CHECKLIST

Contribution to the Knowledge of Fungi of the Kampinos National Park (Central Poland): Part 6 – With Particular Emphasis on the Species Occurring on Windthrown Areas

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Abstract

We identified 17 species of fungi that are new to Kampinos National Park. Sixteen were found during surveys of areas damaged by a strong wind in 2017. The remaining species was found outside the windthrow area. Descriptions of four species new to Poland (Cortinarius subcompar, Hyaloscypha quercicola, Hypocrea tremelloides, and Trechispora aff. invisitata) are also provided. The current number of macrofungi taxa identified in Kampinos National Park is 1,654.

Keywords

Ascomycota; Basidiomycota; fungal biota; ecological disturbance; windfall

1. Introduction

Kampinos National Park (KNP) is located in central Poland, west of Warsaw. The current number of macrofungi taxa identified in KNP is 1,637 (1,413 Basidiomycota and 224 Ascomycota) (Szczepkowski et al., 2022). KNP is one of the most mycologically explored areas in Poland. However, each year, new species of fungi have been reported for KNP (e.g., Gierczyk, Szczepkowski, et al., 2019; Marciszewska et al., 2020; Szczepkowski et al., 2021). After the forest was wind-damaged in the western part of KNP (summer 2017), a 4-year project surveying fungi on windthrown trees was undertaken (2018–2021). The survey has revealed many interesting findings concerning taxa of all lignicolous fungi and has identified new species of non-lignicolous fungi in KNP (Szczepkowski et al., 2021, 2022; Zaniewski et al., 2019).

This paper presents newly identified species of fungi in windthrow areas of KNP during the final year of the project (2021) and provides condensed information on their distribution in Poland. Additionally, one interesting fungal species, new to KNP, which was found outside the windthrow area, is included.

2. Material and Methods

The study involved two plots located in the Różin and Grabina protective subdistricts/forest subdistricts (in Kampinos Protective District/Forest District).
The Grabina plot is located in an 84-year-old damaged stand dominated by *Pinus sylvestris*, with singly occurring *Populus tremula* and two birch species (*Betula pendula* and *B. pubescens*). The Różin plot is located in an approximately 104-year-old damaged stand dominated by two oak taxa (*Quercus petraea* and *Q. ×rosacea*) with a 10% proportion of *B. pendula* and sparse *P. sylvestris* trees. Thirty windthrown trees, with 10 trees of each species (*Quercus* spp., *B. pendula*, and *P. sylvestris*), were extensively studied in the windfall plots. Detailed information on the study area and methods has been previously published (Szczepkowski et al., 2021, 2022; Zaniewski et al., 2019).

The collected specimens were identified using standard mycotaxonomical methods (Clemençon, 2009) by light microscopy. The dried material was rehydrated with 10% ammonia and stained with Congo red, Melzer reagent, cotton blue in lactophenol, and brilliant cresyl blue (CRB). All measurements were performed directly using a light microscope equipped with an oil immersion objective (×100). The spore dimensions were established from measurements of 50 randomly selected, well-formed spores (deformed or atrophied spores were excluded from the analysis). The 95% population limits for the mean were calculated, and the lower and upper values are given. For the other structures, extreme size values were presented. The dimensions of these structures were obtained after measuring 25 elements. Specimens were identified using the following monographs: *Buchwaldoboletus*, *Galerina*, *Inocybe*, *Mycenella*, *Russula* (Knudsen & Vesterholt, 2012), *Cortinarius* (Brandrud et al., 2012; Knudsen & Vesterholt, 2012; Moser, 2001), *Hyalorbilia* (Baral et al., 2020), *Hyaloscypha* (Raitviir, 2004), *Hypocrean* (Jaklitsch, 2011), *Ischnoderma* (Ryvarden et al., 2017), *Mollisia* (Baral & Marson, 2005), *Phellodon* (Hansen & Knudsen, 1997), *Ramaria* (Christian, 2008), *Tomentella* (Dämmrich, 2006; Köjalg, 1996), and *Treichspora* (Bernicchia & Gorjón, 2010). Nomenclature was used according to these monographs. The forest compartment numbers were obtained from the Forest Data Bank (https://www.bdl.lasy.gov.pl/). Dried specimens were deposited in the fungarium of the Department of Forest Protection of the Warsaw University of Life Sciences – SGGW (W AML) and the private fungaria of Błażej Gierczyk (BGF) and Tomasz Ślusarczyk (TŚF). Each number represents a collection.

3. Results – List of the Species

In 2021, 16 species of fungi new to Kampinos National Park were found in wind-damaged areas affected by a strong wind in 2017. The remaining species of fungus was novel to KNP and was found outside the windthrow area.

Abbreviations: AK – Anna Kujawa; AS – Andrzej Szczepkowski; BG – Błażej Gierczyk; TŚ – Tomasz Ślusarczyk; FD – forest district; KNP – Kampinos National Park; LP – landscape park; NP – national park; PD – protective district/forest district; PSD – protective subdistrict/forest subdistrict; res. – nature reserve.

3.1. Ascomycota

**Hyalorbilia fagi** E. Weber, Baral & J. W. Guo. *Specimen examined:* KNP, Zaborówek, 1.5 km NNW, Leszno municipality, Kampinos PD, Różin PSD, forest compartment No.: 258b; numerous ascomata on the trunk of the fallen *Quercus petraea*; 2021-09-04; leg., det. TŚ; TŚF 299/2021. **Notes:** The species have been distinguished recently. In Poland, only known from the vicinity of Śrem (Greater Poland) (Baral et al., 2020).

**Hyaloscypha quercicola** (Velen.) Huhtinen. *Specimen examined:* KNP, Zaborówek, 1.5 km NNW, Leszno municipality, Kampinos PD, Różin PSD, forest compartment No.: 258a; numerous ascomata on a branch of the fallen *Betula pendula*; 2021-10-09; leg., det. TŚ; TŚF 300/2021. **Notes:** Species hitherto not reported from Poland. Widely distributed, mentioned from Europe and North America (Raitviir, 2004).

**Species description:** Apothecia small, cup-shaped, sub sessile, 0.2–0.4 mm in diameter, white, translucent. Margin and outside of receptacle covered with short, white hairs. Asci eight-spored, cylindrical-clavate, 30–45 × 2–4 μm, without croziers and with non-amyloid apical pore. Paraphyses filiform. Spores cylindrical-ellipsoid, sometimes slightly curved, asetate, 6–11 × 2–3 μm, with small drops at each end.
Ectal excipulum of textura prismatica. Hairs narrowly conical, aseptate, hyaline, thin-walled, smooth, 30–50 × 2–4 μm. From other Hyaloscypha with asci arising from simple septa and with finely warted hairs [H. fuckelii var. alniseda (Velen.) Huhtinen, H. leucostigma (Fuckel) Baral, H. priapi Velen., H. tigillaris (P. Karst.) Raitv.] distinguishes by non-amyloid apical pore of asci.

*Hypocrea auranteffusa* Jaklitsch (Figure 1). **Specimen examined:** KNP, Zaborówek, 1.5 km NNW, Leszno municipality, Kampinos PD, Rózin PSD, forest compartment No.: 258b; numerous stromata on a branch of the fallen *Quercus* sp.; 2021-10-09; leg. AK, BG, det. BG; BGF0008267. **Notes:** Very rare species, in Poland hitherto reported from the Kaczawskie Foothills (Gierczyk, Soboń et al., 2018).

*Hypocrea tremelloides* (Schumach.) Fr. (Figure 2). **Specimen examined:** KNP, Zaborówek, 1.5 km NNW, Leszno municipality, Kampinos PD, Rózin PSD, forest compartment No.: 258a; numerous stromata on a branch of the fallen *Quercus* sp.; 2021-10-09; leg. AK, det. BG; BGF0008279. **Notes:** Species not reported from Poland. Hitherto mentioned from Austria, Denmark, Italy, and the United Kingdom (Jaklitsch, 2011). **Species description:** Stromata lenticular, up to 3 mm in diameter, smooth, waxy gelatinous when young, pale flesh-colored, with age becoming darker (orange-brown to reddish-brown), with papillate, concolor ostioles. Surface hairs lacking. Spores bicellular, hyaline, verrucose, cells dimorphic: distal one 2.7–4.2 × 2.4–3.7 μm, broadly ellipsoid, proximal one 3.5–5.4 × 2.0–3.2 μm, oblong. The other species with hyaline, dimorphic spores and waxy appearance is *H. sambuci* Jaklitsch & Voglmayr; however, it is restricted to *Sambucus nigra*.

*Mollisia olivaceocinerea* Srvcék agg. **Specimen examined:** KNP, Zaborówek, 1.5 km NNW, Leszno municipality, Kampinos PD, Rózin PSD, forest compartment No.: 258b; numerous ascomata on a branch of the fallen *Quercus petraea*; 2021-09-04; leg., det. TŚ; TŚF 301/2021. **Notes:** Rare or overlooked species complex, in Poland hitherto known from Gryżyński LP (Ślusarczyk, 2019) and Żurawno res. (Ślusarczyk, 2020). Group of several taxa of the genus *Mollisia* with ectal excipulum staining green with NaOH, were recently transferred to the new genus *Phialocephala* W. B. Kendr. Certain identification is only possible based on morphological studies.
of the culture of the anamorphic state and molecular methods (Crous et al., 2020; Gminder, 2012; Tanney et al., 2016; Tanney & Seifert, 2020).

3.2. Basidiomycota

*Buchwaldoboletus lignicola* (Kallenb.) Pilát. *(Figure 3)*. **Specimen examined**: KNP, Granica, 2 km N Kampinos municipality E, the Granica strictly protected area (Polish: Obszar Ochrony Scisłej Granica), forest compartment No.: 169a; one basidioma on soil near sporocarp of *Phaeolus schweinitzii* (Fr.) Pat growing at the base old *Pinus sylvestris* in *Tilio-carpinetum typicum*; 2021-08-12; leg., det. AS; WAML1068. **Notes**: It is not rare, known from approximately 20 localities published (Kujawa, 2022; Wojewoda, 2003) and one unpublished locality from Modrzewina res. (Szczepkowski, unpbl. data).

*Cortinarius orellanus* Fr. **Specimen examined**: KNP, Zaborówek, 1.5 km NNW, Leszno municipality, Kampinos PD, Różin PSD, forest compartment No.: 258; a few basidiomata on soil in an oak (*Quercus petraea* and *Q. × rosacea*) forest with a 10% proportion of *Betula pendula* and sparse *Populus tremula* and *Pinus sylvestris* trees; 2021-09-04; leg., det. TŚ; TŚF 302/2021. **Notes**: It is not rare, known from over 30 localities (Kujawa, 2022; Wojewoda, 2003).

*Cortinarius subcompar* Bohus. *(Figure 4)*. **Specimen examined**: KNP, Zaborówek, 1.5 km NNW, Leszno municipality, Kampinos PD, Różin PSD, forest compartment No.: 258; a few basidiomata on soil in an oak (*Quercus petraea* and *Q. × rosacea*) forest with a 10% proportion of *Betula pendula* and sparse *Populus tremula* and *Pinus sylvestris* trees; 2021-09-04; leg., det. TŚ; TŚF 303/2021. **Notes**: Species not reported from Poland. Hitherto mentioned from Germany, Hungary, Norway, and Spain (Brandrud et al., 2012). **Species description**: Pileus 20–70 mm, convex, often slightly umbonate, silky fibrillose, ocher-grey to ocher-brown with bluish tinges, slightly hygrophanous. Lamellae emarginate, first bluish-grey, then yellowish-brown. Stipe 30–80 × 0.5–1.1 mm, with a bulb at the base, whitish fibrillose, with bluish tinges at apex, covered with very scanty veil remains. Flesh greyish, often bluish in the apex of the stem, taste mild, smell neutral. Basidiospores ovoid to ellipsoid, rusty brown, strongly verrucose, moderately dextrinoid, 7–9 × 4–5 μm. Basidia four-spored, with clamps. Pileipellis a cutis. There are some other similar species in section *Firmiores* (Fr.) Hennings. In deciduous woods grow: *C. alboviolaceus* (Pers.) Fr. with smaller basidiomata, brighter pileus, stipe without bulb, abundant universal velum and bigger spores, *C. turgidus* Fr. with stipe tapering at the base and bigger spores, *C. acutispissipes* Rob. Henry with more violet shades, stipe tapering at the...
Figure 3 Basidioma of *Buchwaldoboletus lignicola* adjacent to sporocarps of *Phaeolus schweinitzii* from Kampinos National Park; August 12, 2021. Photography by A. Szczepkowski.

base and bigger spores and *C. paralbocyaneus* Eyssart. with smaller basidiomata, more violet shades, stipe without bulb and bigger spores.

**Galerina uncialis** (Britzelm.) Kühner. **Specimen examined:** KNP, Zaborówek, 1.5 km NNW, Leszno municipality, Kampinos PD, Rózin PSD, forest compartment No.: 258a; a few basidiomata on soil among the mosses in *Quercus* sp. windthrow pit and soil of lower side root disc in oak forest; 2021-09-04; leg., det. BG; BGF0007955.

**Notes:** It is rare in Poland, known from a few localities, e.g., the Babia Góra NP (Bujakiewicz, 1979, 2004, 2018), Buki nad Jeziorem Lutomskim res. (Bujakiewicz & Springer, 2009), near Gryżyna (Kujawa & Gierczyk, 2011b), the Izer Mts, the Kaczawskie Mts, Izerskie Foothills, Sudetes Foreland (Gierczyk, Soboń et al., 2018), and Poznań (Gierczyk & Ślusarczyk, 2020; Kujawa et al., 2020).

**Inocybe griseolilacina** J. E. Lange. **Specimen examined:** KNP, Zaborówek, 1.5 km NNW, Leszno municipality, Kampinos PD, Rózin PSD, forest compartment No.: 258b; a few basidiomata on soil in *Betula pendula* windthrow pit in an oak forest; 2021-09-04; leg., det. BG; BGF0007959. **Notes:** It is not rare in Poland, known from over 20 localities (Kujawa, 2022; Wojewoda, 2003).

**Ischnoderma resinosum** (Schrad.) P. Karst. (Figure 5). **Specimen examined:** KNP, Zaborówek, 1.5 km NNW, Leszno municipality, Kampinos PD, Rózin PSD, forest
Figure 4 Basidiomata of *Cortinarius subcompar* from Kampinos National Park; September 4, 2021. Photography by T. Ślusarczyk.

Figure 5 Basidiomata of *Ischnoderma resinosum* from Kampinos National Park; October 9, 2021. Photography by A. Szczepkowski.
Figure 6  Basidiomata of *Phellodon confluens* from Kampinos National Park; September 4, 2021. Photography by A. Kujawa.

compartment No.: 258b; a few basidiomata on trunks of fallen *Quercus* sp.; 2021-10-09; leg. AS, det. AS; WAML1072, WAML1073. **Notes:** It is not rare in Poland, known from over 40 localities (Kujawa, 2022; Wojewoda, 2003).

*Mycenella lasiosperma* (Bres.) Singer. **Specimen examined:** KNP, Zaborówek, 1.5 km NNW, Leszno municipality, Kampinos PD, Rózín PSD, forest compartment No.: 258b; one basidioma among the mosses on the soil of lower side root disc of *Betula pendula* windthrow in oak forest 2021-09-04; leg. AK, det. BG; BGF0007964. **Notes:** It is not rare in Poland, known from over 20 localities (Komorowska, 2005; Kujawa, 2022; Wojewoda, 2003).

*Phellodon confluens* (Pers.) Pouzar. (Figure 6). **Specimen examined:** KNP, Zaborówek, 1.5 km NNW, Leszno municipality, Kampinos PD, Rózín PSD, forest compartment No.: 258b; several dozen basidiomata on soil in oak forest; 2021-09-04; leg. AK, BG, det. BG; BGF0007978, WAML1080. **Notes:** It is rare in Poland, known from seven localities: Kaszubski LP (Karasiński, 2016), Knyszyńska Forest (Kujawa et al., 2019), Olsztyn (Fiedorowicz, 2011; „Allenstein” Gramberg, 1923, as *Hydnum amicum* Quél.; „bei Allenstein” Neuhoff, 1933, as *Hydnum amicum* Quél.), Biebrza NP (Kujawa et al., 2012, 2015), Gryżyński LP (Ślusarczyk, 2019), Kłodnica (Flisińska, 2004), and Czernichów in the Little Beskids (Kujawa & Gierczyk, 2011a).

*Ramaria fennica* (Peck) Schild. var. *fumigata* (Figure 7). **Specimen examined:** KNP, Zaborówek, 1.5 km NNW, Leszno municipality, Kampinos PD, Rózín PSD, forest compartment No.: 258b, a; numerous basidiomata on soil in an oak forest;
Figure 7  Basidiomata of Ramaria fennica var. fumigata from Kampinos National Park; September 4, 2021. Photography by A. Kujawa.

2021-09-04; leg. BG, det. BG; BGF0007970, WAML1069. Notes: In Poland, the species hitherto known only from Kaszuby LP (Karasiński, 2016).

Russula acrifolia Romagn. Specimen examined: KNP, Zaborówek, 1.5 km NNW, Leszno municipality, Kampinos PD, Rózin PSD, forest compartment No.: 258b; a few basidiomata on soil in oak forest; 2021-09-04; leg. BG, det. BG; BGF0007979. Notes: It is rare in Poland, known from six localities: Dolina Huczka res. (Ślusarczyk, 2020), Knyszynska Forest (Kujawa et al., 2019), Poznań (Gierczyk & Ślusarczyk, 2020), the Gorce Mts (Wojewoda et al., 2016), Pieniny NP (Gumińska, 1999), and Przemyśl Foothills (Gierczyk, Szczepkowski, et al., 2018).

Tomentella coerulescens (Bres.) Höhn. & Litsch. Specimen examined: KNP, Zaborówek, 1.5 km NNW, Leszno municipality, Kampinos PD, Rózin PSD, forest compartment No.: 258a; a few basidiomata on branch of the fallen Quercus sp.; 2021-10-09; leg., det. TŚ; TSF 304/2021. Notes: It is rare in Poland, known from a few localities: Białowieża NP (Faliński & Mulenko, 1997; Holec et al., 2019), in the vicinity of Międzyrzecz Podlaski (Bresadola, 1903, as Odontia crinalis Fr.; Eichler, 1907, as Hypoclymus coerulescens Bres.; Flisińska, 2004); in the vicinity of Olkus (Mleczko & Beszczyńska, 2015), and Bieszczady Mts (Domański et al., 1967; Gierczyk, Kujawa, et al., 2019; Kujawa et al., 2016). This species is mentioned from Kraków by Wojewoda (2003) with reference to the work of Wojewoda (1991), but it is not included in the quoted report.

Trechispora aff. invisitata (H. S. Jacks.) Liberta. KNPC, Łubiec, 2.5 km NW, Leszno municipality, Kampinos PD, Grabina PSD, forest compartment No.: 125a; a few basidiomata on a pine cone lying on the ground; 2021-10-10; leg. AK, det. BG;
Species hitherto not reported from Poland. It is widely distributed, known from Belarus, Belgium, Denmark, Estonia, Finland, France, Germany, Italy, Spain, Sweden, and the United Kingdom (Bernicchia & Gorjón, 2010). **Species description:** Basidiomata effused, resupinate, thin, white with a farinaceous surface and slightly fibrillose margin. Hyphal system dimitic, generative hyphae clamped, short celled, skeletal hyphae in hyphal cords, with slightly thickened walls. Basidia four-spored. Spores ellipsoid to ovoid, verrucose, inamyloid, 3.8–4.5 × 3.5–4 μm (literature values are slightly higher: 4.5–5.5 × 3–4 μm). Conidia ellipsoid, 4.5–6 × 4–5 μm, with distinct, rounded warts or lobes. Conidia ornamentation is a unique feature, making this fungus clearly distinct from other Trechispora species. The difference in spores size between literature data and values obtained for specimens from KNP needs further studies, i.e., if it is the effect of intraspecies diversity or it has a taxonomic consequences.

4. Conclusions

During the course of the study on the windthrow area of KNP, 222 taxa were collected (identified to the level of species, forms, varieties, and, in a few cases, genera). Field research in KNP in 2021 yielded interesting mycological findings. Seventeen taxa new to KNP were noted comprising five ascomycetes and 12 basidiomycetes. One species (*Buchwaldoboletus lignicola*) was found in a strictly protected area in Granica. Sixteen species were found during studies of areas damaged by the gale in 2017. Some recorded fungi (for example *Hypocrea aurantiopurpurea*, *Mollisia cfr. olivaceocinerea*, and *Ramaria fennica var. fumigata*) are rare in Poland, having hitherto been mentioned in single localities. Four species (*Cortinarius subcompar*, *Hyaloscypha quercicola*, *Hypocrea tremelloides*, and *Trechispora aff. invisita*) have not been reported previously in Poland. The current number of macromycete taxa identified in KNP is 1,654 (1,425 Basidiomycota and 229 Ascomycota). Detailed results and analyses of the succession of fungal biota in wind-damaged areas will be presented in a separate publication.

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