

New Records of Peniophora Species (Basidiomycota) for the Bulgarian Mycota

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Abstract. This study provides new data for two corticioid species of genus *Peniophora* Cooke for the Bulgarian mycota, *P. piceae* and *P. pini* as wood-decaying saprobes, causing a white rot in coniferous wood. These fungal species have restricted range that follow the spread of the coniferous hosts. *P. piceae* is known only as saprotroph on dead spruce wood while *P. pini* prefers dead wood of pine. The work includes information on the morphology and ecological features as well as the distribution pattern of the species in Bulgaria.

Key words: Bulgarian mycota, *Peniophora*, lignicolous fungi, white rot.

Introduction

The genus *Peniophora* Cooke is a member of the Corticiaceae sensu lato (Basidiomycota). Cooke (1879) described *Peniophora* as the first genus of corticioid fungi based on microscopic features (incrusted cystidia). *Peniophora* is a widespread genus of corticioid fungi with more than 60 species (Kirk et al., 2008).

The genus *Peniophora* includes species with a resupinate basidiome, margin adnate or loosening from the substrata, hymenial surface smooth to tuberculate, grey, violaceous, orange, red or brown, hyphal system monomitic, hyphae hyaline to brown, thin-to-thick walled with clamps in most species, few with simple-septate hyphae. Dendrohyphidia, gloecystidia and lamprocystidia present or lacking. Basidia subclavate to cylindrical, with 4-sterigmata, a basal clamp present in most species.

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Basidiospores usually large, ellipsoid, cylindrical to allantoid, smooth, thin-walled, IKI⁻, spore print pinkish to reddish (Gorjón, 2020). The species within the genus *Peniophora* cause decaying of a white rot type.

In Bulgaria, up to date, ten species of *Peniophora* have been published, as follows: *Peniophora cinerea* (Pers.) Cooke (Pilát, 1937; Hinkova, 1955; Denchev & Assyov, 2010), *P. incarnata* (Pers.) P. Karst. (Pilát, 1937; Kuthan & Kotlaba, 1989; Hinkova, 1955; Bencheva, 2006; Denchev et al., 2006; Denchev & Assyov, 2010; Gospodinov et al., 2018), *P. laeta* (Fr.) Donk (Kuthan & Kotlaba, 1989; Denchev & Assyov, 2010), *P. lycii* (Pers.) Höhn. & Litsch. (Kuthan & Kotlaba, 1981, 1989; Gyosheva, 1997; Bencheva, 2006; Denchev & Assyov, 2010; Gyosheva et al., 2016; Gospodinov et al., 2018); *P. nuda* (Fr.) Bres. (Kuthan & Kotlaba, 1989; Denchev &

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Assyov, 2010; Gospodinov et al., 2018), *P. pilatiana* Pouzar & Svrček (Kuthan & Kotlaba, 1981, 1989; Denchev & Assyov, 2010); *P. pini* (Schleich.) Boidin (Gyosheva & Stoykov, 2019); *P. quercina* (Pers.) Cooke (Kuthan & Kotlaba, 1981, 1989; Pencheva et al., 2009; Denchev & Assyov, 2010; Stoyneva & Uzunov, 2015; Gyosheva et al., 2016; Gospodinov et al., 2018; Lacheva, 2018); *P. rufa* (Fr.) Boidin (Denchev et al., 2007; Denchev & Assyov, 2010) and *P. violaceolivida* (Sommerf.) Masee (Kuthan & Kotlaba, 1989; Denchev & Assyov, 2010).

In addition, two other new species, *P. meridionalis* Boidin and *P. junipericola* J. Erikss. have been found recently (Lambevsk-Hristova et al., 2020), whereby the number of the *Peniophora* species for the

Bulgarian Mycota becomes 12. During field investigations related to the study of coniferous communities in the ecological network NATURA 2000, two more species of the genus have been identified. *P. piceae* (Pers.) J. Erikss. has been recorded for the first time for the Bulgarian mycota while *P. pini* (Schleich.) Boidin has been earlier reported from Bulgaria only once (Gyosheva & Stoykov, 2019).

This article aims to add new data to the knowledge about the diversity of the genus *Peniophora* in Bulgaria. The purpose of this study is to report the first descriptions of two species, *P. piceae* and *P. pini* for the Bulgarian mycota and to provide information about their morphological and ecological characteristics and distribution in the country (Fig. 1).

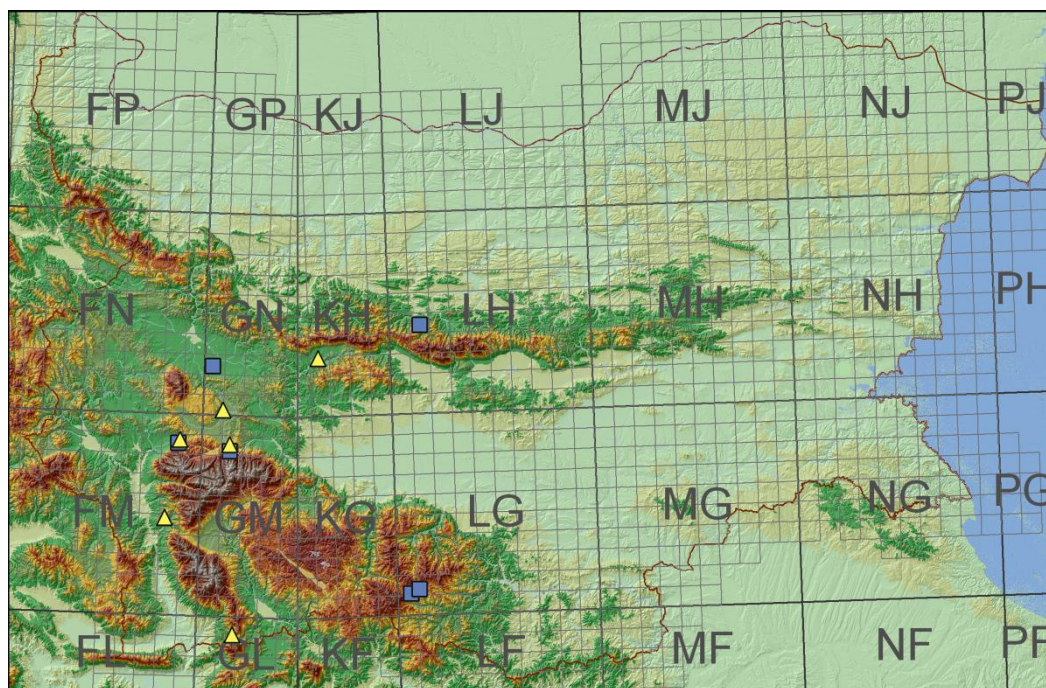


Fig. 1. A distribution map of *P. piceae* (blue square) and *P. pini* (yellow triangle) in Bulgaria.

Material and Methods

The field studies were conducted during the period 2015-2021 in different parts of the country. For identification of the lignicolous fungi, standard methods were applied, implying microscopy and application of reagents (Melzer's reagent

and 5% KOH). Measurements and photographs were examined at magnification up to 1000×, with a LW scientific microscope and MiniVID camera. The specimens were identified by the following sources: Eriksson et al. (1978); Jülich (1984); Breitenbach & Kränzlin (1986);

Hansen & Knudsen (1997); Bernicchia & Gorjón (2010); Yurchenko (2010). The abbreviations of the authors of fungal names follow Kirk & Ansell (2004). The studied specimens were deposited in the Mycological Collection of the Institute of Biodiversity and Ecosystem Research, within the Bulgarian Academy of Sciences (SOMF).

Results and Discussion

1. *Peniophora piceae* (Pers.) J. Erikss., Symb. Bot. upsal. 10(5): 49 (1950).

Bas.: *Thelephora piceae* Pers., Mycol. Eur. (Erlanga) 1: 123 (1822).

Morphological description. Basidiome resupinate, effused, adnate, but margin loosening from the substratum, hymenophore smooth or tuberculate,

reddish grey to grey to dark violaceous grey, margin whitish, hyphal system monomitic, hyphae with clamps, basal hyphae brown, thick-walled, 3-4 μm wide, subhymenial hyphae hyaline to brown, thin-to-thick walled, 2.5-4 μm wide, lamprocystidia hyaline to brown, encrusted, 40-80 x 6-18 μm , basidia subcylindrical, 30-50 x 5-7 μm , with 4-sterigmata and with a basal clamp, basidiospores allantoid, 6.5-9 x 2-2.5 μm , smooth, thin-walled, hyaline (Fig. 2, A-B).

The species is very similar to *P. pithya* (Pers.) J. Erikss., which occurs on conifers, but differs in the lack of sylvocystidia and the loosening from the substratum, and with the closely related species *P. limitata* (Chaillet ex Fr.) Cooke, it differs in the size and shape of basidiospores (Eriksson et al., 1978).

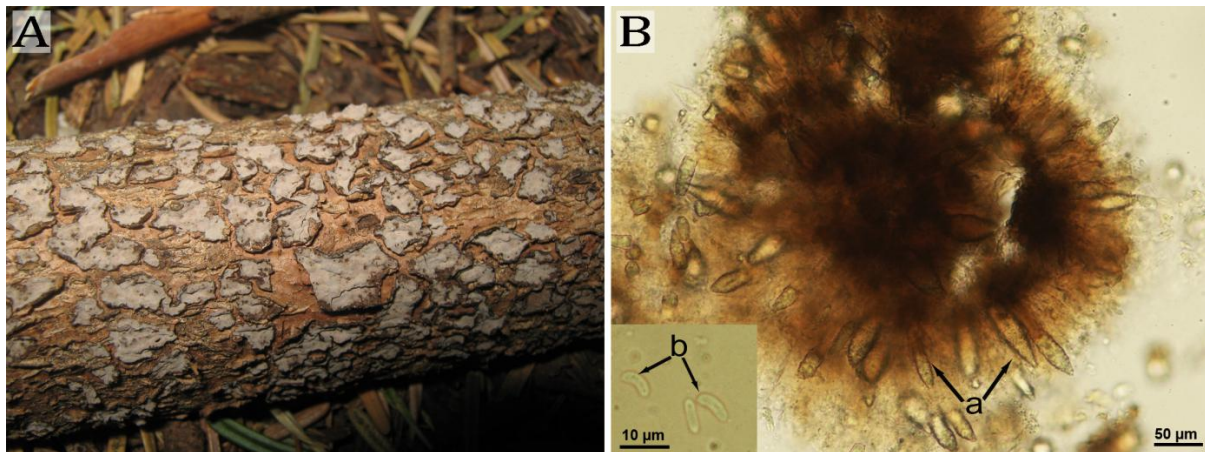


Fig. 2. A) A macroscopic view of basidiome of *P. piceae*; B) Microscopical features of *P. piceae*: section of basidiome, a) presence of numerous encrusted cystidia (lamprocystidia), b) basidiospores.

Distribution in Bulgaria. The species has been found in 4 regions of the country: Sofia region, Stara Planina Mts., Rila Mts. and Rhodopes Mt.

General distribution. The species is generally distributed in Europe, Caucasus, Asia, North America, South America (Liberta & Navas, 1978; Klán & Kotilová-Kubičková, 1982; Mukhin & Stepanova, 1983; Mukhamedshin, 1992; Boidin, 1994, Sesli & Denchev, 2005). It has not been previously reported for Bulgaria.

Ecological remarks and host. The species causes decay of a white rot type on dead wood of conifers (Lambevska et al., 2013). According to the available literature, the taxa prefers dead wood of spruce species, but it is also known from *Abies*, *Juniperus*, *Pinus*, *Thuja*, *Tsuga* and *Pseudotsuga* (Mukhin & Stepanova, 1983; Tortić, 1985; Grosse-Brauckmann, 1987; Ginns & Lefebvre, 1993; Boidin, 1994; Dämon, 2001;

Polemis et al., 2002; Bernicchia & Gorjón, 2010).

Remarks. In northern Europe, the species has been described as destructor of processed wood materials (Bondartseva et al., 1999). At the same time, it is included in the Red List of Threatened Macrofungi of Poland (Wojewoda & Ławrynowicz, 1992).

Material examined Sofia region, Park-Museum "Vrana", in mixed forest of white pine (*P. sylvestris*) and *Abies* sp., on fallen branches of coniferous tree, N 42.63808° E 23.43195°, 574 m, 04.04.2018, leg. A. Lambevskaja-Hristova, G. Hristov, det. A. Lambevskaja-Hristova (SOMF 30 282); Stara Planina Mts., 2 km S of Stoynovskoto village, hydroelectric power station (VEC) Cherni Osam, in coniferous forest (*P. nigra*, *Abies* sp. and *Picea* sp.), on fallen branches of a coniferous tree, N 42.80382° E 24.77489°, 623 m, 24.02.2018, leg. A. Lambevskaja-Hristova, G. Hristov, det. A. Lambevskaja-Hristova (SOMF 30 283); Rila Mts., 5.5 km S of Beli Iskar village, coniferous forest, on a fallen cut trunk of *P. abies*, N 42.22783° E 23.54761°, 1 305 m, 13.07.2019, leg. A. Lambevskaja-Hristova, G. Hristov, det. A. Lambevskaja-Hristova (SOMF 30 281); Panichishte village, near Panorama Hotel, in mixed forest with white pine (*P. sylvestris*) and *Abies* sp., on fallen branches of a coniferous tree, N 42.26864° E 23.29274°, 1 456 m, 09.09.2017, leg. A. Lambevskaja-Hristova, G. Hristov, det. A. Lambevskaja-Hristova (SOMF 30 280); Rhodopes Mt., Pamporovo ski resort, *P. abies* forest, on fallen branches of *P. abies*, N 41.65156° E 24.69824°, 1 566 m, 25.07.2019, leg. A. Lambevskaja-Hristova, I. Todorov & P. Boyadzhiev; det. A. Lambevskaja-Hristova (SOMF 30 279); the road to Rozhen village, in *Picea abies* forest, on fallen branches of *P. abies*, N 41.67365° E 24.73205°, 1 420 m, 25.07.2019, leg. A. Lambevskaja-Hristova, I. Todorov & P. Boyadzhiev; det. A. Lambevskaja-Hristova (SOMF 30 278).

2. *Peniophora pini* (Schleich.) Boidin, Revue Mycol., Paris 21: 123 (1956).

Bas.: *Thelephora pini* Schleich., in de Candolle & Lamarck, Fl. franç., Edn 3 (Paris) 5/6: 31 (1815).

Morphological description. Basidiome resupinate, confluent and effused, adnate, margin loosening from the substratum, hymenophore smooth to tuberculate, violaceous grey to dark bluish violaceous, hyphal system monomitic, hyphae with clamps, thin-walled, 2.5-7 µm wide, hyaline to pale brownish, more or less gelatinized, denser and vertically arranged in the subhymenium, thick-walled and swollen in the subiculum, lamprocystidia, present in the subhymenium, 25-40 × 5-8 µm, at first thin-walled, pointed or obtuse, finally strongly encrusted in the apical part, both externally and internally, encrusted part 12-20 × 5-8 µm, gloeocystidia, thin- or with distinct walls, very variable in shape and size, cesicular to cylindrical, 20-50 × 10-25 µm, with granular contents, basidia subclavate, 20-40 × 4.5-6 µm, with 4-sterigmata, and a basal clamp, basidiospores allantoid, 6-9 × 2.5-3 µm, smooth, thin-walled, hyaline (Fig. 3, A-B).

Distribution in Bulgaria. The species has been found in 4 regions of the country: Vitosha Mt. (Plana Mt.), Slavyanka Mt., Rila Mts. and Sredna Gora Mt. The species has previously been reported only once, from Rila Mts., Ibur Reserve.

General distribution. It occurs in Europe, North America and Asia (Davydkina, 1980; Jülich & Stalpers, 1980; Ginns & Lefebvre, 1993; Boidin, 1994; Hansen & Knudsen, 1997; Bernicchia & Gorjón, 2010). According to the data provided by Eriksson (1958) and Eriksson et al. (1978), it occurs in the northern taiga above the Arctic Circle and follows the distribution of pine.

Ecological remarks and host. Davydkina (1980) mentioned this species as a boreal geographical element, distributed only in the northern hemisphere, with a panboreal type of distribution. *P. pini* is considered a white rot saprobe that is apparently restricted only to dead wood of pine species.

To date, it has been known from *P. halepensis* Mill., *P. hamata* (Steven) Sosn. [non Roetzl], *P. montezumae* Lamb., *P. mugo* Turra, *P. nigra* J. F. Arnold, *P. nigra* subsp. *pallasiana* (D. Don) Holmboe, *P. peuce* Griseb., *P. pityusa* Steven,

P. strobus L., *P. sylvestris* L. and *P. wallichiana* A. B. Jacks. (Eriksson et al., 1978; Tortić, 1985; Breitenbach & Kränzlin, 1986; Renvall, 1995; Dämon et al., 2009; Yurchenko, 2010; Lambevskaja-Hristova et al., 2013).

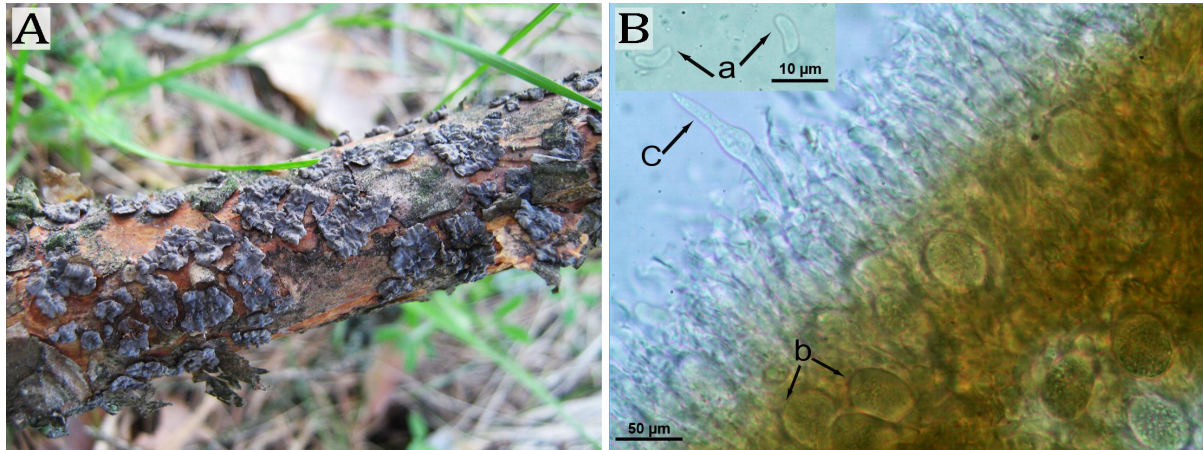


Fig. 3. A) A macroscopic view of basidiome of *P. pini*; B) Microscopical features of *P. pini*: section of basidiome, a) basidiospores, b) presence of numerous gloeocystidia with granular content, c) sulfocystidium.

Remarks. According to the data published by Domański (1976), *P. pini* occurs most commonly on fallen twigs of *Pinus sylvestris* or in a complex with pathogenic fungi *Cenangium ferruginosum* Fr. and *Valsa pini* (Alb. & Schwein.) Fr. Sometimes it manifests as necrotrophic species, and it causes necrosis of coniferous trees (Davydkina, 1980). Domański et al. (1976) consider *P. pini* as a possible agent of crown necrosis in forest communities of *Pinus sylvestris*.

Material examined Plana Mt., 1 km NW of Mechkata villa area, in *P. sylvestris* forest, on fallen branches of *P. sylvestris*, N 42.44214° E 23.52360°, 918 m, 29.04.2018, leg. A. Lambevskaja-Hristova, G. Hristov, det. A. Lambevskaja-Hristova (SOMF 30 284); Slavyanka Mt., 3 km SE of Goleshovo village, near Livade place, in mixed forest, on fallen branches of *P. nigra*, N 41.40811° E 23.60829°, 1 513 m, 19.06.2020, leg. A. Lambevskaja-Hristova, S. Lukanov; det. A. Lambevskaja-Hristova (SOMF 30 285); Rila Mts., 3.6 km S of Beli Iskar village, in mixed

coniferous forest, on fallen branches of *P. sylvestris*, N 42.241916° E 23.542250°, 1 232 m, 13.07.2019, leg. A. Lambevskaja-Hristova, G. Hristov, det. A. Lambevskaja-Hristova (SOMF 30 288); above Gorno Harsovo village, in mixed forest, on fallen branches of *P. sylvestris*, N 42.02510° E 23.16348°, 732 m, 10.09.2021, leg. G. Hristov, det. A. Lambevskaja-Hristova (SOMF 30 277); Panichishte village, near Panorama Hotel, in mixed forest of white pine (*P. sylvestris*) and *Abies* sp., on fallen branches of *P. sylvestris*, N 42.26864° E 23.29274°, 1 456 m, 09.09.2017, leg. A. Lambevskaja-Hristova, G. Hristov, det. A. Lambevskaja-Hristova (SOMF 30 287); Sredna Gora Mt., 2 km SW of Koprivshtitsa town, in coniferous forest, on fallen branches of coniferous trees, N 42.62812° E 24.33837°, 1 316 m, 25.04.2015, leg. A. Lambevskaja-Hristova, G. Hristov, det. A. Lambevskaja-Hristova (SOMF 30 286).

In conclusion, it can be noted that the present work contributes to the knowledge of the diversity of the genus *Peniophora* in Bulgaria. However, given that the diversity

in this group in Bulgaria has not yet been fully explored, the finding of new taxa is not surprising.

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