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Diversity and ecology of polypores in urban vegetation of northern, central and southern Slovakia

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Abstract

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During the years 2010–2011, we recorded 102 findings of polypores including 20 taxa in three different kinds of urban vegetation of northern, central and southern Slovakia. The most abundant taxa were *Phellinus igniarius* s. l. (16 findings) and *Fomes fomentarius* (L.) J. J. Kickx (11 findings). There was also a broad range of the host plants (15 genera, 22 species). The most abundant species of the host plants were *Acer platanoides* L. (12%), *Cerasus serrulata* (Lindl.) Loudon (11%) and *Salix* × *sepulcralis* 'Tristis' (10%). 53% of polypores colonized stem, fewer of them (21%) colonized branches. We observed the polypores in the town parks, street lines (alleys) and streamside stands. City parks and alleys were the most often habitats of polypore occurrences.

Keywords

diversity, ecology, host plant, polypore, urban vegetation

Introduction

Wood-destroying fungi represent serious problems in urban conditions. They are causing wood rots of infected woody plants and they have an unfavorable influence not only on the health of hosts but also on their aesthetic appeal. Although their harmful activity in the association with trees and shrubs has been studied extensively, relatively few specific studies have been conducted on the urban mycoflora in Europe (Tello et al., 2005). Supuka et al. (1991) mention that parasitic mycoflora of urban areas is very various. The fungi are getting in this environment from forest nursery, surrounding forest stand, orchards and gardens. From there they are transferred by the wind, the insects, by the rain, and very often by human on the woody plants, which are grown for improvement of environment. There are number of factors which influence polypore spreading. Overall, there are biotic and abiotic agents, for example Takemoto et al. (2010) indicate unfavourable weather conditions (drought, heat, low temperatures, overhumidity, ongoing global warming). Sinclair et al. (1987) also stated that the fungus might aggressively colonize trees stressed by heat and drought. Similarly, Schwarze et al. (2000) also consider that weather conditions such as humidity, temperature fluctuations, and UV radiations definitely cause degradation of wood after a certain time. Concerning abiotic agents, there are some examples of fungal spreadings – traffic, industries, incorrect tree maintenance, construction work near trees, and deliberate man-made injuries. Furhermore, Balder (1994) revealed nitrogen enrichment in the subsoil caused by dog urine in urban situation. He considered that high nitrogen contents in the wood can lead to higher rates of degradation by fungi, or cause increased disposition for decay. In

Slovakia, predominantly Gáper with his co-workers (Gáper, 1996; 1998; 2001; 2002; 2003a; 2003b; Gáper and Gáperová, 1999; Gáper and Repáč, 2003) are concerning with diversity and distribution of polypores and wood-decaying fungi in urban areas. Tello et al. (2005) state that polypores such as *Bjerkandera adusta* (Willd.) P. Karst., *Fomes fomentarius* (L.) J. J. Kickx, *Phellinus igniarius* s. l., *Trametes versicolor* (L.) Pilát and some others are always common in urban areas if the appropriate host is present. Furthermore, Tello et al. (2005) state that species with a narrow host range show great differences in abundance when their hosts are distributed unequally.

There are also some differences in the occurrence and distribution of particular fungal species according to the size of a populated area. The greatest species number was recorded in the largest cities. Some wood-destroying fungi such as *Ganoderma australe* (Fr.) Pat. occur almost exclusively in areas of the human habitation or areas influenced by the human activity (known as synantropic species) (Tello et al., 2005).

The goal of this work is to find out polypore diversity and their binding to host trees in selected type of the urban vegetation areas in observed towns.

Materials and methods

The field research was realised in 8 towns of northern, central and southern Slovakia: Dolný Kubín, Tvrdošín, Námestovo, Ružomberok, Zvolen, Detva, Lučenec, and Fiľakovo. In-field research ran for two years. The findings are recorded in 3 categories of urban vegetation: town parks, street lines (alleys), and streamside stands. Findings were repeatedly taken place in all three sampling sites. The harmonogram of sampling was as follows:

1st collection: October–November 2010
2nd collection: May–June 2011
3rd collection: November 2011.

The polypores were collected according to the harmonogram of their fructification growing period. There were the fruiting bodies of the expected higher incidence and greater diversity of occurring polypores in spring and autumn. Abstraction activities were performed repeatedly in the same localities. Occurrence of new findings was recorded on host trees. We recorded essential characteristics of occurring polypores, host trees, and habitat in which host occurred during abstraction in the field.

The patterns of the field record were as follows: sequential sample number, type of fungus, town, street, who collected, who determined, collection date, GPS coordinates of finding, altitude, type of host tree species, type of fruiting bodies, the number of fruiting bodies, place of fruiting bodies on tree species, description of tree damage (presence of cavities, rots, crown-dying and other visible damage; in case of cavity – height, depth and width of the cavity), diameter of the trunk and description of habitat conditions. The sample material obtained in the field research was therefore determined in the laboratory. Individual wood-decaying polypores were determined by using of the designation keys (Hagara et al., 2005; Hansen and Knudsen, 1992; Breitenbach and Kränzlin, 1986; Jülich, 1984). The evaluation of the results was necessary for creating the comprehensive database containing all collected data during the field research.

Results

During the field research in the years 2010 and 2011 we recorded 102 findings, 20 taxa and 13 genera of polypores in the selected towns of northern, central and southern Slovakia (Fig. 1.). As it is obvious from the chart, most commonly occurring taxon was *Phellinus igniarius* s. l., which accounted for 13.73% of all the findings. As relatively frequent taxa, *Fomes fomentarius* (L.) J. J. Kickx (10.78%), *Bjerkandera adusta* (Willd.) P. Karst. (8.82%), and *Trametes versicolor* (L.) Pilát (8.82%) were recorded. Rare taxa were *Ganoderma resinaceum* Boud., *Inonotus hispidus* (Bull.) P. Karst., *Inonotus rheades* (Pers.) Bondartsev & Singer, *Phellinus alni* (Bond.) Parmasto, and *Spongipellis spumeus* (Sowerby) Pat. (Fig. 2).

The individual samples were collected in three selected kinds of the urban vegetation – town parks, street lines (alleys) and streamside stands. The town parks and street lines were the most frequent habitat of polypores. A great number of findings was recorded in the towns of Zvolen and Lučenec. For the town of Zvolen, there were recorded 30.69% of all findings and 20.79% in the town of Lučenec. The fewest findings were recorded in the towns of Fiľakovo and Námestovo, there was approximately equal number of the polypores – 2.97% of all recorded findings (Fig. 3).

The most frequently occurring polypores were in the town parks of Zvolen and Lučenec, no incidence was recorded in this category in Námestovo. The most frequently occurring polypores were recorded in the street lines of Zvolen, Dolný Kubín, and Detva and no occurrence was recorded in Námestovo. For streamside stands, the most frequently occurring polypores were in Zvolen and Ružomberok and no occurrence was in Fiľakovo, Dolný Kubín and Detva (Fig. 4).

The polypores colonized 14 genera of the host trees. The most often were *Acer platanoides* L., *Aesculus hippocastanum* L., *Cerasus serrulata* (Lindl.) Loudon and *Salix* × *sepulcralis* 'Tristis'. The highest number of taxa of the host plants was recorded in Zvolen and Detva. For Zvolen it was 10 taxa and 8 taxa in Lučenec. 5 taxa of polypores were recorded in Detva and Tvrdošín. The least spectrum of the host plants was in Dolný Kubín (2 taxa).

Fig. 1. The map of field research of distribution of polypores in the towns of Námestovo, Tvrdošín, Dolný Kubín, Ružomberok, Zvolen, Detva, Lučenec, and Fiľakovo.

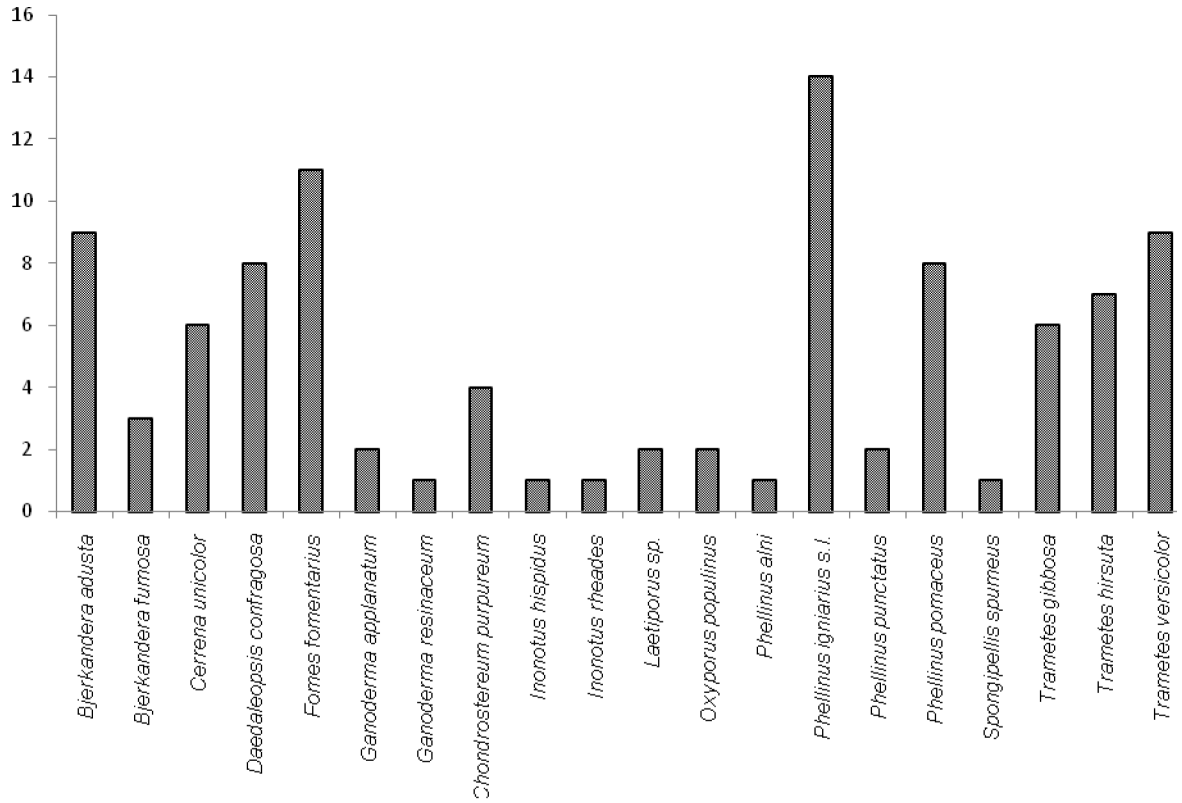

Fig. 2. The number of all polypore species collected from all selected towns (%).

Mentioned taxa were associated with different parts of host plant and they were as it follows: *Bjerkandera adusta* (Willd.) P. Karst., *Cerrena unicolor* (Bull.) Murrill, *Daedaleopsis confragosa* (Bolton) J. Schröt., *Phellinus pomaceus* (Pers.) Maire, *P. igniarius* s. l., *Trametes gibossa* (Pers.) Fr., *T. hirsuta* (Wulfen) Lloyd, and *T. versicolor* (L.) Lloyd. *Bjerkandera fumosa* (Pers.: Fr.) P. Karst. was observed on stem and stump, and *F. fomentarius* (L.) J. J. Kickx on stem and branches. Other taxa were bound to a specific part of host plant:

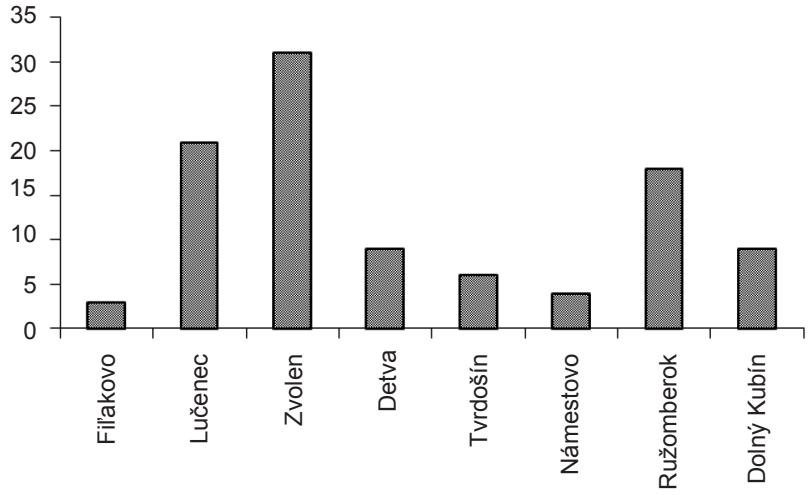

Fig. 3. Comparison of abundance of polypores in each town (%).

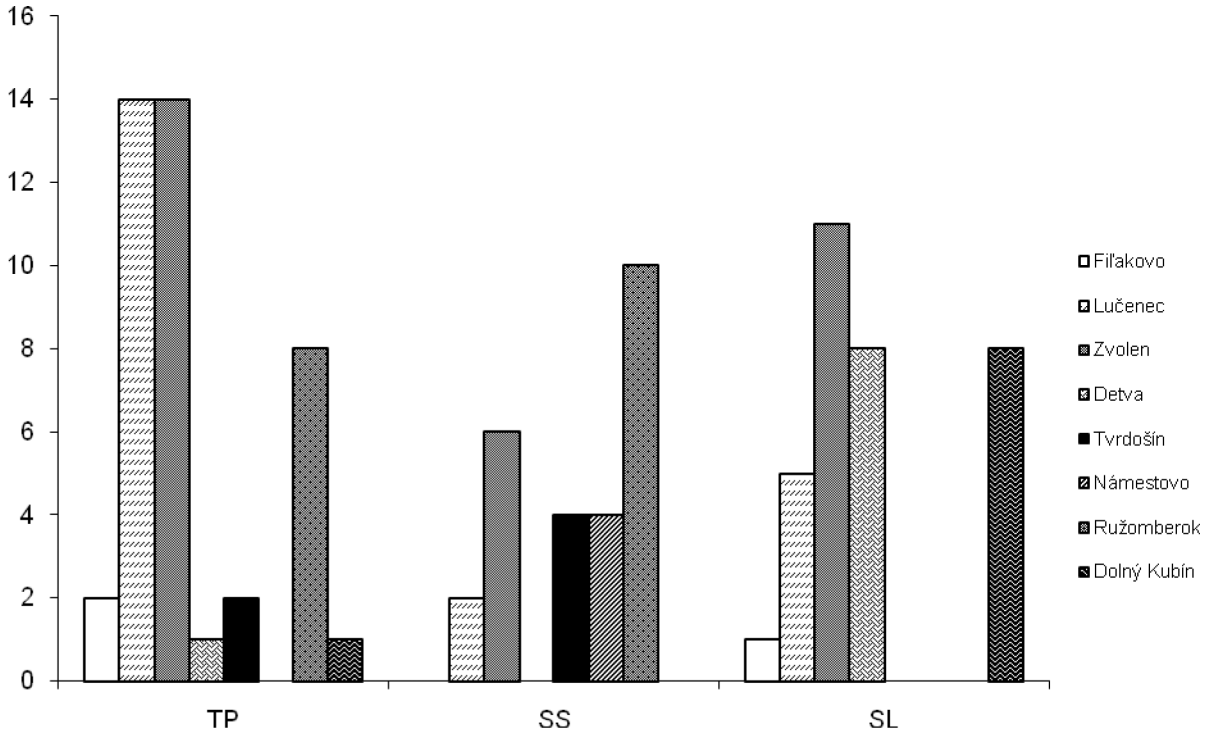

Fig. 4. The comparison of polypore numbers bound to categories of urban vegetation in individual towns. Explanations: SL, street line (alley); SS, streamside stand; TP, town park.

Ganoderma applanatum (Pers.) Pat., *G. resinaceum* Boud., and *Inonotus rheades* (Pers.) Bondartsev & Singer on the base of stem; *Chondrosteum purpureum* (Pers.) Pouzar, *Laetiporus* sp., *Oxyporus populinus* (Schumach.) Donk and *Phellinus alni* (Bondartsev) Parmasto on stem; *Inonotus hispidus* (Bull.) P. Karst. and *Phellinus pomaceus* (Pers.) Maire on branches and *Spongipellis spumeus* (Sowerby) Pat. in cavity (Fig. 5). The greatest number of polypores was observed on the stem. These findings accounted for 53% of the

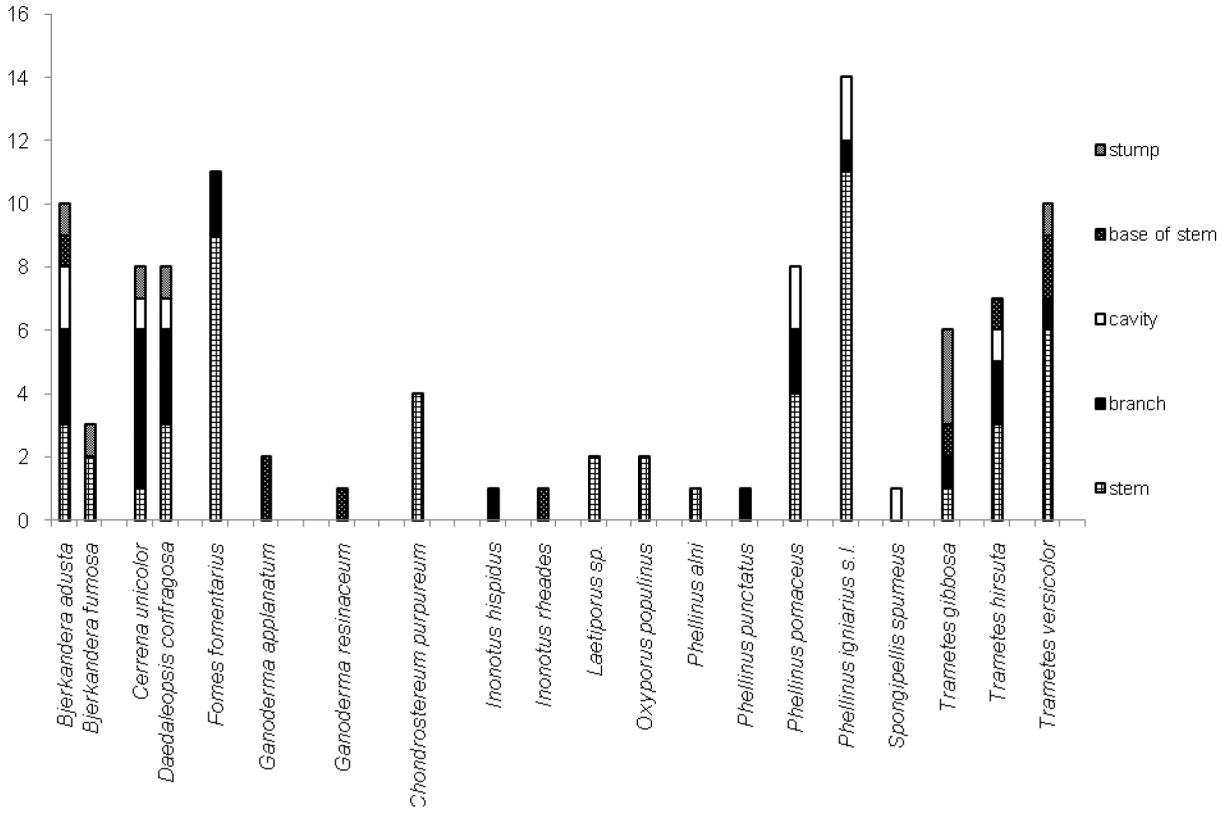

Fig. 5. Binding of polypore taxa to the parts of the host plants.

comprehensive spectrum. On the stumps, we recorded 21% of all polypore findings. In the cavities, there were 10% of all polypores, on the branches 9%, and on the base of stem, only 7% of all findings were recorded (Fig. 6).

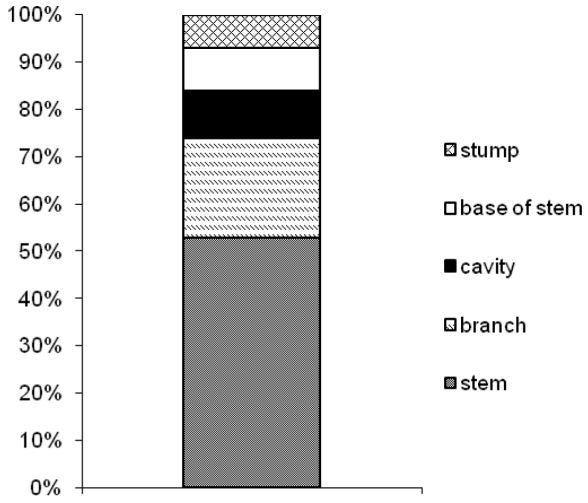

Fig. 6. Proportional representation of all polypores for host plants colonization.

Discussion

The occurrence and the species diversity of the polypores are affected by environmental pollution and nature habitats. Hagara et al. (2005) report that *Fomes fomentarius* (L.) J. J. Kickx is found very abundantly on living and dead wood of different species of the hardwoods. In our case it is occurred more widely and represented until 10.78% of all collected species.

Polypores were bound to 20 taxa of woody host plants. Schwarze et al. (2004) indicate that great number of wood-destroying fungi which cause white rot occur on the hardwoods, what we can confirm. Tomalak et al. (2011) point out the fact that caring of trees should already be started by selecting of the type in urban vegetation. It is appropriate to plant trees originating from the northern coastal areas, exposed to strong winds and salt spray in our conditions. We found that the most invading tree plant species are *Acer pseudoplatanus* L., *Acer platanoides* L., *Aesculus hippocastanum* L., *Salix* × *scepulcralis* 'Tristis'. The vitality of these plants is reduced mainly by frosts in our northern towns observed and by products of human activity. Hudeková (2002) concludes that in spite of attempt to applicate domestic plants their utilization is difficult in urban polluted en-

vironment. There are frequently attacked species of *Acer* spp., as well as trees used for landscaping and fruit production purposes as *Cerasus avium* (L.) Moench, *Malus domestica* Borkh. or *Prunus spinosa* subsp. *dasyphylla* in our research. Ashmore (2003) reports that substances that pollute the environment can assist in the process of wood-destroying fungi infection of plants by altering the surface of the host plant in terms of surface chemistry, permeability, wettability or changing the character of the leaf exudates in the urban environment. The rate of air pollution often has an impact on the species composition of fungal communities. Up to now, however, these interactions are not well understood. A further factor is the humidity. There is negligible percentage of growing areas relative to the asphalt surface in urban vegetation. Wood-decaying fungi require high temperature and appropriate humidity, mostly at the site of host plant infection for their growth. Polypores were taken from three categories of urban vegetation – town parks, street lines, and streamside stands. The greatest percentage of polypores was taken from town park category. The environment of the park mainly reminds of forest ecosystems by its habitat conditions. There is created enough dense tree crown cover, which prevents rapid evaporation. There is also a high proportion of grassland preventing rapid outflow of the surface water. The second category, the richest for the findings from which we took the polypores, were the street lines. Taking into account the site conditions, it can be argued that in all categories of urban vegetation areas, where the incidence of polypores was noticed, habitat was the most stressful for the host plants. The trees are directly influenced by the smog produced by the traffic. The trees are also directly exposed to the salination. We can confirm that trees were in that second richest category of findings influenced by smog and salination even in five of the eight towns. Tello et al. (2005) also report that trees are highly influenced by salt spray, when passing cars spray aboveground biomass of trees by melted emulsion of the snow and the salt. Therefore, there is altered wettability of wood surface, and also the technical salt gets into the soil and disturbs the root system.

Conclusions

During 2010–2011 we recorded 102 findings of polypores (20 taxa, 13 genera) in categories town parks, street lines (alleys), and streamside stands in the towns of Námestovo, Tvrdošín, Dolný Kubín, Ružomberok, Zvolen, Detva, Fiľakovo, and Lučenec. The most often taxa were *Phellinus igniarius* s. l. (13.73%) and *Fomes fomentarius* (L.) J. J. Kickx (10.78%). The town parks and street lines were the most frequent habitats of polypores. A great number of findings was recorded in the towns of Zvolen (30.69%) and Lučenec (20.79%). The polypores colonized 14 genera of host trees. The most often were *Acer platanoides* L., *Aesculus hippocastanum* L., *Cerasus serrulata* (Lindl.) Loudon, and *Salix* × *sepulcralis* 'Tristis'. The polypore taxa colonized different parts of host plant. The greatest number of polypores was observed on the stem (53%) and on the stumps (21%).

Acknowledgements

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References

Ashmore, M. R. 2003. Effects of oxidants at the whole plants and community level. In Bell, J.N.B., Treshow, M. (eds). *Air pollution and plant life*. Chichester: John Wiley and Sons, p. 89–118.

Balder, H. 1994. Schäden durch Hunde-Urin im öffentlichen Grün. *Stadt und Grün*, 43: 621–624.

Breitenbach, J., Kränzlin, F. 1986. *Fungi of Switzerland*. *Vol. 2, Non gilled fungi. Heterobasidiomycetes*, *Aphyllophorales*, *Gasteromycetes*. Lucerne: Mykologia. 412 p.

Gáper, J. 1996. *Polypores affecting of woody plants in urban areas of Slovakia*. Vedecké štúdie 9/1996/A. Zvolen: Technická univerzita vo Zvolene. 50 p.

Gáper, J. 1998. *Trúdniky na území Slovenska a ich šírenie bazídiospórami* [*Polypores of Slovakia and their distribution by basidiospores*]. Vedecké štúdie 6/1998/A. Zvolen: Technická univerzita vo Zvolene. 75 p.

Gáper, J. 2001. Polypores as an important pests on woody plants in town parks and other green spaces at towns of Slovakia according to climatic region and injured plant organs. *Matthias Belivs Univ. Proc.*, 1: 79–88.

Gáper, J. 2002. Niektoré nové poznatky o rozšírení synantropných trúdnikov v urbánnom prostredí Slovenska [Certain new data on the distribution of synantropic polypores in urban environment of Slovakia]. *Sprav. Slov. Mykol. Spol*., 27: 15.

Gáper, J. 2003a. Drevokazné huby v ovocných sadoch západoslovenského a stredoslovenského regiónu [Wood-decaying fungi in fruit orchards of Western and Central Slovakia regions]. In *Acta Fac. Rer. Nat. Univ. Ostr. Biol.-Ekol*., *211 (10)*. Ostrava: Ostravská univerzita v Ostravě, p. 121–127.

Gáper, J. 2003b. Fructification and discharge of basidiospores from wood-destroying fungi in oak urban forests. In Juhásová, G. (ed.). *Dreviny vo verejnej zeleni*. *Zborník z konferencie s medzinárodnou účasťou*. Košice: Univerzita Pavla Jozefa Šafárika, p. 101–104.

Gáper, J., Gáperová, S. 1999. Porovnávacia štúdia vertikálneho rozšírenia trúdnikov v mestskom prostredí Slovenska a v iných ekosystémoch [Comparative study of vertical distribution of polypores in urban areas of Slovakia and other ecosystems]. In *Houby a les. Sborník referátů.* Brno: Mendelova zemědělská a lesnická univerzita, p. 41–46.

Gáper, J., Repáč, I. 2003. Drevokazné huby vo vybraných sídlach a ovocných sadoch západného a stredného Slovenska v čistých kultúrach [Wood-decaying fungi in the selected settlements and fruit orchards in pure cultures of Western and Central Slovakia]. In *Acta Fac. Rer. Nat. Univ. Ostr. Biol.-Ekol*., *210 (9)*. Ostrava: Ostravská univerzita v Ostravě, p. 139–144.

Hagara, L., Antonín, V., Baier, J. 2005. *Atlas húb* [The atlas of fungi]. Praha: Aventinum. 416 p.

Hansen, L., Knudsen, H. 1992. *Nordic Macromycetes*. *Vol. 2, Polyporales, Boletales, Agaricales, Russulales*. New York: Nordsvamp. 474 p.

Hudeková, Z. 2002. *Ochrana stromov*. *Legislatívne podmienky a základy starostlivosti o dreviny* [*Protection of trees*. *Legislative conditions and fundamentals of care for woody plants*]. Bratislava: Regionálne environmentálne stredisko Slovensko. 33 p.

Jülich, W. 1984. *Die Nichtblätterpilze, Gallerpilze und Bauchpilze. Aphyllophorales, Heterobasidiomycetes, Gastromycetes*. Kleine Kryptogamenflora, Bd. 2b/1. Stuttgart, New York: Gustav Fischer. 626 p.

Schwarze, F.W.M.R., Engels, J., Mattheck , C. 2000. *Fungal strategies of wood decay in trees*. Berlin: Springer. 168 p.

Sinclair, W.A., Lyon, H.H., Johnson, W.T. 1987. *Diseases of trees and shrubs*. New York: Cornell University. 660 p.

Supuka, J., Benčať, F., Bublinec, E., Gáper, J., Hrubík, P., Juhásová, G., Maglocký, Š., Vreštiak, P. 1991. *Ekologické princípy tvorby a ochrany zelene* [*Ecological principles of verdure creation and protection*]. Bratislava: SAV. 324 p.

Takemoto, S., Nakamura, H., Imamura, Y., Shimane, T. 2010. Schizophyllum commune as a ubiquitous plant parasite. *Japan Agr*. *Res*. *Quart*., 44: 357–364.

Tello, M.-L., Tomalak, M., Siwecki, R., Gáper, J., Motta, E., Mateo-Sagasta, M. 2005. Biotic urban growing conditions – threats, pests and diseases. In Konijnendijk, C.C., Nilsson, K., Randrup, T., Schipperijn, J. (eds). *Urban forests and trees*. Heidelberg: Springer, p. 325–365.

Tomalak, M., Rossi, E., Ferrini, F., Moro, P.A. 2011. Negative aspects and hazardous effects of forest environment on human health. In Nilsson, K., Sangster, M., Gallis, C., Hartig, T., de Vries, S., Seeland, K., Schipperijn, J. (eds). *Forests*, *trees and human health*. New York, Dordrecht, Heidelberg, London: Springer, p. 77–126.

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