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Wojciech Pusz, Faculty of Environmental and Life Sciences, Wrocław University of Environmental and Life Sciences, Poland

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SHORT COMMUNICATION

The first record of *Fistulina hepatica* (Schaeff.) With. on *Castanea sativa* Mill. in Poland

Jacek Piętka^{1*}, Wojciech Ciużycki²

¹ Division of Mycology and Forest Phytopathology, Department of Forest Protection and Ecology, Faculty of Forestry, Warsaw University of Life Sciences – SGGW, Nowoursynowska 159, 02-776 Warsaw, Poland

² Department of Forest Botany, Faculty of Forestry, Warsaw University of Life Sciences – SGGW, Nowoursynowska 159, 02-776 Warsaw, Poland

* Corresponding author. Email: jacek_pietka@sggw.pl

Abstract

This paper discusses details of the locality of *Fistulina hepatica* recorded on *Castanea sativa*, a new host species in Poland. Since 2014, *F. hepatica* has been featured on the list of species under partial protection, and has been marked as “R” (rare species) on the “Red list of the macrofungi in Poland”. A new locality of *F. hepatica* has been found in Warsaw, in the Mokotów neighborhood, on the premises of the Central Clinical Hospital of Ministry of the Interior and Administration. Two basidiomata of *F. hepatica* were discovered at the base of a declining sweet chestnut tree.

Keywords

protection of fungi; wood-decaying fungi; Warsaw; central Poland

Introduction

The beefsteak fungus *Fistulina hepatica* (Schaeff.) With. belongs to the family Fistulinaceae, order Agaricales, and class Agaricomycetes [1]. It is a parasitic fungus that develops mainly on *Quercus* and *Castanea* trees, and also very rarely on *Acer*, *Alnus*, *Betula*, *Carpinus*, *Corylus*, *Eucalyptus*, *Fagus*, *Fraxinus*, *Juglans*, *Platanus*, *Robinia*, *Tilia*, and *Ulmus* trees. It is found in Europe, North America (Canada, USA), South America (Argentina), Australia, and Asia [2–7]. As a saprotroph, the fungus grows on tree stumps and on dead, fallen trunks, leading to the development of brown rot in the wood [4,5].

In 2004, the species was included in the list of fungi under strict protection [8]; since 2014, *F. hepatica* has been on the list of species under partial protection [9]. It is also featured on the “Red list of the macrofungi in Poland”, marked as “R” for “rare species” [10].

An infection with *F. hepatica* is possible through various forms of mechanical damage to the tree trunk. The process of decomposition may last for several dozen years without causing serious damage to the tree structure. With time, the timber breaks and falls apart into prismatic cubes. This results in trunk hollowness at the base of infected trees. Rot develops in the central part of the trunk, i.e., in the tree butt, sometimes reaching a height of up to 6 m [6,11,12]. Basidiomata occur on the tree trunks, roots (sometimes seemingly on the ground), and also inside tree hollows and on tree stumps [12].

Fistulina hepatica is not a very common species in Poland [2]. According to Szczepkowski [13], there are 46 localities of this fungus in central-eastern Poland, most of which are located in various types of conservation areas.

First occurrences of *F. hepatica* in Warsaw were recorded towards the end of the nineteenth century. The localities situated within the present city limits of Warsaw, where basidiomata of the beefsteak fungus have been discovered on oak trees, include

the following neighborhoods: Bielany – “Las Bielański” Reserve, Wawer – “Las im. Króla Jana Sobieskiego” Reserve, Bemowo – forest park, Pyry, Park Łazienkowski, “Skarpa Ursynowska” Reserve, “Las Natoliński” Reserve, “Dęby Młocińskie” Nature-Landscape Complex, and Mokotów [13–15]. In the “Las Natoliński” Reserve, 134 basidiomata of *F. hepatica* were recorded on 83 oak trees. At present, the most numerous localities of *F. hepatica* are in Warsaw and in central-eastern Poland [12]. A comparatively high number of infected trees (from five to 20) have been discovered in the following nature reserves: “Las Bielański”, “Las im. Króla J. Sobieskiego”, “Jabłonna”, and “Chojnów” [13].

In Poland, the genus chestnut (*Castanea* Mill.) from the family Fagaceae is represented almost exclusively by the sweet chestnut (*Castanea sativa* Mill.). The species originates from Southern Europe, but its exact natural range is presently difficult and probably even impossible to establish, as it has been cultivated as a useful species since ancient times. Currently, its geographical range mainly encompasses Italy, southern Austria, former Yugoslavian countries, Albania, southwestern Hungary, western Bulgaria, Greece, Turkey, and Asia Minor. It is probable that it was first introduced beyond its natural range, for example in England, by the Romans. In Poland, it was planted for the first time in the Royal Botanical Garden of the king John II Casimir, in 1651 [16]. The popularization of edible chestnuts over Europe, beginning from the ancient cultivation until the present, has been discussed by Conedera et al. [17].

As a southern, thermophilic species, *C. sativa* has found the best conditions for development in western Poland, mainly in Western and Eastern Pomerania, Lubusz Land, and Lower Silesia. It also occurs in Mazovia in central Poland, but only as a rare species. A study of the detailed distribution of the species in Poland, complete with a map, a list of localities, and an evaluation of the degree of acclimatization was compiled by Browicz [18]; at the time, eastern Poland, and especially northeastern Poland, were beyond the range of the species. In Poland, *C. sativa* Mill. is grown as an ornamental species because of its decorative leaves and spectacular blossoms that appear during the flowering period.

According to Browicz [18], *C. sativa* occurs in 79 localities in Poland. The most splendid examples can be found in Repty Śląskie in Silesian Province (height: 18.5 m, circumference: 851 cm, age: ca. 250–300 years) and in Celbów in Pomerania (height: 25 m, circumference: 655 cm, age: ca. 230 years) [19]. According to Grzywacz and Pietrzak [20], 36 sweet chestnut trees in Poland are featured on the list of natural monuments.

In Southern Europe, *C. sativa* has considerable importance from the point of view of society, economy, and landscape. In Spain, it was concluded that *F. hepatica* was one of the most important fungal species that lead to the lowering of timber quality [11]. Furthermore, in Greece, *F. hepatica* is a fungus species often occurring on old, living *C. sativa* trees [21]. However, in Portugal, some individual occurrences of *F. hepatica* on sweet chestnut trees were recorded [22].

According to Kotlaba [3], in Czechoslovakia, there were 310 localities of *F. hepatica* with an identified host plant; in 301 of them (97%), the genus *Quercus* was identified as a host plant, while *C. sativa* was identified to fulfill that role only in nine localities.

The aim of this work is to present the first locality of *F. hepatica* on *C. sativa* in Poland.

Material and methods

The following field activities have been performed:

- measuring the trunk diameter (at the height of 1.3 m) and the height of the tree (*C. sativa*) with basidiomata of *F. hepatica*;
- specifying the number of basidiomata on the tree;
- measuring the heights at which the basidiomata occurred;
- establishing the geographical directions that the basidiomata were facing.

The fungal names were given according to MycoBank [1].

Results

The new locality of *F. hepatica* is situated in Warsaw, in the neighborhood of Mokotów, on the premises of the Central Clinical Hospital of Ministry of the Interior and Administration, at the address Wołoska 137. The fungus was found on September 20, 2017, at the base of a declining sweet chestnut tree (*C. sativa*) located on a small lawn (N 52°11' 56.4" / E 020°59'55.9") (Fig. 1). There were individual withered leaves on the side branches of the tree, as well as characteristic cupules thickly covered with sharp spikes. There was a pavement at the distance of 0.5 m from the tree. The host was ca. 7 m high, with a circumference of 103 cm. On the east side, along almost the whole length of the tree trunk (from the height of 20 cm up to the top of the bole) there was an open wound 27 cm wide at the widest place (Fig. 2). The discovered basidiomata were situated directly below the wound, at a height of 3–5 cm above the ground (Fig. 3). They were semicircular and laterally attached to the trunk. The measurements of the first basidioma (length, width, thickness) were 8 cm × 7.5 cm × 3 cm, and the measurements of the second basidioma were 6.5 cm × 6.5 cm × 2.5 cm (leg./det. J. Piętka).

On September 27, 2017, it was discovered that the basidiomata had been torn away from the tree trunk and were lying on the lawn in the proximity of the tree, partly dried out. Two other taxa of fungi were identified on the tree: the species *Peniophora quercina* (Pers.) Cooke on the declining branches, and basidiomata of a fungus representing the genus *Stereum* on the boughs and on the upper part of the trunk.



Fig. 1 The sweet chestnut tree (*Castanea sativa*) with basidiomata of *Fistulina hepatica*.

Discussion

In Poland, during severe winters, sweet chestnut trees are damaged to various degrees by subzero temperatures, but are rarely killed by them. The species is characterized by a high resprouting ability; it quickly contains the damage and regrows from the trunk. Traces of damage caused by frost (i.e., frost cracks) are observed in individuals that develop a single, clear-cut trunk [18].

The frequency of occurrence of fungal species in particular habitats may change depending on the observed climate change [23]. Climate change is not generally considered a direct threat to the majority of microfungi, which may encounter only limited obstacles against gradual expansion to the north as the climate becomes warmer. However, in the case of fungal species associated with specific host plants, their fate will depend on the reaction of those plants to the climate change [24]. Wojewoda and Karasiński [25] have stated that many European fungi have become popular in Poland over the last 50 years.



Fig. 2 The open wound on the side of the *Castanea sativa* trunk.

On the Polish checklist of vascular plant species of 2002, *C. sativa* has the status of a cultivated species [26]. However, according to some studies, it is a locally domesticated species, spreading spontaneously as a kenophyte [27]. The growing degree of acclimatization observed in recent years and reflected in the local domestication of many tree species is probably connected with global warming [28].

Trees weakened by urban stress are more easily infected by parasitic fungi. Such fungi penetrate their hosts via wounded sites, i.e., in the places where tissues have been bared, for instance, in the course of plant care procedures, or where roots have been damaged during ground works, or due to other forms of damage frequent in urban trees, e.g., frost cracks [29]. In light of the above data, more occurrences of *F. hepatica* on *C. sativa* are expected to be reported in the future.



Fig. 3 Basidiomata of *Fistulina hepatica* at the base of the *Castanea sativa* trunk.

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