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Original scientific paper

THE MOST FREQUENT DISEASES OF CERTAIN INTRODUCED TREE SPECIES IN PARKS, PARK FORESTS, AND TREE ROWS OF SERBIA

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Abstract: Various symptoms of diseases, including primarily rotting and dieback of branches were recorded on individual trees of boxelder maple (*Acer negundo*), honey locust (*Gleditsia triacanthos*), and green ash (*Fraxinus pennsylvanica*) during the urban forest health monitoring in the territory of Serbia. This paper presents the most frequent parasitic and saprophytic fungi related to the decline of these tree species. 14 species in total of lignicolous fungi and 1 species that causes necroses and die-back of trees were recorded. The greatest damages were recorded on boxelder maple (*Acer negundo*) and green ash (*Fraxinus pennsylvanica*) and the smallest on honey locust (*Gleditsia triacanthos*). The application of protection strategies should be aimed at reducing the source of inoculum for healthy trees. This can be achieved using various forestry measures, which primarily should be aimed at better phytosanitary treatments of parks and park forests of Serbia, as well as the papers aimed at production of phenotypically adequate trees.

Keywords: introduced species, main diseases, chain damage

NAJČEŠĆE BOLESTI POJEDINIH INTRODUKOVANIH VRSTA DRVEĆA U PARKOVIMA, PARK ŠUMAMA I DRVOREDIMA SRBIJE

Sažetak: Na pojedinačnim stablima *negunda* (*Acer negundo*), *gledičije* (*Gleditsia triacanthos*), i *pensilvanijskog jasena* (*Fraxinus pennsylvanica*) zabeleženi su različiti simptomi bolesti, prvenstveno uključujući trulež i sušenje grana tokom monitoringa zdravstvenog stanja urbanih šuma na području Srbije. U radu su prikazane najčešće parazitske i saprofitske gljive povezane sa propadanjem ovih vrsta drveća. Konstatovano je ukupno 14 vrsta lignikolnih gljiva i 1 vrsta koja prouzrokuje nekroze i odumiranje stabala. Najveće štete su zabeležene na *negundu* (*Acer negundo*) i *pensilvanijskom jasenu* (*Fraxinus pennsylvanica*) a najmanje na *gledičiji* (*Gleditsia triacanthos*). Primena strategija zaštite treba da bude usmerena u smanjenju izvora inokuluma za zdrava stabla. Ovo se može postići različitim šumarskim merama, koje prvenstveno treba da budu usmerene u boljim fitosanitarnim tretmanima parkova i park šuma Srbije, kao i radovima usmerenim prema proizvodnji fenotipski odgovarajućih stabala.

Ključne reči: introdukovane vrste, glavne bolesti, ulančavanje šteta

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1. INTRODUCTION

Boxelder maple (*Acer negundo* L.), honey locust (*Gleditsia triacanthos* L.) and green ash (*Fraxinus pennsylvanica* Marsch.) represent allochthonous tree species in Serbia, often grown for decorative purposes in parks and tree rows (Cvjetičanin et al., 2016). Boxelder maple represents invasive weed species on alluvial habitats (Cvjetičanin et al., 2016). Since boxelder maple represents widely grown species, many pathogens of this tree species are present in various parts of range, whereby it occasionally represents a new host for already known pathogens (Li et al., 2020; Liu et al., 2021). In addition, new species of fungi have been discovered on boxelder maple lately (Patejuk et al., 2023). On the other hand, according to the available literature, in recent times there are no studies related to the diseases of honey locust trees.

The dieback of green ash trees deserves special attention. First of all, there is a relatively small number of studies of *Hymenoscyphus fraxineus* on green ash. One of the main causes is the fact that *Hymenoscyphus fraxineus* causes the most damage to common ash (*Fraxinus excelsior* L.) and narrow-leaved ash (*Fraxinus angustifolia* Vahl) (Enderle et al., 2019). The damages on manna ash (*Fraxinus ornus* L.) are far smaller and limited to the leaves (Schwanda and Kirisits 2015; Kirisits 2017). Also, in domestic literature, almost there are no studies that dealt with the causes of dieback of green ash trees. The obtained results will open the way to further studies of pathogens related to decay of this tree species, but above all they will enable more efficient application of protection measures in order to preserve green ash trees in urban areas of Serbia.

In accordance with all mentioned above, the objective of the research was to determine the presence of the most common and most important causative agents of decay of boxelder maple, honey locust and green ash trees. The focus of the research was on lignicolous fungi because they cause the greatest damage and danger in urban conditions.

2. MATERIAL AND METHODS

2.1 Field methods

In the period from spring 2023 to autumn 2025, an inspection of parks, park forests and tree rows in large cities of Serbia was carried out. A special focus was on the city of Belgrade, where Ada Ciganlija, Košutnjak, Šumice, Byford's Forest, Topčider Park, Topčidersko Brdo and Bežanijska Kosa were inspected as locations with great presence of trees of introduced tree species.

The inspection of the terrain encompassed periodical monitoring of the occurrence of decay several times a year. Damaged parts of the trees, including rotting wood and fruiting bodies of macrofungi were sampled for laboratory analyses. In case of green ash, branch samples with the appearance of ash dieback were also collected; 100 branches from 10 trees were collected, i.e. 10 branches per tree.

The collected samples were packed in paper bags and transported to the laboratory for forest protection of the Institute of Forestry in Belgrade and the

Faculty of Forestry of the University of Belgrade. The samples were stored in refrigerators at the temperature of 5-10°C. Before storing in refrigerators, carpophores were dried at room temperature for 24 hours.

2.2 Laboratory methods

The isolation of fungi from the samples of wood and carpophores was carried out on malt extract agar nutrient medium (MEA, Biolab, Hungary), prepared according to the manufacturer's instructions. Before the isolation the surface of samples was sterilized by coating with 96% alcohol and exposure to flame of spirit lamp for a few seconds. The procedure was repeated 2-3 times. After the growth of the first hyphae, they were transplanted to a new MEA nutrient medium in order to obtain pure cultures.

Part of the fungi was identified based on the appearance of the fruiting bodies, i.e. carpophores based on the description of Ryvarden and Melo (2014) and Karadžić et al., (2016). The identification of fungi based on the cultures was carried out using the description of Nobles (1948, 1965), Stalpers (1978) and Kowalski (2006).

Pure cultures of lignicolous fungi were identified immediately, while the cultures of fungus morphotype isolated from green ash were previously stored at the temperature of 5-10 °C for 3 months.

3. RESULTS AND DISCUSSION

Table 1 shows an overview of the recorded species of fungi. The largest number of the mentioned species of fungi was recorded for the first time on the researched tree species in the parks of Serbia.

Table 1. The overview of the recorded parasitic and saprophytic fungi on the researched introduced tree species

Fungus species	Host	Part of the tree	Type of damage	Importance
<i>Antrodia heteromorpha</i>	Boxelder maple, green ash	Trunk	Sapwood rot	+
<i>Auricularia auricula judae</i>	Boxelder maple	Trunk	Dead wood rot	+
<i>Auricularia mesenterica</i>	Boxelder maple, green ash	Trunk	Dead wood rot	+
<i>Bjerkandera adusta</i>	Boxelder maple, honey locust, green ash	Trunk	Sapwood rot	++
<i>Fomes fomentarius</i>	Honey locust, green ash	Trunk	Central rot	+++
<i>Ganoderma applanatum</i>	Boxelder maple, honey locust, green ash	Root, trunk	Central rot	+++
<i>Ganoderma pfeiferii</i>	Boxelder maple, green ash	Root, trunk	Central rot	+++
<i>Hymenoscyphus fraxineus</i>	Green ash	Branches	Necrosis, dying off	+++
<i>Inonotus hispidus</i>	Green ash	Trunk	Sapwood rot	+++
<i>Irpex lacteus</i>	Boxelder maple, honey locust, green ash	Trunk	Dead wood rot	+
<i>Laetiporus sulphureus</i>	Boxelder maple, honey locust	Trunk	Central rot	+++

Fungus species	Host	Part of the tree	Type of damage	Importance
<i>Meripilus giganteus</i>	Honey locust	Root, trunk	Central rot	+++
<i>Phylloporia ribis</i>	Boxelder maple, green ash	Root, trunk	Central rot	+++
<i>Schizophyllum commune</i>	Boxelder maple, honey locust, green ash	Trunk	Sapwood rot	++
<i>Trametes versicolor</i>	Boxelder maple, honey locust, green ash	Trunk	Sapwood rot	++

Addendum to the table: + the fungus has little importance
 ++ the fungus causes damage
 +++ the fungus causes great damage

Most of the present species of fungi were found in advanced and final stage of tree rot, when the fruiting bodies were visible (Figure 1). *Fomes fomentarius*, *Ganoderma applanatum*, *Ganoderma pfeiferii*, *Inonotus hispidus*, *Laetiporus sulphureus*, *Meripilus giganteus* and *Phylloporia ribis* fungi caused greatest damage. Other fungi appeared in succession after these species or on the trees which were damaged due to undefined causative agents (Figure 1).

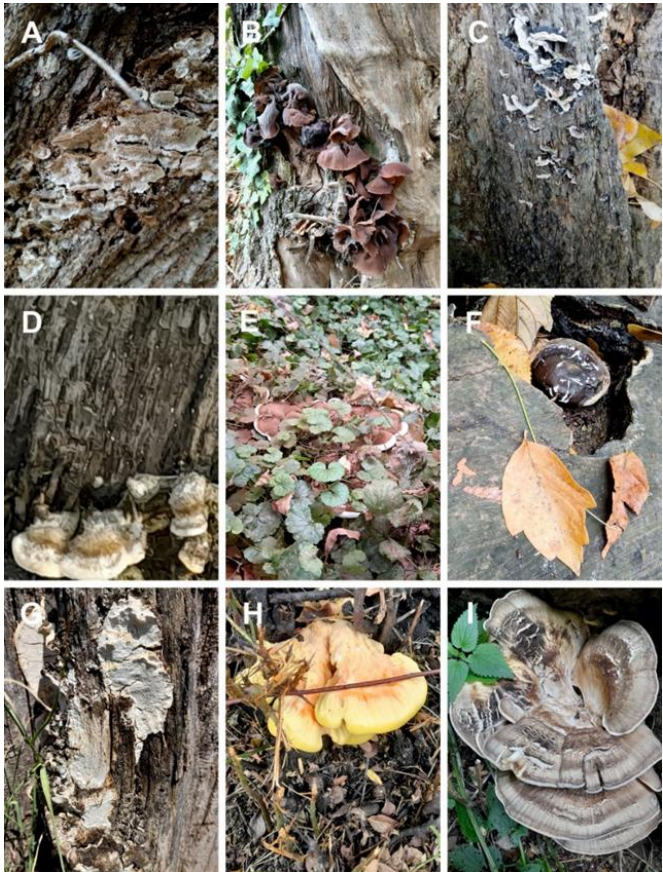


Figure 1. Presentation of certain fungi found: A – *Antrodia heteromorpha*, B – *Auricularia auricula judae*, C – *Auricularia mesenterica*, D – *Bjerkandera adusta*, E – *Ganoderma applanatum*, F – *Ganoderma pfeiferii*, G – *Irpex lacteus*, H – *Laetiporus sulphureus*, I – *Meripilus giganteus*

The presence of a fungus *Hymenoscyphus fraxineus* was found on green ash (Figure 2). The fungus was isolated from one sample, collected from a tree in Bežanijska Kosa, i.e. from 1% of branches.

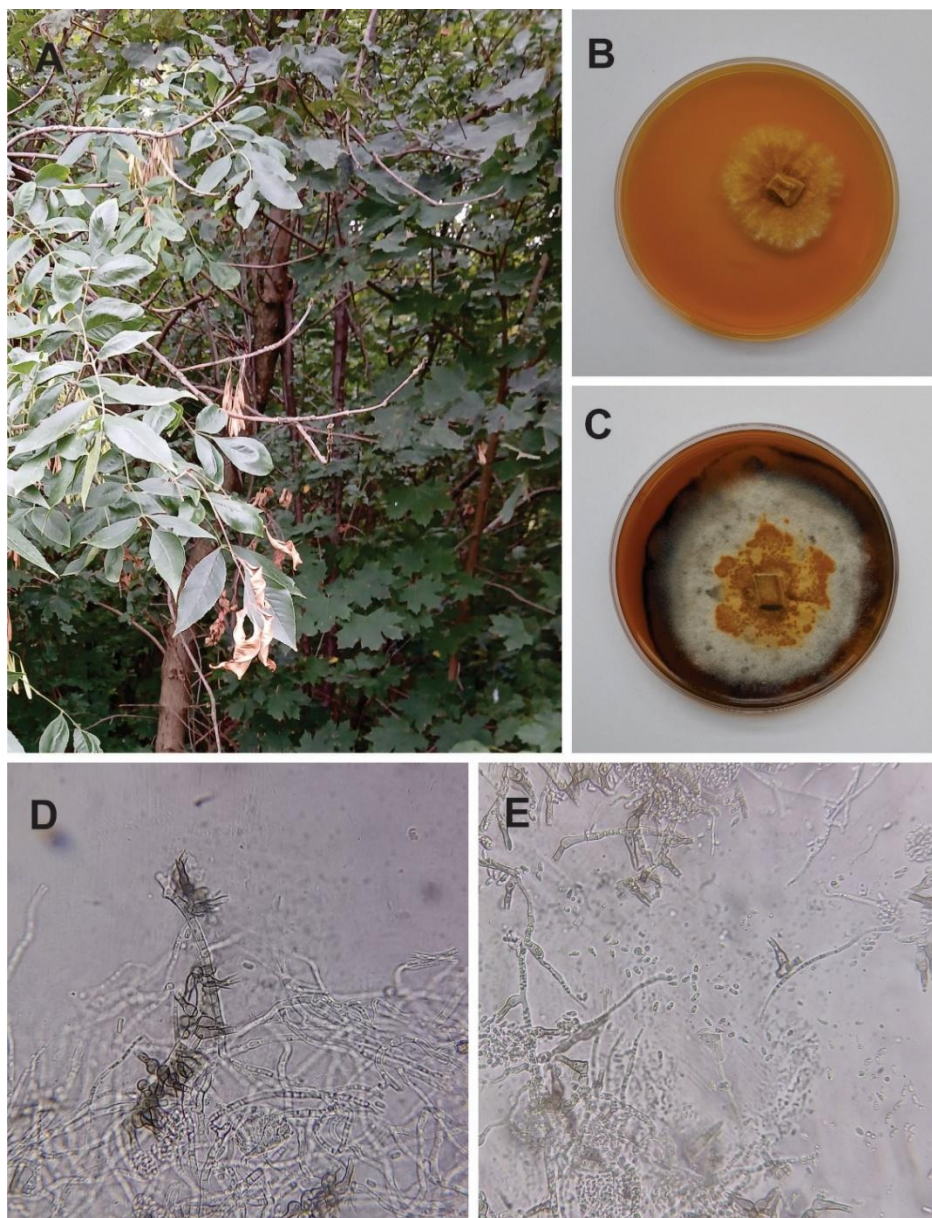


Figure 2. Presentation of fungus *Hymenoscyphus fraxineus* on green ash: A – symptoms, B-C – pure cultures, D-E – phialides and conidia

This study covers the most common causative agents of tree decay of some of the main introduced tree species in parks and other green areas in Serbia. The fact that the fungi with hard carpophores, which are more specific for natural stands, are frequently found, stands out in particular (Vasaitis 2013). The aforementioned

phenomenon indicates that the trees of introduced tree species in urban conditions of Serbia reached certain age and decline in vitality, which according to Vasaitis (2013) represent the most important triggers of active development of infection by lignicolous fungi with hard fruiting bodies.

The obtained results indicate that the health status of introduced tree species in Serbia is under infection pressure of various pathogens which colonize trees. Breakages and fallen trees affected by *Fomes fomentarius*, *Laetiporus sulphureus* and *Phylloporia ribis* fungi, most likely caused by snow and wind, confirm the above statement. Such damages from abiotic factors are expected also in trees affected by other lignicolous fungi which cause the greatest damage, i.e. species *Ganoderma applanatum*, *Ganoderma pfeiferii*, *Inonotus hispidus* and *Meripilus giganteus*.

An exception to the above is boxelder maple, where a different way of observing of determined damages is recommended, and in that sense moderate application of protection measures. Boxelder maple shows a potential for intensive spreading and suppression of other tree species, especially in wet habitats (Sikorska et al., 2019). In addition, due to increase in soil moisture of these habitats, a negative impact on adaptability and succession of various plant species occurs (Dubrovin et al., 2022). When implementing future protection measures in urban forests, in the case of boxelder maple trees near water bodies it is necessary to make a balance in terms of leaving a certain number of trees to harmful factors. In this way, their invasive potential and the reduction of diversity in these habitats will be reduced.

The presence of *Hymenoscyphus fraxineus* is confirmed on the green ash trees with the symptoms of dieback in urban conditions of Serbia. The symptoms are limited to certain branches i.e. parts of crown. That is, *Hymenoscyphus fraxineus* was isolated in a small percentage from symptomatic trees. However, it should be emphasized that in case of *Hymenoscyphus fraxineus* the degree of isolation should not be considered an important indicator of its harmfulness. The reason for the above may be the slow growth of the fungus, i.e. the appearance of various species of saprophytic fungi which appear in the later stages of the development of necrotic lesions, i.e. dieback of trees (Kowalski et al., 2016).

Hymenoscyphus fraxineus pathogenicity tests on green ash showed the occurrence of necrotic lesions on 5.5% of inoculated trees (Kowalski et al., 2015), while 16% of trees with necrotic lesions was recorded in nature (Gross and Sieber 2016). The above indicates that *Hymenoscyphus fraxineus* does not develop actively as on sensitive ash species (*Fraxinus* spp.). An additional difficulty in determining the frequency of ash dieback symptoms on green ash reflects in the fact that necrotic lesions caused by *Hymenoscyphus fraxineus* are small and do not differ from necroses caused by other factors (Kowalski et al., 2015; Gross and Sieber 2016). On the researched sites, dieback of branches was relatively often present, while necrotic lesions were rarely clearly visible. This phenomenon can indicate several things: that *Hymenoscyphus fraxineus* is more common on green ash trees in urban forests of the city of Belgrade but cannot be reliably confirmed at the moment, or the dieback of the crown is necessary to be attributed to other factors. Anyway, a small number of isolates of this fungus is consistent with the results of previous research.

High temperatures limit the spreading of *Hymenoscyphus fraxineus* (Grosdidier et al., 2018). In addition, the mycelium of the fungus ceases to be vital at high temperatures (Kowalski and Bartnik 2010). These studies may provide a

partial explanation why the symptoms are present without the possibility of isolation of the fungus. It is possible that the fungus previously achieved infection, but quickly ceased to be vital due to high temperatures. The only confirmed finding of this fungus was in the forests on Bežanijska Kosa which were neglected due to the lack of care measures, which probably influenced more favorable conditions for the growth of the fungus.

As previously stated, dieback of certain branches or parts of the crown was noted, without the tendency of dieback of entire trees. Pastirčáková et al., (2020) state a lower degree of crown defoliation in green ash compared to the crown of common ash. In the future, it is necessary to research the connection of different characteristics of green ash trees and dieback intensity. The above data will enable better understanding of the occurrence of symptoms caused by *Hymenoscyphus fraxineus* and distinguishing it from other factors which contribute to dieback of green ash trees.

5. CONCLUSION

The carried-out study was one of the first to study diseases of introduced tree species in parks of Serbia. As such, it represents the basis for further research which will characterize in more detail dieback of each of the stated tree species. Based on the results obtained, individual conclusions were formed.

- In total, 14 species of lignicolous fungi were found on introduced tree species: boxelder maple, honey locust and green ash. The most important recorded fungi, causative agents of rot, were *Fomes fomentarius*, *Laetiporus sulphureus* and *Phylloporia ribis*.
- The majority of the recorded fungi was found for the first time on trees of introduced tree species in urban areas of Serbia.
- After the occurrence of central rot caused by fungi *Fomes fomentarius*, *Laetiporus sulphureus* and *Phylloporia ribis*, a chain damage from snow and wind is recorded.
- *Bjerkandera adusta*, *Irpex lacteus*, *Schizophyllum commune* and *Trametes versicolor* fungi were occasionally found on the damaged trees.
- Fungus *Hymenoscyphus fraxineus* was found on green ash. According to the available literature the above finding represents the first finding of *Hymenoscyphus fraxineus* on green ash in Serbia.

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REFERENCES

- Cvjetičanin, R., Brujić, J., Perović, M., & Stupar V. (2016). Dendrology. Faculty of Forestry, University of Belgrade (Original title: Dendrologija. Univerzitet u Beogradu, Šumarski fakultet).
- Dubrovin, D.I., Rafikova, O.S., & Veselkin, D.V. (2022). Soil Moisture in Urbanized Habitats Invaded by Alien *Acer negundo*. *Russian Journal of Ecology*, 53, 347-356. <https://doi.org/10.1134/S1067413622050034>
- Gross, A., Sieber, & T.N. (2016). Virulence of *Hymenoscyphus albidus* and native and introduced *Hymenoscyphus fraxineus* on *Fraxinus excelsior* and *Fraxinus pennsylvanica*. *Plant Pathology*, 65(4), 655-663. <https://doi.org/10.1111/ppa.12450>
- Grosdidier, M., Ioos, R., & Marçais, B. (2018). Do higher summer temperatures restrict the dissemination of *Hymenoscyphus fraxineus* in France? *Forest Pathology*, 48(4), e12426.
- Enderle, R., Stenlid, J., & Vasaitis, R. (2019). An overview of ash (*Fraxinus* spp.) and the ash dieback disease in Europe. *CABI Reviews*, 14(025), 1-12. <https://doi.org/10.1079/PAVSNNR201914025>
- Karadžić, D., Keča, N., Milenković, I., Milanović, S., & Stanivuković, Z. (2016). Forest mycology. Faculty of Forestry, University of Banja Luka (Original title: Šumska mikologija, Univerzitet u Banjoj Luci, Šumarski fakultet.).
- Kirisits, T. (2017). Further Observations on the Association of *Hymenoscyphus fraxineus* with *Fraxinus ornus*. *Baltic Forestry*, 23(1), 60-67.
- Kowalski, T. (2006). *Chalara fraxinea* sp. nov. associated with dieback of ash (*Fraxinus excelsior*) in Poland. *Forest Pathology*, 36(4), 264-270. <https://doi.org/10.1111/j.1439-0329.2006.00453.x>
- Kowalski, T., & Bartnik, C. (2010). Morphological variation in colonies of *Chalara fraxinea* isolated from ash (*Fraxinus excelsior* L.) stems with symptoms of ash dieback and effects of temperature on colony growth and structure. *Acta Agrobotanica*, 63(1), 99-106. <https://doi.org/10.5586/aa.2010.012>
- Kowalski, T., Bilański, P., & Holdenrieder, O. (2015). Virulence of *Hymenoscyphus albidus* and *H. fraxineus* on *Fraxinus excelsior* and *F. pennsylvanica*. *PLoS ONE* 10(10), e0141592. <https://doi.org/10.1371/journal.pone.0141592>
- Kowalski, T., Kraj, W., & Bednarz, B. (2016). Fungi on stems and twigs in initial and advanced stages of dieback of European ash (*Fraxinus excelsior*) in Poland. *European Journal of Forest Research*, 135(3), 565-579. <https://doi.org/10.1007/s10342-016-0955-x>
- Li, M., Dai, Y., Zheng, Z., & Chen, F. (2020). First Report of *Fusarium solani* Causing Stem Canker of *Acer negundo* in China. *Plant Disease*, 104(12), <https://doi.org/10.1094/PDIS-03-20-0477-PDN>

- Liu, C-L., Zheng X.R., & Chen F.M. (2021). Dieback and Leaf Spot in Box Elder (*Acer negundo*) Caused by *Exserohilum rostratum*. *Plant Disease*, 105(10), 2955-2963. <https://doi.org/10.1094/PDIS-07-20-1424-RE>
- Nobles, M.K. (1948). Studies in Forest Pathology. VI. Identification of cultures of Wood-rooting fungi. *Canadian Journal of Research* 26, 281-431.
- Nobles, M.K. (1965). Identification of cultures of wood-inhabiting Hymenomycetes. *Canadian Journal of Botany*, 43, 1097-1139.
- Pastirčáková, K., Adamčíková, K., Barta, M., Pažitný, J., Hořka, P., Sarvašová, I., & Kádasi Horáková, M. (2020). Host Range of *Hymenoscyphus fraxineus* in Slovak Arboreta. *Forests*, 11(5), 596. <https://doi.org/10.3390/f11050596>
- Patejuk, K., Czachura, P., Baturo-Cieśniewska, A., Owczarek-Kościełniak, M., Pusz, W., Najberek, K., & Piątek, M. (2023). *Colletotrichum acericola* sp. nov. from seeds of the invasive alien tree species *Acer negundo* in Poland. *Plant Pathology*, 72(9), 1716-1725. <https://doi.org/10.1111/ppa.13785>
- Ryvarden, L., & Melo, I. (2014). Poroid fungi of Europe second edition, Sinopsis fungorum 37, Fungiflora, Oslo, Norway.
- Schwanda, K., & Kirisits, T. (2015). Pathogenicity of *Hymenoscyphus fraxineus* towards leaves of three European ash species: *Fraxinus excelsior*, *F. angustifolia* and *F. ornus*. *Plant Pathology*, 65(7), 1071-1083. <https://doi.org/10.1111/ppa.12499>
- Sikorska, D., Sikorski, P., Archiciński, P., Chormański, J., & Hopkins, R.J. (2019). You Can't See the Woods for the Trees: Invasive *Acer negundo* L. in Urban Riparian Forests Harms Biodiversity and Limits Recreation Activity. *Sustainability*, 11(20), 5838. <https://doi.org/10.3390/su11205838>
- Stalpers, J.A. (1978). Identification of Wood inhabiting Aphyllophorales in pure culture. *Studies in mycology*, 16, 1-248.
- Vasaitis, R. (2013). Hearth Rots, Sap Rots and Canker Rots, In P. Gontier., & G. Nicolotti (Eds.), *Infectious forest diseases*, (pp. 197-229). CAB International, UK. <https://doi.org/10.1079/9781780640402.0197>

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Summary

The paper presents the results of a three-year monitoring of health condition of boxelder maple (*Acer negundo*), honey locust (*Gleditsia triacanthos*) and green ash (*Fraxinus pennsylvanica*) from the point of view of pathogenic fungi. Various urban forests were inspected, including individual trees, tree rows, parks and park forests. Most of the

recorded lignicolous fungi caused great damage on trees. The most important recorded abiotic damages are breakages caused by snow or wind, which often occur after damages from parasitic fungi.

Also, the results of monitoring of fungus *Hymenoscyphus fraxineus* on symptomatic trees of green ash are presented in the paper. The symptoms of ash dieback were recorded on several sites, while *Hymenoscyphus fraxineus* was isolated from one symptomatic tree. Dieback of green ash was limited to individual branches, without the tendency of dieback of whole trees. The isolate was characterized by moderate growth, formation of phialides and conidia after three months at 5-10 °C.

The trees with the dieback symptoms were often damaged by abiotic factors or were located in unfavorable habitat conditions. According to the available data, the above results represent the first finding of *Hymenoscyphus fraxineus* on green ash in Serbia. The influence of environmental factors on the occurrence of *Hymenoscyphus fraxineus* was discussed especially.

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Rezime

U radu su prikazani rezultati trogodišnjeg monitoringa zdravstvenog stanja negunda (*Acer negundo*), gledičije (*Gleditsia triacanthos*) i pensilvanijskog jasena (*Fraxinus pennsylvanica*) sa stanovišta patogenih gljiva. Pregledane su različite urbane šume, uključujući pojedinačna stabla, drvoređi, parkovi i park šume. Najveći broj konstatovanih lignikolnih gljiva je izazvao velika oštećenja na stablima. Najvažnija konstatovana abiotička oštećenja su lomovi uzrokovani snegom ili vetrom, koja se često pojavljuju posle šteta od parazitskih gljiva.

Takođe, prikazani su rezultati monitoringa gljive *Hymenoscyphus fraxineus* na simptomatičnim stablima pensilvanijskog jasena. Simptomi odumiranja jasena su konstatovani na više lokaliteta, dok je *Hymenoscyphus fraxineus* izolovana iz jednog simptomatičnog stabla. Sušenje pensilvanijskog jasena je bilo ograničeno na pojedinačne grane, bez tendencije odumiranja celih stabala. Izolat se karakterisao umerenim rastom, formiranjem fialida i konidija posle 3 meseca na 5-10 °C.

Stabla sa pojavom simptoma odumiranja su često bila oštećena od abiotičnih faktora ili se nalazila u nepovoljnim stanišnim uslovima. Prema dostupnim podacima, navedeni rezultati predstavljaju prvi nalaz *Hymenoscyphus fraxineus* na pensilvanijskom jasenu (*Fraxinus pennsylvanica*) u Srbiji. Uticaj ekoloških faktora na pojavu *Hymenoscyphus fraxineus* je posebno diskutovan.