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## NOTEWORTHY POLYPORES OF PUSHKIN CITY NEAR THE SAINT PETERSBURG (RUSSIA), THE RESERVE OF OLD-GROWTH TREES.

### 1. *TRAMETES SUAVEOLENS*

#### SUMMARY

The paper opens a series focused on noteworthy polypores associated presumable with old-growth broadleaf trees in the Pushkin (Tsarskoye Selo) ensemble near St. Petersburg. Some nemoral species complexes are reserved here due to protection of old-growth trees over this area. The species in focus of the present paper is *Trametes suaveolens* (Polyporaceae, Agaricomycetes), the species with rather uneven taxonomical history. The basionym initially was applied to another fragrant polypore, and its nomenclature was stabilized rather recently, after its neotypification. This is a rare species associated presumable with large willow trees. In some countries (Britain, Montenegro, Finland, Estonia, some regions of Russia) this species is protected. Four habitats of this protected on St. Petersburg species were revealed in the Pushkin city. All these are documented and an enlarged morphological and ecological description of *T. suaveolens* is given. A new form *T. suaveolens* f. *dorsalis* was described.

**Keywords:** Polyporaceae, polypores, trametoid fungi, parks, old-growing trees, Tsarskoye Selo park ensemble.

#### INTRODUCTION

The opened series is focused on polypores, associated presumably with old-growth nemoral trees. Such trees are very rare in natural forests of Europe, because of maintaining here the strained forest management. Paradox enough, on some sites of city landscapes (e.g. parks, cemeteries, historical ensembles) there were prerequisites for preservation of old broadleaf trees exemplars. It is known also that during its aging the tree forms an expanding realm of niches, free for settling by various organisms, including the fungi. Noteworthy species of polypores, avoiding of oligotrophic habitats or presented there by leptosomic ecades, can reproduce self-population in association with an old broadleaf trees.

The Pushkin city (known also under name Tsarskoye Selo, Russia) represents a mosaic urban-parks landscape merged into trained hills on edge of the Izhora Plateau near the Saint Petersburg city. As the area of major tourist attraction the Tsarskoye Selo landscape ensemble was included in the list of monuments protected by the UNESCO. The *Picea abies* (L.) Karst. containing

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boreo-nemoral forests characteristic to this intra-zonal Izhora Vegetation Rayon (Alexandrova, Yurkovskaya, 1989) were cut, some additional drying works were carried out and this territory became comparable with those of Central European cities in their environmental plane. The Catherine Park was founded in 1750s, surrounding tree-stands were formed in 1800–1910s and rather wide range of broadleaf trees of the Pushkin parks has endured a bicentennial age. The main stand-formers here are *Quercus robur* L., *Acer platanoides* L. *Fraxinus excelsior* L. and *Tilia cordata* Mill. – all these represent native element of cutted *Picea abies*-boreo-nemoral forests once widespread here. Also, two trees-formed willow species, *Salix alba* L. and *S. fragilis* L. as well as *Alnus incana* (L.) Moench and *A. glutinosa* (L.) Gaertn. were distributed here along the rivers. Additionally, *Tilia platyphyllos* Scop., *Aesculus hippocastanum* L., *Acer rubrum* L. were introduced into park and roadside landings. A lot of nemoral and boreo-nemoral shrubs were landed under bed curtains of the main stand-formers. Within them, *Padus avium* Mill., *Sorbus aucuparia* L., *Malus* spp., *Crataegus* spp., *Acer negundo* L., *Caragana arborescens* Lam., *Corylus avellana* (L.) Karst., *Prunus domestica* L., *Frangula alnus* Mill., *Amelanchier* sp., *Cotoneaster lucidus* Schltld. are predominant.

The main purpose of this series is enlarged description of ecological polymorphism of noteworthy polypores species founded in Pushkin city (Tsarskoye Selo) territory and documentation of habitats of these organisms.

The fragrant bracket fungus, *Trametes suaveolens*, which opens of the present series, in its current interpretation was described by Fries (1821), whereas its nomenclatural history seems to be uneven. Linnaeus established *Boletus suaveolens* L. (Linnaeus, 1753) with a short diagnosis (“*Boletus acaulis, superne laevis, salicinus*”), habitat information (“Habitat in *Salice*”), and a reference to his polynomial “*Boletus acaulis, superne laevis, salici insidens*” (Linnaeus, 1737) with such characteristic as “*Rarius occurrit hic in salicibus et odore suavissimoque pollet*”. Fries made the new combination *Polyporus suaveolens* (L. : Fr.) Fr. (Fries, 1821), but applied this name to another species, which was characterized as “*Pileo carnoso-suberoso azono villosa albo, poris majusculis fuscentibus. Odor gratus, aniseus. Pileus subsolarius, crassus, azonatus, 2–4 unc. latus. Pori obtusi, opaci, in superficie plana rotundi aequales, in declivi inaequales*”. Indeed, there are two salicicolous species of trametoid habit, one of them (*Boletus suaveolens* sensu L.) is characterized by even naked (“*superne laevis*”) pale pilei and strong (“*suavissimus*”) odor, another one characterized by white tomentose (“*villosa albo*”) pilei and not strong anise (“*gratus*”) odor. The differences between these diverse species are given, for example, by Ryvarden and Melo (2014), where the names used were *Haploporus odoratus* (Fr.) Bondartsev & Singer and *Trametes suaveolens* (L. : Fr.) Fr., respectively.

Later, Fries (1837) described the genus *Trametes* typified by *Polyporus suaveolens* (L. : Fr.) Fr. (Murrill, 1905) and this genus is widely accepted nowadays (Zmitrovich & Malysheva, 2013). However, the Linnaean name *Boletus suaveolens* L. was misapplied to type species of *Trametes* in Friesian

sense and some authors beginning with Donk use the combination *Haploporus suaveolens* (L. : Fr.) Donk in application to the type species of *Haploporus*, but not *Trametes* (Donk, 1971). The consequent sanctioned and correctly applied synonym which substitutes an ambiguous *Trametes*-type would be *Boletus discoideus* Dicks. ("Acaulis planiusculus villosus rugoso-tuberculosus sordide albens poris labyrinthiformibus concoloribus. Nequaquam convenit cum *B. suaveolente* Linn., qui pulvinatus, superficie laevi, nec rugosa aut villosa; poris rotundatis, nec labyrinthiformibus". Cited according to J. Dickson, 1793). It was sanctioned by Fries in Index (1832, p. 57). The corresponding combination *Trametes discoideus* (Dicks. : Fr.) Rauschert was made by Rauschert (1990). However, in 1991 the name *Boletus suaveolens* L. : Fr. was neotypified by Ryvar den (1991), who has selected the specimen from Sweden (Upland, Uppsala, *van der Post* 1872, S) corresponded to *Trametes suaveolens* as neotype. Because the general principle of Nomenclatural Committee was to minimize – and indeed if possible prevent – name changes arising from the change of starting date, which is why names can be typified either on an element in the context of the original protologue or an element in the context of the sanctioning treatment, the Ryvar den's selection in this case was as something best decision (Art. 9.2 and 9.10 of ICBN, Prof. J. McNiell, pers. comm.).

In all the parts of Europe this is rather infrequent species gravitating in its distribution to large and presumably live *Salicaceae* trees. This species is included in a series of European Red lists (Kotiranta & Niemelä, 1996; Evans et al., 2006; Kasom & Miličković, 2006; Parmasto, 2009). In Russia, this species was entered in Red book of Leningrad Region (2000) and Red book of Saint Petersburg (2004). Our research on Pushkin area allows to reveal some populations of this interesting fungus.

## MATERIALS AND METHODS

**Territory studied.** The Tsarskoye Selo (Pushkin) city occupied hilly landscape on border of the Prinevsky Lowland and the Izhora Plateau in 15 kilometers to the south of the St. Petersburg on approx. 59.75°N and 30.36°E crosshairs. The highest areas lie here about 100 m above Sea level. Park zone of the Pushkin (Tsarskoye Selo) ensemble keeps within the area of 704 hectares.

**Material collection.** A total of thirty kilometer quarters were subject to monitoring since 2012. Old-growth leaf-trees phytosphere was examined regarding existence of the polypore species. The fruitbodies were fixed on photo or collected in the case of necessity and an existence of sufficient for reproduction quantity of a remained propagative structures of the fungus. In laboratory, – 20 °C followed by freezing of material were carried out. The material is kept in mycological herbarium of the Komarov Botanical Institute of the Russian Academy of Sciences (LE).

**Material elaboration.** The macroscopic descriptions were based on a study of fresh and dried specimens. Microscopic preparations were mounted from dried material in Melzer's solution, 10% ammoniacal Congo Red and 5%

aqueous solution of KOH, using a LOMO Micmed-6 light microscope. The hyphal system was revealed and described according to updated technique (Zmitrovich et al., 2009). The size of mature spores was measured on 30 spores in distilled water and Melzer's solution. The taxonomic position of the species was based on recent molecular studies (Zmitrovich, Malysheva, 2013; Zmitrovich, Kovalenko, 2015), higher taxa are given according to Hibbett et al. (2014).

## RESULTS AND DISCUSSION

### Agaricomycetes

#### Polyporales

#### *Polyporaceae*

*Trametes suaveolens* (L. : Fr.) Fr., Epicr.: 491, 1838. – Bas.: *Boletus suaveolens* L., Sp. Pl.: 1177, 1753 ex Fr., Syst. Mycol. 1: 366, 1821 [ut *Polyporus suaveolens* L. sensu Fr. nec L. (= *Polyporus odorus* Sommerf., 1826)]<sup>2</sup>. ≡ *Haploporus suaveolens* (L. : Fr.) Donk, Prok. K. Ned. Akad. Wet. Ser. C 74(1): 20, 1971<sup>3</sup>. – Syn.: *Boletus suberosus* Bolton, Hist. Fung. Append. 3: 162, 1792. – *B. discoideus* Dicks., Fasc. Pl. Crypt. Brit. 3: 21, 1793 sanct. Fr., Index: 57, 1832 [≡ *Trametes discoidea* (Dicks.) Rauschert, Feddes Rep. 101: 643, 1990]. – *Daedalea bulliardii* Fr., Syst. Mycol. 1: 335, 1821. – *Trametes inodora* Fr., Epicr.: 491, 1838. – *Polyporus itoi* Lloyd, Mycol. Writ. 7: 1274, 1924.

Icon.: Bulliard (1787: pl. 310, Fig. A); Sowerby (1799: tab. 288 ut *Boletus suaveolens*); Niemelä (2005: p. 266, Fig. 281); Melo & Ryvarden (2014: p. 419, fig. 323).

Basidiomata annual or perennial, sessile, of trametoid habit, 4–15 cm wide and 2–4 cm thick, triquetrous to cushion-like in section, semicircular in outline, pilei plane or slightly convex; as a rule clustered, but in normal not decurrent and devoid of stipe. Upperside without a differentiated subpellis, subtomentose, villose, of fine bristly, more or less even, but in some specimens scrupose, uniformly white, then cream, then grayish-bloom. Context purely white, rather dense, suberose, homogeneous, with prominent anise odor when fresh, up to 3 cm thick. Margin initially obtuse or bolster-like, then acute, with sterile zone around the hymenophore, in abhymenial surface cream or with grayish shades. Hymenophore as a single tube layer up to 10 mm thick, white to honey-colored or isabelline. Pores normally 0.5–1.5 mm in diam., but in average 1–2 per mm, with thick dissepiments, angular, sinuose in some regions, white, cream to light-coffee, or in some specimens near dissepiments initially becoming grayish-brown (Fig. 1a).

Hyphal system dimitic with sympodially branched sclerohyphae. Generative hyphae 3–5.5 µm in diam., clamped, thin-walled, rarely branched. Sclerohyphae

<sup>2</sup> Neotypus (vide Ryvarden in Syn. Fungorum 5: 230, 1991): Sweden, Upland, Uppsala, van der Post 1872 (S).

<sup>3</sup> Nomenclatural, but not taxonomical synonymy.

2.5–8.5  $\mu\text{m}$  in diam., thick-walled to subsolid, hyaline, acyanophilic, inamyloid; the branching pattern sympodial, moderate in internal tissues and regular near surfaces, mostly rectangular. Basidia 20–30  $\times$  5–7.5  $\mu\text{m}$ , clavate, 4-spored, with a basal clamp. Cystidia none, but hyphal pegs composed by generative hyphae are regular in the hymenium. Basidiospores 7.5–12.5  $\times$  (3)4–4.7  $\mu\text{m}$ , short-cylindrical, in certain projections lacrymoid or amygdaloid, hyaline, thin-walled, inamyloid, acyanophilous.



Figure 1. Typical form of *Trametes suaveolens* growing on *Salix fragilis* (protected population, 59°43'46"N, 30°25'08"E): *a* – basidiome of current season; *b* – wintered basidiome. Scale bar – 1 cm.

**Substrata and ecology.** *T. suaveolens* grows on living, rarely dry trees, stumps and fallen logs of *Salix* spp. In other parts of Europe the fungus is reported also on *Populus*, *Aesculus*, *Alnus*, *Betula*, *Carpinus*, *Fagus*, *Fraxinus*, *Malus*, *Populus*, *Quercus*, *Salix*, *Tilia*, and *Ulmus* (Ryvarden & Melo, 2014). Causes a white heart-rot.



Figure 2. Typical habitats of *Trametes suaveolens* in the Pushkin city (59°43'46"N, 30°24'22"E). Fruit bodies area is highlighted.

Basidiomata of *T. suaveolens* usually exist during a single season, but even in the boreal zone some fungi which colonize slantwise growing willows over river falls can develop wintering basidiomata capable to resume their active growth after warming. In this case fruit bodies can reach rather sufficient sizes.

The most typical habitat of this fungus is presented by floodlands along rivers where arboriform willows are growing (Fig. 2). In urban landscapes, *T. suaveolens* is associated as a rule with old willows trees.

**Distribution.** EUROPE: United Kingdom, Norway, Germany, Italy, Georgia, Finland, Russia. ASIA: Russia, Mongolia, Taiwan, China, S. Korea, Japan. NORTH AMERICA: USA, Canada (Global., 2016).

Table. Records of *Trametes suaveolens* on the Pushkin city (Tsarskoye Selo) territory

N	Coordinates	Locality, habitat	Substrate	Specimen
1.	59°44'42"N, 30°24'19"E	Bufferny Park valley of Kuzminka river	<i>Salix fragilis</i>	<i>T. suaveolens</i> f. <i>griseopora</i> (LE 287618)
2.	59°43'46"N, 30°24'22"E	Bufferny Park valley of Kuzminka river	<i>Salix fragilis</i>	<i>T. suaveolens</i> f. <i>dorsalis</i> (LE 287619)
3.	59°43'46"N, 30°25'08"E	Detskoslensky parkway, public garden	<i>Salix fragilis</i>	–
4.	59°42'09"N, 30°24'08"E	Novaya str., public garden	<i>Salix fragilis</i>	–

The distribution of this species over Pushkin (Tsarskoye Selo) territory is rather scarce. Only 4 habitats are revealing (Table), and only two deviated specimens were collected, since the populations of *T. suaveolens* are protected on Saint Petersburg territory (see also Fig. 2, 3).



Figure 3. Pushkin city quarter plan with indications of habitats of *Trametes suaveolens* (red circles). The numbers are corresponded to those in Table.



**Morphological variability.** In a field, the fungus can be recognized due to its rather large basidiomata with plane to convex subtomentose to villose pilei of uniform coloration. Cap zonation or radial color alterations are not characteristic for this species. Only near the margin some grayish shades can be observed in some representatives. The upperside relief normally even, but some obscure ridges or pimples can be expressed, especially when the basidiomes are merged into plant sprouts around basic trunk. The wintering basidiomata bear as a rule stramineous upperside and honey-colored tubes (Fig. 1b). Microscopically, this is rather invariable species, characterized by large basidia and basidiospores. Vegetative hyphae are typical for *Trametes* species. The hyphal system containing both weakly and strongly branched sclerohyphae was described as trimitic (e.g. Ryvarden & Gilbertson, 1993, 1994), but in a reality the binding hyphae represent an apical branches of skeletal dendrites merely, therefore we deal with a kind of dimiticism (Zmitrovich & Malysheva, 2013).

Three forms are known for this species – f. *inodora* Fr. in Pilát, characterized by absence of any odor, f. *gibbosiformis* Nikol. in Bondartsev, characterized by smaller pores 2–2.5 per mm, f. *griseopora* Komarova, characterized by gray-coffea shades already in young tubes of the fungus, and f. *dorsalis* ined., characterized by dorsally attached basidiomes with narrow reflexed border. Within aforementioned forms, two last ones were registered in Tsarskoye Selo together with type form and they will be characterized below.

*Trametes suaveolens* forma *griseopora* Komarova, Notulae Systematicae e Sectione Cryptogamica Instituti Botanici nomine V. L. Komarovii Academiae Scientiarum URSS 12: 256–257, 1959.

Icon.: Komarova (1959: p. 256, Fig. 8).

«Basidiomata 2–3.5 × 3–6 × 1–2 cm, with convex milky-white, then yellowish upperside, obtuse margin and snow-white context with slight anise odor. Tubes thin-walled, with gray shades at the margin. Pores roundish-angular, 0.25–0.6 mm in diam., usually 2–3 per mm. The surface of hymenophore varies from light- to intensive mouse-gray, something with brownish tinge. Contextual hyphae of two types: 1) thick-walled to subsolid, rarely branched, 2–6 µm in diam., and 2) thinner-walled, 3–10 µm in diam. Basidia 20–25 × 4.5–6.5 µm, with sterigmata 4–6.5 µm long. Spores hyaline, cylindrical, with prominent base, 7–10.5 × 3–3.5 µm. Found in Minsk Region (Borisovsky district, Borovlyany) on aspen fallen log. October 1954. [without an indication of type specimens attributes – I. Z.]. The form described differs from the type one by mouse-gray hymenophoral surface and smaller pores».

Ann additional material was founded by us in the Pushkin vicinities growing on living willow tree on valley of the Kuzminka river. A short description of additional material follows.

Basidiome consists of two clustered and merged pilei with very obtuse margin, 8.5 × 6.2 × 1–5.5 cm, with decurrent base. Upperside tomentose, white to creamish near the margin, even. Hymenophoral side of the margin is uneven, slightly scrupose and obscurely porose, but mostly sterile, white of milk coffee

colored. Context purely white, with anise odor, thick. Pores anisodiametric, 2–3 per mm on internal and 1–2 per mm on marginal parts, more or less thick-walled, on decurrent part lacerate, combining whitish, milky coffee, mouse-gray and cinnamon coloration (Fig. 4).

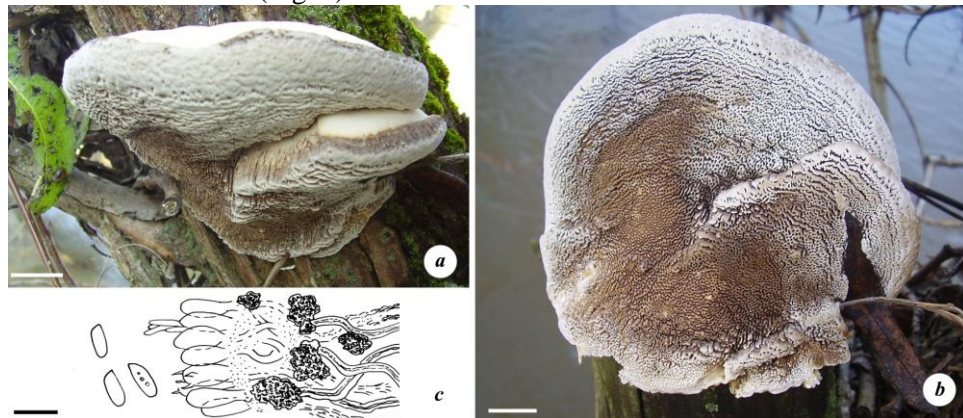


Figure 4. *Trametes suaveolens* f. *griseopora* (LE 287618): *a* – general view, *b* – hymenophore (scale bar – 1 cm), *c* – encrusted subhymenium and hymenium with basidiospores (scale bar – 10 µm).



Figure 5. *Trametes suaveolens* f. *dorsalis* (LE 287619): *a* – hymenophore, *b* – cross-sections of basidiome (yellow lines bordering area of substrate attachment). Scale bar – 1 cm.

Generative hyphae 3–5.3 µm in diam., sclerohyphae 2.5–8(9) µm in diam., varying as in a neutral type, but in subhymenium strongly gelatinized and covered with abundant chrysescent resinous-crystalline matter. Basidia 20–28 × 5–7.5 µm. Basidiospores 7.0–11.5 × 3–4.5 µm.



Specimen examined: Russia, Saint Petersburg, Pushkin (Tsarskoye Selo), Bufferny Park valley of Kuzminka river, 59°44'42"N, 30°24'19"E, coll. & det. I.V. Zmitrovich 15.09.2014 (LE 287618).

*Trametes suaveolens* forma *dorsalis* Zmitr. forma nova (MB 817131).

Basidiome as dorsally attached roundish patch 5.5 × 4.5 × 1.7 cm with pileus-like border up to 0.7 cm wide. Upperside subtomentose to hispid, cream, even. Context up to 0.7 cm thick, purely white, with anise odor. Pores anisodiametric, 2–3 per mm, more or less thin-walled, honey-colored, with rufescent margin (Fig. 5).

Generative hyphae 2.5–5.5 µm in diam., sclerohyphae 2.5–8.5 µm in diam., varying as in a neutral type. Basidia 22.5–28.5 × 5–7.5 µm. Basidiospores 7.1–12.0 × 3.5–4.5 µm.

Specimen examined: Russia, Saint Petersburg, Pushkin (Tsarskoye Selo), Bufferny Park valley of Kuzminka river, 59°43'46"N, 30°24'22"E, coll. & det. I.V. Zmitrovich 25.04.2016 (LE 287619).

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