon-colored with age. The stem is cylindrical, smooth or delicately banded, whitish, stout, sometimes slightly thickened at base, and usually deeply sunken in the substrate. The smell is faint, typical of mushrooms or somewhat radish-like. Spore print is salmon-colored to light brown.

Basidiomata of *V. bombycina*, usually in small groups (of several each), typically grow in cracks of bark, old wounds, and hollows, on the main trunks and branches of various species of deciduous trees. In Europe the species has been recorded on trees of the genera *Acer*, *Aesculus*, *Ailanthus*, *Betula*, *Castanea*, *Carpinus*, *Celtis*, *Crataegus*,

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Fagus, *Fraxinus*, *Juglans*, *Malus*, *Populus*, *Pyrus*, *Quercus*, *Robinia*, *Salix*, *Sorbus*, *Tilia*, and *Ulmus* [8, 10, 11, 14-20]. Outside Europe, it was also found on trees of the genera *Acacia*, *Ficus*, *Liquidambar*, *Magnolia*, *Mangifera*, and dead trunks of an unidentified palm species of the *Arecaceae* family [21-28]. Only exceptionally was the species recorded on coniferous trees, e.g. *Abies bornmuel-leriana*, *A. alba*, *Pinus* sp. [9], and *Picea abies* [29]. Interestingly, *V. bombycina* basidiomata also were observed on the compost pile, partly decomposed basidiome of *Ganoderma australe*, wasp nest, waste paper, clay-covered stone, moist timber in building, or concrete wall in a cellar [2, 4, 17, 30-33]. Sometimes it is severely caused to decrease the products of oyster mushrooms (*Pleurotus ostreatus*) by widely spreading on the beds for the cultivation house [4].

In Europe, basidiomata of *V. bombycina* usually appear in summer (June-August). However, in Poland this species has been recorded from May to November [9].

In Poland there is no tradition of collecting and eating basidiomata of *V. bombycina*. However, they are consumed in many regions of the world (Asia, Africa) [6]. Moreover, attempts to cultivating have been made [34, 35]. It is considered to be a species with medicinal properties and it is used in traditional medicine of the Far East [27, 36].

On the European scale, *V. bombycina* is regarded as a widely distributed but scattered species, with low level of threat [37]. However, in some countries it is included in red lists: in Denmark, Estonia, Hungary, Montenegro, Norway, Sweden, Switzerland and also some of the lands in Germany, e.g. Schleswig-Holstein, Rhineland Palatinate [38-46], or even is protected by law [41, 47]. The highest category of endangerment was assigned to this species in Switzerland - EN B1ab(iv) [43], and the lowest in Estonia, Denmark, and Norway - NT [40, 41, 45]. In Armenia, *V. bombycina* is on the list of species proposed to be placed in the Red Book [48].

In Poland, in the first 2 editions of the red list of fungi, Wojewoda and Ławrynowicz [49, 50] had considered the species as having an indeterminate threat status, i.e. a taxon for which so little information is available it is impossible to designate more accurately the most appropriate threat category. In the third, latest edition, its threat category was changed to rare (R) [51]. This species also is included in 2 of the 3 Polish regional red lists of macrofungi: as rare (R) in the Polish Carpathians [9, 52] and rare (R) (NT) in the Świętokrzyskie Mts. [53, 54].

This article is aimed to present an up-to-date list of locations, hosts, and notes on distribution, ecology, and conservation status of *V. bombycina* in Poland on the basis of original and published data.

Methods

This study is based on original field research and locations given in publications. We did not verify materials preserved in Herbaria and did not take into account any unpublished records submitted to the Rare Fungi Register (Rejestr

grzybów rzadkich, www.grzyby.pl) in 2010-11. The record from Warszawa Kawęczyn (F. Błoński: Fungi Varsovienses Exiccati), published by Skirgiełło [30], and later repeated by other authors, has been excluded as an error. In the preserved Błoński's collection (Fungi Varsovienses Exiccati) on one card, beside specimen No. 505 labelled as "*Volvaria bombycina* Ząbki 1/XI 1886," there is specimen No. 281, from Kawęczyn, labelled "Ag. (*Volvaria volvaceus*) 13/X 1886." We have not found any information questioning its identification as *V. volvaceus*. We excluded also a record from the village of Kadłub near Środa Śląska, reported by Skirgiełło [17] and Wojewoda [55] after Schröter [56], because Schröter [56] in his work did not list this village among locations of *V. bombycina*.

Our original data were collected in 2000-11. We deposited the collected specimens in the *Fungarium* of the Department of Mycology and Forest Phytopathology of the Warsaw University of Life Sciences (WAML), Herbarium of the Museum of Natural History of Wrocław University (WRSL), and the Institute for Agricultural and Forest Environment Polish Academy of Sciences - Field Station in Turew (ZBŚRiL PAN).

All locations are listed according to the physical-geographic division of Poland [57], with reference to sub-provinces and macroregions. If several records were taken in one city or town, we assumed that this is one locations, but in the main body of the article and in Fig. 1, the number of sites per locations is given. Names of tree species follow Mirek et al. [58]. Names of the tree species that were not taken into account by Mirek et al. [58] follow the terminology used in the cited articles.

Results

In Poland, *Volvariella bombycina* occurs in more than 80 locations, including 12 new ones found by the authors in recent years. It is found on 25 species of broadleaved trees of 16 genera (Tables 1 and 2).



Fig. 1. Group of basidiomata of *Volvariella bombycina* (Schaeff.) Singer on an old beech log in the strictly protected Radęcin area in Drawa National Park (13 Aug 2010, photo by A. Szczepkowski).

Table 1. New locations of *Volvariella bombycina* in Poland.

Place	Site	Host	Month and year of records	References
<i>SOUTH BALTIC LAKELANDS (POJEZIERZA POŁUDNIOWOBALTYCKIE)</i>				
South Pomeranian Lakeland (Pojezierze Południowopomorskie)				
Drawa National Park, strictly protected area Radęcin, section 247	oak-beech forest	<i>Fagus sylvatica</i>	Aug 2010	vid. A. Szczepkowski, (Fig. 1)
Wielkopolska Lakeland (Pojezierze Wielkopolskie)				
Lubiń, 1 km NW, road 308, near a petrol station	tree line	<i>Acer platanoides</i>	Aug 2004	vid. A. Kujawa
General Chłapowski Landscape Park, Rąbiń, 0.5 km N, road from Rąbiń to Rąbinek	tree line	<i>A. platanoides</i>	July 2011	vid. M. Michalak and A. Kujawa
General Chłapowski Landscape Park, Rogaczewo Wielkie, 1 km W	roadside, single tree	<i>Aesculus hippocastanum</i>	Aug 2011	leg. & det. A. Kujawa, ZBŚRiL PAN
General Chłapowski Landscape Park, Rąbiń, 1.5 km SE, road from Rąbiń to Dalewo	tree line	<i>A. platanoides</i>	Sept 2011	vid. A. Kujawa
<i>CENTRAL POLISH LOWLANDS (NIZINY ŚRODKOWOPOLSKIE)</i>				
Silesian Lowland (Nizina Śląska)				
Wrocław: Park Szczytnicki; Skłodowskiej-Curie St.	park; tree line	<i>Platanus×acerifolia</i> , <i>Acer</i> sp.; <i>A. saccharinum</i>	July 2002; Sept 2009; Sept 2007	leg. & det. M. Halama, WRSL
North Masovian Lowland (Nizina Północnomazowiecka)				
Ciechanów: Płońska St. near Rondo Solidarności; Strażacka St. near Małgorzacka St.; Mławska St.	tree line; tree line; tree line	<i>A. platanoides</i> ; <i>A. hippocastanum</i> ; <i>A. negundo</i>	Aug 2006; July 2002; July 2003	leg & det. A. Szczepkowski, WAML
Central Masovian Lowland (Nizina Środkowomazowiecka)				
Warszawa: Zwycięzców St., area of primary school and Czesław Niemen Gymnasium; Londyńska St.; Lotaryńska St. near Brukselska St.; Zakopiańska St.; Elsterska St. near Berezyńska St.; Park Skaryszewski; Washington Park (Park OWS Waszyngtona); Bielany Forest (Las Bielański); Wybrzeże Helmskie St.; Wandy St. near Meksykańska St.; Nowoursynowska St., Park of the Warsaw University of Life Sciences (SGGW); Finlandzka St. near Jakubowska St.	tree line; tree line; single tree-nature monument; tree line; single tree; tree; park; park; park; forest; tree line; tree line; park; tree line	<i>A. platanoides</i> ; <i>Sorbus aucuparia</i> and <i>Populus nigra</i> ; <i>P. alba</i> ; a stump of <i>Acer</i> ?; <i>A. saccharinum</i> ; <i>A. platanoides</i> , <i>A. saccharinum</i> , <i>Ulmus laevis</i> ; <i>Malus×floribunda</i> ; <i>A. platanoides</i> ; <i>P. nigra</i> ; a stump of <i>Populus</i> sp.; <i>A. hippocastanum</i> ; <i>A. saccharinum</i>	June 2000; June 2000; Aug 2005; Aug 2005; June 2007; July 2000; Aug 2005; June 2011; July 2007; Oct 2009; June 2011; Aug 2006; July 2010 and July 2011; July 2011	leg & det. or vid. A. Szczepkowski, WAML
Serock, Pułtуска St. (national road no. 61)	tree line	<i>A. negundo</i>	July 2007	vid. A. Szczepkowski
South Masovian Hills (Wzniesienia Południowomazowieckie)				
Lipce Reymontowskie, near a church	tree line	<i>A. platanoides</i>	Sept 2003	vid. A. Szczepkowski
<i>POLESIE</i>				
Western Polesie (Polesie Zachodnie)				
Wola Wereszczyńska	roadsidesingle tree	<i>A. hippocastanum</i>	July 2006	vid. A. Szczepkowski
<i>LUBLIN LWÓW UPLAND (WYŻYNA LUBELSKO-LWOWSKA)</i>				
Lublin Upland (Wyżyna Lubelska)				
Garbów, national road no. 17, near a petrol station	tree line	<i>U. glabra</i>	Aug 2011	leg & det. A. Szczepkowski, WAML

Table 1. Continued.

Place	Site	Host	Month and year of records	References
<i>NORTH SUBCARPATHIA (PODKARPACIE PÓŁNOCNE)</i>				
Sandomierz Basin (Kotlina Sandomierska)				
Jarosław, 3-go Maja St. near Morawska St.	tree line	<i>Malus×purpurea</i>	July 2011	leg. & det. A. Szczepkowski, WAML
<i>EASTERN BESKIDS (BESKIDY WSCHODNIE)</i>				
Lesiste Beskids (Beskidy Lesiste)				
Bieszczady National Park, Hylate valley, slopes of Średni Wierch, altitude 750 m	beech-fir forest	<i>F. sylvatica</i>	Sept 2011	leg. & det. A. Szczepkowski, WAML

Discussion

Distribution of *Volvariella bombycina* in Poland

The first records of *V. bombycina* in Poland come from the late 19th century [56, 73, 74, 95]. Before 1945, this species was reported at 10 locations [56, 65, 70, 73, 74, 76, 82, 85, 89, 95]. Until the early 1970s, *V. bombycina* was regarded as an infrequent species, known from 19 locations presented on a map by Skirgiełło [30]. In the next 40 years, many new locations were reported, so that by the early 2010s about 65 locations of this species had been published [9, 17-19, 30, 54, 55, 59-63, 67, 69, 71, 72, 75, 77, 79, 84, 86, 93, 94, 96-99]. In earlier studies of the distribution of *V. bombycina* data from Zaleski et al. [64] were not taken into account.

In recent years, we found 12 new locations of this species, including 12 records in Warsaw, three in Ciechanów, and three in Wrocław. Thus, now *V. bombycina* is known in Poland at some 80 locations. In some (towns and cities) it was found at many sites: two (Gdańsk, Imielin, Lublin), three (Ciechanów, Łódź), four (Katowice, Kraków), five (Szczecin, Wrocław), and as many as 19 in Warsaw (Fig. 2). Thus the total number of its records exceeds 100.

Most of its locations are in central and southern Poland. So far, the species has not been recorded in Warmia, the Suwałki Region, and Kujawy. It is known from few locations in Masuria and Pomerania, as well as in the submontane zone and in the mountains. Its most elevated published locations (altitude about 600 m) are situated on Łysica and Łysa Góra in the Świętokrzyskie Mts. [54, 85]. At an altitude of about 300-350 m it was found in Bystrzyca Kłodzka [56] and Silesian Beskid [9]. Currently, its newly discovered locations in Bieszczady National Park, at an altitude of about 750 m, is its most elevated spot in Poland. This altitude is close to the upper limit (about 800 m) of the distribution of this species in Central Europe [2].

About 60% of the records were made in urban areas (trees planted along streets, in cemeteries, parks, squares, forest parks, orchards solitary trees, and dendrological and

botanical gardens). In woodlands *V. bombycina* was found e.g. in oak-hornbeam forest *Tilio-Carpinetum* [80, 93], pine-oak forest *Pino-Quercetum*, pine forest *Vaccinio myrtilli-Pinetum* [80], beech forest *Dentario glandulosae-Fagetum* [18, 54, 72, 86, 90], upland mixed fir forest *Abietetum polonicum* [90], sallow-alder-buckthorn thickets *Salici-Franguletum* [71], submontane-upland acidophilous oak forest *Luzulo-Quercetum petraeae* [68, 69], xerothermic shrub communities [87], and flowery xerothermic grasslands *Adonido-Brachypodietum* and *Origano-Brachypodietum pinnati* [84, 98], which jointly account for about 20% of records. The remaining records (i.e. about 20%) represent mostly tree lines along roads in rural areas, some private property and a village park.

V. bombycina is known to be at seven national parks (Białowieża, Bieszczady, Drawa, Polesie, Roztocze, Świętokrzyski, and Wielkopolska), six nature reserves (Stara Buczyna w Rakowie, Uroczysko Obiszów, Łęczok, Trzy Jeziora, Torfowisko przy Jez. Czarnym, and Murcki), two

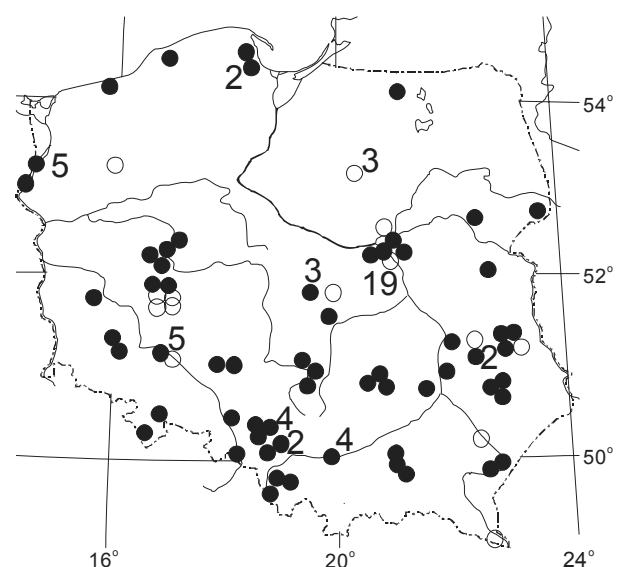


Fig. 2. Distribution of *Volvariella bombycina* (Schaeff.) Singer in Poland.

● – locations known from the literature; ○ – new locations
2, 3, 4, 5, 19 – numbers of sites in cities

Table 2. Published locations of *Volvariella bombycina* in Poland.

Place	Site	Host	References
<i>SOUTH BALTIC COAST DISTRICTS (POBRZEŻA POŁUDNIOWOBAŁTYCKIE)</i>			
Szczecin Coast District (Pobrzeże Szczecińskie)			
Szczecin: Szosa Polska St., Niemcewicz St., Park Leśny Arkoński, Dendrological Garden, Central Cemetery	tree line, tree line, forest parks, dendrological garden, cemetery (woodlot)	<i>Aesculus hippocastanum</i> , <i>Acer pseudoplatanus</i> , <i>Tilia</i> sp., <i>Populus nigra</i> , <i>A. campestre</i>	[55, 59, 60]
Cedynia Landscape Park, near Bielinek	roadside	<i>A. hippocastanum</i>	[55, 61]
Koszalin Coast District (Pobrzeże Koszalińskie)			
Near Ustronie Morskie, Kołobrzeg Forest, Gościno Forest District, section 32a	beech forest	<i>Fagus sylvatica</i>	[18]
Słupsk	pine forest with <i>Prunus padus</i>	-	[17, 55]
Gdańsk Coast District (Pobrzeże Gdańskie)			
Gdynia Obluże, Płk. Dąbka St.	roadside	<i>Acer</i> sp.	[62]
Gdańsk: Mikołaja Reja St. (Wrzeszcz); Wita Stwosza St. (Oliwa)	roadside; private property	<i>Betula</i> sp.; <i>Betula</i> sp.	[18, 19, 63]
<i>EASTERN BALTIC LAKELANDS (POJEZIERZA WSCHODNIOBAŁTYCKIE)</i>			
Masurian Lakeland (Pojezierze Mazurskie)			
near Kętrzyn, between Wilczy Szaniec and Parcz Village	roadside	<i>B. pendula</i>	[9, 55]
<i>SOUTH BALTIC LAKELANDS (POJEZIERZA POŁUDNIOWOBAŁTYCKIE)</i>			
Wielkopolska Lakeland (Pojezierze Wielkopolskie)			
Puszcza Zielonka Landscape Park, between Zielonka and Odrzykożuch (Wroneczyn Forester's Lodge)	roadside	<i>A. hippocastanum</i>	[64]
Poznań, Mary Magdalene Gymnasium	courtyard	<i>A. hippocastanum</i>	[9, 30, 55, 65]
Luboń, near Poznań (area of Chemical Works)	-	on a clay-covered stone	[9, 17, 30, 55]
Wielkopolska National Park, near Lake Góreckie (Ludwikowo)	forest	<i>Fraxinus excelsior</i>	[9, 30, 55, 66]
Kurza Góra	wet meadow	a stump of <i>Populus</i> sp.	[19]
Turew	village park	<i>A. platanooides</i>	[67]
<i>CENTRAL POLISH LOWLANDS (NIZINY ŚRODKOWOPOLSKIE)</i>			
Trzebnica Ridge (Wał Trzebnicki)			
“Uroczysko Obiszów” Reserve	acidophilous oak forest <i>Luzulo-Quercetum petraeae</i>	<i>Quercus</i> sp.	[9, 68, 69]
Silesian Lowland (Nizina Śląska)			
Głogów	-	a stump of <i>Populus</i> sp.	[9, 30, 70]
Wrocław: Na Grobli St. (Weidendamm); Strachocin (Wojnów/Drachenbrunn); promenade along river Oder (Odra)	roadsides?	only general information: <i>Salix</i> sp. and <i>Populus</i> sp.	[9, 17, 30, 55, 56]
Radwanice	roadside	<i>Populus</i> sp.?	[60]
“Łęczok” Reserve	open community of <i>Salici-Franguletum</i>	<i>Populus</i> sp.	[71]
South Wielkopolska Lowland (Nizina Południowowielkopolska)			
“Stara Buczyna w Rakowie” Reserve	<i>Dentario glandulosae-Fagetum</i>	<i>F. sylvatica</i>	[72]
Siemianice	-	<i>A. hippocastanum</i>	[30, 55]

Table 2. Continued.

Place	Site	Host	References
Central Masovian Lowland (Nizina Środkowomazowiecka)			
Warszawa: Bielany (Park Bielański, Bielany Forest); Młociny; Saska Kępa; Wawrzyszew; Mokotów (Dendrological Park of the Warsaw University of Life Sciences – SGGW); in vicinity of the city	park, forest; -; -; dendrological park, -	<i>Quercus</i> sp., <i>Carpinus betulus</i> ; -; -; -; <i>A. negundo</i> , <i>A. platanoides</i> and <i>F. excelsior</i> ; broadleaved trees	[9, 17, 18, 30, 73, 74, 75]
Sulejówek	-	broadleaved tree	[9, 17, 30]
Ołtarzew	-	-	[9, 17, 30]
Ząbki	-	-	[9, 30]
South Masovian Hills (Wzniesienia Południowomazowieckie)			
Łódź: no location; Zgierska St.; Źródłowa St.	-; park; roadside	<i>Robinia pseudoacacia</i> ; <i>C. betulus</i> ; <i>P. nigra</i>	[17, 19, 55]
Tomaszów Mazowiecki, Św. Antoniego St. near Piotra Ściegiennego St.	roadside	<i>A. negundo</i>	[62]
South Podlasie Lowland (Nizina Południowopodlaska)			
Near Międzyrzec Podlaski	roadside	<i>Populus×canadensis</i>	[9, 17, 30, 55, 76, 77]
<i>PODLASIE-BELARUS PLATEAUS (WYSOCZYNY PODLASKO-BIAŁORUSKIE)</i>			
North Podlasie Lowland (Nizina Północnopodlaska)			
Ciechanowiec	-	-	[17, 55]
Białowieża National Park, sections 371 and 372	forest	-	[78]
Białowieża Forest, Browsk Forest District, educational tourist trail “Pod Dębami”	forest	-	[79]
<i>POLESIE</i>			
Western Polesie (Polesie Zachodnie)			
Polesie National Park	forest	broadleaved trees	[17, 55, 77, 80, 81]
“Trzy Jeziora” Reserve	forest	broadleaved trees	[17, 55, 77, 80, 81]
“Torfowisko przy Jez. Czarnym” Reserve	forest	broadleaved trees	[17, 55, 77, 80]
<i>SAXON-LUSATIAN LOWLANDS (NIZINY SASKO-LUŻYCKIE)</i>			
Silesian-Lusatian Lowland (Nizina Śląsko-Lużycka)			
Near Lubin	-	-	[55]
<i>SUDETES (SUDETY) AND SUDETIAN FOOTHILLS (PRZEDGÓRZE SUDECKIE)</i>			
Sudetic Foothills (Przedgórze Sudeckie)			
Ząbkowice Śląskie	roadside	<i>A. hippocastanum</i>	[9, 30, 55, 82]
Central Sudetes (Sudety Środkowe)			
Bystrzyca Kłodzka: Łomnica	-	-	[17, 55, 56]
<i>SILESIA-KRAKÓW UPLAND (WYŻYNA ŚLĄSKO-KRAKOWSKA)</i>			
Silesian Upland (Wyżyna Śląska)			
Strzelce Opolskie, Parkowa St.	roadside	<i>A. platanoides</i>	[9, 55]
Katowice: Ks. Szramka Square near Warszawska St.; Uniwersytecka St.; Osiedle Paderewskiego; edge of “Murcki” Reserve	-; -; -; (single tree or tree line?); forest	<i>A. platanoides</i> ; a stump of <i>A. platanoides</i> ; <i>A. hippocastanum</i> ; <i>A. hippocastanum</i>	[9, 55, 83]

Table 2. Continued.

Place	Site	Host	References
Gliwice, Chopin Park	park	<i>A. hippocastanum</i>	[9]
Brzezinka near Gliwice	tree line along road	<i>Q. robur</i>	[9, 55]
Imielin: Wandy St.; Hallera St.	roadsides	<i>Populus</i> sp.; <i>A. hippocastanum</i>	[9, 55]
<i>MAŁOPOLSKA UPLAND (WYŻYNA MAŁOPOLSKA)</i>			
Przedbórz Upland (Wyżyna Przedborska)			
Near Borowe	deciduous forest	<i>Acer</i> sp.	[62]
Żytno	solitary tree	<i>A. hippocastanum</i>	[62]
Kraków-Częstochowa Upland (Wyżyna Krakowsko-Częstochowska)			
Olsztyn near Częstochowa (planned "Olsztyńskie Skały" Reserve)	flowery xerothermic grasslands <i>Adonido-Brachypodietum</i> and <i>Origano-Brachypodietum</i>	-	[84]
Kielce Upland (Wyżyna Kielecka)			
Świętokrzyskie Mts., Łysica	-	-	[17, 30, 55, 85]
Kielce (centre)	-	<i>A. hippocastanum</i>	[54]
Świętokrzyski National Park, Łysa Góra	<i>Dentario glandulosae-Fagetum</i>	<i>F. sylvatica</i>	[54, 86]
Podgrodzie near Ćmielów	xerothermic shrubland	<i>P. tremula</i>	[9, 17, 55, 87]
<i>LUBLIN-LWÓW UPLAND (WYŻYNA LUBELSKO-LWOWSKA)</i>			
Lublin Upland (Wyżyna Lubelska)			
Lublin: Akademicka St. and between Orkana St. and Kraśnicka St.	square and roadside	<i>A. negundo</i> and <i>Salix</i> sp.	[9, 18, 55, 77, 88]
Grabówka near Annopol	-	<i>Juglans regia</i>	[17, 30, 55, 77]
Puławy	-	-	[17, 30, 55, 73, 77, 89]
Roztocze			
Roztocze National Park, "Bukowa Góra" Reserve	fertile beech forest <i>Dentario glandulosae-Fagetum</i>	<i>F. sylvatica</i>	[9, 17, 30, 55, 77, 90]
Roztocze NP, "Czerkies II" Reserve	<i>Dentario glandulosae-Fagetum</i>	<i>F. sylvatica</i>	[9, 17, 55, 77, 90]
Roztocze NP, "Obroc" Reserve	upland mixed fir forest <i>Abietetum polonicum</i>	<i>F. sylvatica</i>	[9, 17, 55, 90]
<i>NORTH SUBCARPATHIA (PODKARPACIE PÓLNOCNE)</i>			
Oświęcim Basin (Kotlina Oświęcimska)			
Bobrek near Oświęcim	roadside	<i>A. platanoides</i>	[9]
Western Beskid Foothills (Pogórze Zachodniobeskidzkie)			
Olszówka Górna near Bielsko Biała	roadside	-	[9, 55]
Bielsko Biała-Mikuszowice	roadside	<i>A. hippocastanum</i>	[9, 55]
Kraków Gate (Brama Krakowska)			
Kraków: Rakowicka St.; Balicka St.; Karmelicka St.; Rakowicki Cemetery	-; -; (single tree or tree line?); cemetery (woodlot)	<i>A. platanoides</i> ; for the other three sites: <i>Acer</i> sp. and <i>Populus</i> sp.	[9, 17, 55, 91, 92]
Sandomierz Basin (Kotlina Sandomierska)			
Tarnów, Czerwona St. near Krakowska St.	orchard	<i>Malus domestica</i>	[99]
<i>OUTER WESTERN CARPATHIANS (ZEWNĘTRZNE KARPATY ZACHODNIE)</i>			
Western Beskids (Beskidy Zachodnie)			
Ustron (Wisła)	roadside	<i>T. cordata</i> and <i>Salix</i> sp.	[9, 17, 55]

Table 2. Continued.

Place	Site	Host	References
Central Beskid Foothills (Pogórze Środkowobeskidzkie)			
Pleśna near Tarnów	deciduous forest	<i>F. sylvatica</i>	[93]
Tuchów	-	-	[55]
Bolestraszyce near Przemyśl, Botanical Garden	botanical garden	stump of a broadleaved tree	[55, 94]
Przemyśl, Przekopana St. near river Wiar	-	-	[55]

landscape parks (Cedynia and General Chłapowski LPs) and a Natural Landscape Complex (Park of the Warsaw University of Life Sciences – SGGW in Warsaw Mokotów). Once it was even recorded on a nature monument tree (*Populus alba*) in Warsaw.

Tree hosts of *Volvariella bombycina* in Poland

In earlier studies, *V. bombycina* was reported in Poland to grow on 18 species and genera of host trees. We found this species on another 7 taxa of trees: *Malus × purpurea*, *M. × floribunda*, *Platanus × acerifolia*, *Populus alba*, *Sorbus aucuparia*, *Ulmus laevis*, and *U. gabra*. Our observation of *V. bombycina* on *Platanus × acerifolia* is the first record of the fungus on this tree species. The collected data show that *V. bombycina* is most frequent on trees of the genera *Acer* (30 records), *Aesculus* (16), and *Populus* (16). Considering individual tree species, it is recorded most frequently on *Aesculus hippocastanum* (16), *Acer platanoides* (13), and *Fagus sylvatica* (9). Numbers of records on the remaining species do not exceed 5 (Tables 1, 2). Lange [2], generally for Europe, does not list *Acer* and *Aesculus* among its most frequent host trees. However, other authors [8, 12, 15] include both genera of host trees in the group preferred by *V. bombycina*. It is noteworthy that only Polish authors [18, 19] list *Carpinus betulus* as its host. However, another species of the genus *Carpinus* (*C. caucasica*) is listed by Murvanishvili et al. [28].

Threat Assessment

In Poland, *Volvariella bombycina* is widespread, known from about 80 locations. It is found on 25 species of broadleaf trees of 16 genera. The recent change in the practice of tree hollow and wound protection in urban areas (lack of cleaning of wounds and hollows, limited use of chemicals) has resulted in the creation of more favourable sites for the development of various species of fungi growing on trees, including *V. bombycina*.

New locations and new data about its hosts and substrates allow verification of the conservation status of this species according to IUCN red-listing criteria. Considering the recommendations of Dahlberg and Mueller [100], the following conclusions can be drawn.

1. In recent years, no decreasing trend in population size of *V. bombycina* has been observed (criterion A).
2. Available data do not indicate any possible decrease in population size of this species in the future (criterion A).
3. The range of distribution of *V. bombycina* covers most of Poland (criterion B).
4. The actual population size of this species is difficult to estimate (criteria C and D).

Dahlberg and Mueller [100] proposed to assume, for fungi growing on trees, that one tree is colonized by 1-2 “mature individuals,” so the recorded specimens of *V. bombycina* represent about 120-240 “mature individuals.” However, bearing in mind its substrate availability, plasticity, and high potential for colonization of both natural and anthropogenic habitats, it can be assumed that its actual population size is many times larger, and no decreasing trend is predicted.

On this basis we conclude that *Volvariella bombycina* is widespread in Poland and is not threatened with extinction, so it should be classified as LC (least concern).

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