The Meruliaceae of Russia. II. Panus

I. V. Zmitrovich1, M. A. Bondartseva1, L. G. Perevedentseva2, A. G. Myasnikov3, A. E. Kovalenko3

1 Komarov Botanical Institute, BIN RAS, Prof. Popov str., 2, St. Petersburg, 197376, Russia. E-mail: IZmitrovich@binran.ru
2 Perm State National Research University, PGNIU, Bukireva str., 15, Perm, 614990, Russia
3 Moscow State University of Civil Engineering, MSSU, Yaroslavskoe shosse, 26, Moscow, 129337, Russia

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Summary. The history of taxonomical study of the genus Panus Fr. (Meruliaceae, Polyporales, Basidiomycota) is considered. A current revision of the genus in Russia was carried out. Two species of the genus Panus were recorded in various regions of Russia, Panus conchatus (Bull.) Fr. and P. lecomtei (Fr.) Corner. For P. conchatus, the lateral ectotype with conchiform pileus and rather dark wine-red to lilac-brown surface is more characteristic. Two main deviations from such a neutral type were described: 1) the chromatic one, characterized by light-colored (red or clay-yellow), usually conchiform pilei [P. conchatus var. inconstans (Pers.) Zmitr., Bondartseva, Perevedentseva, Myasnikov et Kovalenko] and 2) the growth one, characterized by a central (often bulbous) stipe, funnel-shaped cap and strongly inrolled margin [P. conchatus var. torulosus (Pers.) Zmitr., Bondartseva, Perevedentseva, Myasnikov et Kovalenko]. For P. lecomtei, the ectotype having small eccentric to lateral elegant stipe is considered. However, the stipe shape and size are variable. The stipe can be either central – rather small, with a bulbous base [P. lecomtei var. semirudis (Singer) Zmitr., Bondartseva, Perevedentseva, Myasnikov et Kovalenko], or strongly elongated [P. lecomtei var. stipitata (Malk.) Zmitr., Bondartseva, Perevedentseva, Myasnikov et Kovalenko]. Four new combinations, P. conchatus var. inconstans, P. conchatus var. torulosus, P. lecomtei var. semirudis, and P. lecomtei var. stipitata were suggested. It was concluded that Panus represents rather well-delimited genus belonging to merulioid phylogenetic radiation, whose morphotype on essential features of its organization is trametoid, but superficial habitual features make it closer to the lentoid one. Its essential features are the abundance of fibrohyphae which form textura intricata, slowly growing basidiocarps and strictly lamellate hymenophore. Apparently, such an adaptive structure was generated at arid and warm climatic zones, and only 2 species, P. conchatus, and P. lecomtei, have been irradiated into temperate latitudes. The substrate spectrum of these fungi is determined by their insensitivity to substrate moistening and best ability to colonize hardwood, so the greatest number of their finds can be made on stumps and large remnants of stand-formers of corresponding forest areas. In Russia, a reliable association of Panus species to Betula spp. and Populus spp. was revealed. An ecotypic differentiation of the genus Panus is related to the quality of substrate colonized. The basidiocarps, growing over top cuts of the stumps, are characterized by strong central stipe (P. conchatus var. torulosus, P. lecomtei var. semirudis), whereas basidiocarps with sublateral attachment are common on fallen logs. Certain chromatic adaptations (P. conchatus var. inconstans) are associated with an insolation regime of the habitat. During last years, the Panus representatives have attracted an interest in biomedical research development. Their resource potential estimation should proceed from the fact that within Russian territory, such areas as Middle Belt of European Russia, North Caucasus, Altai and other regions of Southern Siberia are promising for replenishing the strains of P. conchatus and P. lecomtei.

Мерулиевые грибы России. II. Род Panus

И. В. Змитрович1, М. А. Бондарцева1, Л. Г. Переведенцева2, А. Г. Мясников3, А. Е. Коваленко3

1 Ботанический институт им. В. Л. Комарова, БИН РАН, ул. Проф. Полова, 2, г. Санкт-Петербург, 197376, Россия
2 Пермский государственный национальный исследовательский университет, ПГНИУ, ул. Букирева, 15, г. Пермь, 614990, Россия
3 Московский государственный строительный университет, МГСУ, Ярославское шоссе, д. 26, г. Москва, 129337, Россия

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Аннотация. Рассмотрены этапы таксономического изучения рода Panus Fr. (Meruliaceae, Polyporales, Basidiomycota). Проведена ревизия видов, известных для России. Изучены материалы Гербариев Ботанического института им. В. Л. Комарова (LE) и Пермского государственного национального исследовательского университета (PERM). Впервые обобщены литературные и гербарные данные о внутритипическом полиформизме бореальных таксонов рода. Согласно имеющимся гербарным и литературным данным, на территории России зафиксировано 2 вида рода Panus — Panus conchatus (Bull.) Fr. и P. lecomtei (Fr.) Corner. Для P. conchatus наиболее характерен латеральный экотип с раковинообразной шляпкой и довольно темной лиофильно-коричневой поверхностью. Были описаны два основных отклонения от такого модального типа: 1) хроматическое, характеризующееся светло-красными (красными или глиняно-желтыми) шляпками [P. conchatus var. inconstans (Pers.) Zmitr., Bondartseva, Perevedentseva, Myasnikov et Kovalenko] и 2) ростовое, характеризующееся центральной (часто бульбовидно вздутой) ножкой, воронковидной шляпкой и сильно подогнутым краем [P. conchatus var. torulosus (Pers.) Zmitr., Bondartseva, Perevedentseva, Myasnikov et Kovalenko]. Для P. lecomtei наиболее характерным экотипом является латеральный, с небольшой ножкой. Встречаются экотипы со вздутой центральной [P. lecomtei var. semiridis (Singer) Zmitr., Bondartseva, Perevedentseva, Myasnikov et Kovalenko], либо сильно удлиненной латеральной ножкой (P. lecomtei var. stipitata). Для перечисленных разновидностей было предложено 4 новых комбинаций [P. conchatus var. inconstans, P. conchatus var. torulosus, P. lecomtei var. semiridis, P. lecomtei var. stipitata Malk.]. Проведенные исследования позволяют характеризовать Panus как хорошо ограниченный род, относящийся к мерулионидной филогенетической радиации, морфотип которого в основе траметоидный, но несущий поверхностные черты лентиноидных грибов. Его существенными особенностями являются обилье фибригил, образующих «перепутанную текстуру» ткани, медленно растущие базидиомы и строго пластинчатый гименофор. По-видимому, такая адаптивная структура была выработана изначально в условиях теплого засушливого климата, и лишь 2 вида (P. conchatus и P. lecomtei) позднее приспособились к обитанию в умеренных широтах. Субстратный спектр этих грибов определяется их нечувствительностью к обводненности субстрата и лучшей способностью к колонизации древесины лиственных пород, поэтому наибольшее количество их находок можно сделать на пнях и крупных остатках основных лесообразующих пород лесов умеренных и теплых широт. Гербариев материал с территории России собран с пней и валежной древесины из родов Betula и Populus. Экотипическая дифференциация рода Panus связана с особенностями колонизированного субстрата. Базидиомы, появляющиеся снизу пней, характеризуются обычно крепкой центральной ножкой (P. conchatus var. torulosus, P. lecomtei var. semiridis), в то время как на боковых поверхностях валежных стволов развиваются латерально прикрепленные экотипы со слабо развитой ножкой. Оценка ресурсного потенциала представителей этого рода в пределах России должна исходить из наибольшей распространенности P. conchatus и P. lecomtei в Средней полосе России, на Северном Кавказе, Алтае и других районах Южной Сибири, где имеет смысл организовать работы по пополнению штаммового разнообразия этих видов.

Introduction

This paper continues a taxonomical survey on the genera of Meruliaceae (Polyporales, Basidiomycota) presented in Russian mycobiota (Zmitrovich et al., 2016), and it is devoted to an interesting genus Panus Fr., for a long time considering first within Pleurotaceae, later within Polyporaceae families, but in fact being closely related to the genera Cerrena and Steckerinum Gray of Hymenomycetaceae (Fries, 1838) where it was distinguished by Fries in the genus Panus and Steckerinum, as was described by Fries in «Epicrisis Systematis Mycologici seu Synopsis Hymenomycetem» (Fries, 1838) where it was characterized as follows: «Totus fungus carnoso-coriaceus, tenax, arescens, contexto fibroso. Lamellae perfectae, tenaces, firmae, inaequales, acte acuta integerrima, saxe venoso-connexae; trama distincta, fibroa in hymenium radians. Sporidia alba. Fungi epixylili, diformes laterales, diu persistens». From previously described genus Lentinus Fr. (Fries, 1825) the genus Panus was differentiated by Fries in the following way: «A Lentinus genuinus, quales omnes Europaei, lamellis tenacibus et acie integerrima max dignoscitur». Hereby, an entire gills edge in Panus representatives was established as the basic discriminant character of two genera by Fries. In total, 17 species have been distinguished by Fries in the genus Panus, while some of which cannot be correlated with existing herbarium material (below such species will be marked with an interrogation point): Panus farneus Fr. (?), P. cytinaiforinis (Schaef.) Fr. [= Neolentinus cytinaiforinis (Schaef.) Della Mag. et Trassin., P. pycnoticus (Klotzsch) Fr. (?), P. torulosus (Pers.) Fr. [= P. conchatus (Bull.) Fr.], P. rudis Fr. [= P. lecomtei (Fr.) Corner], P. velutinus (Fr.) Sacc.,
Panus hirtus Fr. (?), P. foetens Fr. (?), P. dorsalis (Bosc.) Fr. (?), P. stipticus (Bull.) Fr. [= Panellus stipticus (Bull.) P. Karst.], P. farinaceus (Schumach.) Fr. (= Panellus stipticus), P. lunatus Fr. (?), P. copulatus (Ehrenb.) Fr. [= Lentinus copulatus (Ehrenb.) Henn.], P. patellaris Fr. [= Tectella patellaris (Fr.) Murrill], P. delastri Fr. (?), P. lithophilus Fr. (?). Subsequently, the character of gills edge for differentiation Panus from Lentinus was adopted by many agaricologists.

An important episode in the Panus taxonomy is related to the works by Singer. In 1951, on the basis of complex similarities between Lentinus, Panus, and Polyporus Fr., this mycologist has united three genera with such genera as Pseudovolus Pat., Mycobonia Pat., Phyllostips E.-J. Gilbert et Donk ex Singer, and Pleurotus (Fr.) P. Kumm. in the family Polyporaceae (Singer, 1951). Considering the Lentinus lepideus (Fr.: Fr.) Fr. as type species for Lentinus (the more correct modern typification is L. crinitus L.), Singer unites all the small-spored species within the genus Panus. Thereafter he has reissued this system three times without essential changing of the concept (Singer, 1962, 1975, 1986).

Corner (1981) has differentiated the genera Lentinus and Panus on the basis of the branching pattern of skeletal hyphae which are organized as dendrites with an inflated axial element in Lentinus and stay unbranched in Panus. In 1983, Pegler has published a monograph on the genus Lentinus, which includes according to this author the Panus-union as a subgenus, but basing on Corner’s principles. Within the Lentinus subgenus there are considered species with branched and swollen sclerophyiae, whereas the Panus subgenus unites the species with fibrophyiae (Pegler, 1983).

In the period of molecular taxonomy (Ko, Jung, 1999; Grand, 2004; Larsson, 2007; Lee, Lim, 2010; Miettinen, Larsson, 2011; Zmitrovich, Malysheva, 2013) it was shown that the genus Panus sensu Corner is substantially distant from Lentinus (core Polyporaceae), but closely related to the genus Cerrena Gray (large meruloid phylogenetic radiation). Within the framework of “splitter’s approach”, even two closely related families – Cerrenaceae and Panaceae – have been described (Justo et al., 2017), although we believe that the preservation of the “large Meruliaceae” lies in canvas of more balanced classification of the Polyporales.

Distracting from macromorphology, it can be seen that Cerrena and Panus have much in common: e. g. unbranched fibrohyphae, highly characteristic sclerified elements protruding the hymenium, traditionally called as sclerocystidia or metuloids in the genus Panus, and as pseudocyistidia in the genus Cerrena, finally, rather similar basidia and basidiospores. It should be emphasized the absence of any inflated hyphal elements (characteristic feature of representatives of Lentinus and Polyporus s. l.) in all tissues of representatives of the genus Panus. This feature, as well as rather slow growth of the basidiomata with the formation of solid and often twisting stipe of textura intricata, allows to interpret Panus-like morphotype consider only superficially similar to lentinoid one. It is rather a unique adaptive structure combining true lamellate hymenophore and trametoid growth and tissues organization. Studies on hymenophore development in Panus conchatus, P. lecomtei, and P. fulvus (Hibbett et al., 1993) also confirm this conclusion.

The aim of the present paper is detailed characterization of the genus Panus in Russia, including a modern morphological elaboration, survey of intraspecies polymorphism, substrate preferences and resource potential, considering that some species of this genus are known as promising subject for biomedical research, since produce panepoxidone and isopanepoxidone, substances that has an inhibitory effect on a number of inflammatory chemokines secreted by cancer tissues (Erkel et al., 1996; Shotwell et al., 2000).

Materials and Methods

The macroscopic descriptions were based on a study of fresh and dried specimens. The materials of the herbaria of Komarov Botanical Institute (St. Petersburg, LE) and Perm State National Research University (PERM) were studied. Microscopic preparations were mounted from dried specimens 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.

Results and Discussion

Meruliaceae Rea, 1922, British Basid.: 620.
= Podoscyphaceae D. A. Reid, 1965, Beih. Nova Hedwigia 18: 43.
= Steccherinaceae Parmasto, 1968, Consp. syst. Cort.: 169.
= Bjerkanderaeaceae Jülich, 1982, Bibl. Mycol. 85: 356.
= Hapalopilaceae Jülich, 1982, Bibl. Mycol. 85: 370.
On dying and dry trees, fallen logs, stumps and large fallen branches of trees and shrubs, presumable angiosperms. Causes a white rot. Worldwide, more abundant in the tropics.

**Type species:** *Agaricus torulosus* Pers., 1801, Syn. meth. fung. 2: 475 : Fr., 1821, Syst. Mycol. 1: 181 = *A. conchatus* Bull., 1787, Herb. Fr. 7: tab. 298 : Fr., 1821, Syst. Mycol. 1: 181 (selected in Greuter et al. 2000).

Type specimen is deposited in Friesian herbarium of the Uppsala University Museum of Evolution (UPS) (Ryvarden, 1991).

**Differential generic suggestions.** The genus *Lentinus* Fr. has a superficial resemblance, but differs by skeletobinding hyphae with inflated axial segment (all the *Panus* representatives have uninflated skeletals). The genus *Lignomyces* R. H. Petersen et Zmitr. is superficially similar too, but differs by monomitic hyphal system with strongly inflated hyphal segments and a dorsal stem attachment (Petersen et al., 2015). Phylogenetically related genus *Cynamoderma* Jungh. differs by podoscyphoid habitus and the presence of ventricose hymenial gloecystidia. Phylogenetically related genus *Cerrera* differs by daedaleoid/trametoid habitus and less elongated (in median) basidiospores.

**Ecology and substrata.** All the *Panus* representatives are rather therophilic, xerotolerant and non-sensitive to substrate watercut, why they are especially often found on large logs and stumps, without allocation of strict substrate specificity. On the other hand, they have not very high enzymatic activity and are generally not adapted to deep decomposition of coniferous wood. This circumstance, as well as their attraction to large-scale tree residues, are the reasons that in zonal biomes they are most often associated to deciduous stand formers (mostly *Betula* and *Populus* in the temperate-boreal zone, and *Quercus* and *Fagus* in the nemoral zone), although they readily colonize many other trees.

**Type of rot.** All the *Panus* representatives cause a white rot. Oxidative enzymes were carefully investigated in *Panus lecomtei* and *P. conchatus* (Zhang et al., 2006; Zhou et al., 2014). It was shown that purified enzymes of these fungi belong to the laccases family, due to the following observations: 1) the enzyme exhibited a broad substrate pattern, 2) oxygen was used as an oxidative agent, while there was no H₂O₂ to initiate the catalytic oxidation, and 3) the determined N-terminal primary structure of the enzyme exhibited a high degree of similarity with the corresponding laccases sequences.
Secondary metabolites and perspectives in biomedical research. A metabolite of great application value, panepoxidone has been detected in *P. lecomtei* by Erkel group (Erkel et al., 1996). Such metabolite as isopanepoxidone has been isolated from *P. conchatus* by Shotwell et al. (2000), and this substance has a similar effect reducible to the prevention of degradation of inhibiting particles of NF-κB (IκBα) that inactivate this transcriptional factor.

NF-κB chemokine represents the main pro-inflammatory factor, constitutionally associated with cancer progression (Zmitrovich, 2015), therefore such substance as panepoxidone is a prospective subject for biomedical research, whereas the *Panus* species have a great resource value.

Also, it should be mentioned the production of pink-lilac pigment complexes by both tropical and temperate *Panus* representatives which were noted already by Miller (1967), but yet were not chemically fractioned.

Specifics of *Panus*-like morphotype. Basidiocarp development in the *Panus* representatives was studied by Hibbett et al. (1993), whereas their hyphal differentiation was studied by Zmitrovich et al. (2009). As it was shown, the hymenophore differentiation in *Panus* involves the periclinal growth of context hyphae below a closed surface palisade of hymenial elements, resulting in a cantharelloid appearance and radiate trama. This pattern is qualitatively different from that in *Lentinus* s. str., which suggests that lamellae of *Panus* and *Lentinus* are not homologous. *P. conchatus* and *P. lecomtei* basidiocarps have short stipes, whereas *P. fulvus* basidiocarps have an elongate stipe, and develop from a pseudosclerotium. *P. conchatus* sporocarps developed an ephemeral partial veil that was obliterated during basidiocarp expansion, whereas primordia of *P. lecomtei* are initially gymnocarpic. Analysis of hyphal system of all the tropical representatives of the genus indicates the rigorous dimitism of mature basidiocarp, whereas in *P. conchatus* and *P. lecomtei* the hyphae sclerify slower, while mature basidiocarps include the hyphal elements on different stages of maturation (Zmitrovich et al., 2009).

The absence of physalohyphae determining the accelerated growth of agaricoid basidiocarps makes the growth of *Panus* representatives more monotonous and slow, what, in combination with its hyphal structure, brings *Panus*-like morphotype together with trametoid one. However, the hymenophore of *Panus* is a classical lamellate that indicates a surprising convergence among agaricomycetes.

Tropical species. As a rather specific adaptive type, the genus *Panus* was generated by arid and warm climates of the planet, where the main species diversity of the genus is concentrated. The following species, common in various tropical regions, are most known.

*Panus ciliatus* (Lév.) T. W. May et A. E. Wood, 1995, Mycotaxon 54: 148 (Bas.: *Lentinus ciliatus* Lév., 1844; Syn.: *L. melanophyllus* Lév., 1844; *L. setiger* Lév., 1844; *L. echinopus* Lév., 1846; *L. braccatus* Lév. in Zolling., 1854; *L. dichrous* Lév. In Zolling., 1854; *L. zonifer* Berk. et Broome, 1873; *L. egregius* Massee, 1910; *Panus brunneipes* Corner, 1981).

*P. fasciatus* (Berk.) Singer, 1962, Agaricales mod. Tax. 2nd ed.: 172 (Bas.: *Lentinus fasciatus* Berk., 1840; Syn.: *L. dealbatus* Fr. in Lehmann, 1847; *L. fiscopurpureus* Kalchbr., 1880; *L. holopogonius* Berk. ex Cooke, 1892; *L. terrestris* Lloyd, 1925).

*P. hookerianus* (Berk.) T. W. May et A. E. Wood, 1995, Mycotaxon 54: 148 (Bas.: *Lentinus hookerianus* Berk., 1851).

*P. similis* (Berk. et Broome) T. W. May et A. E. Wood, 1995, Mycotaxon 54: 148 (Bas.: *Lentinus similis* Berk. et Broome, 1873; Syn.: *L. velutinus* Fr. var. *africanus* P. Henn. in Engler, 1893; *L. erringtohnii* Pat., 1900; *L. samurensis* Pilát, 1941). *P. strigellus* (Berk.) Chardot et Toro, 1934, Monogr. Univ. Porto Rico Ser. B 2: 315 (Bas.: *Lentinus strigellus* Berk., 1868; Syn.: *Panus guaraniticus* Spec., 1883; *Lentinus crispus* Pat., 1889; *L. tubarius* Pat., 1899; *Pocillaria palmeri* Earle, 1906; *Lentinus subglaber* Lloyd, 1917).

*P. tephroleucus* (Mont.) T. W. May et A. E. Wood, 1995, Mycotaxon 54: 148 (Bas.: *Lentinus tephroleucus* Mont., 1851; Syn.: *L. leprieurii* Mont., 1854; *L. siparius* Berk. et M. A. Curtis, 1868; *L. dentatus* Bres., 1925).

*P. velutinus* (Fr.) Overh., 1930, J. Dept Agric. Porto Rico 14: 353 non Fr., 1838 (Bas.: *Lentinus velutinus* Fr., 1830; Syn.: *Lentinus fulvus* Berk., 1842; *L. coelopus* Lév., 1846; *L. nepalensis* Berk., 1854; *L. blepharodes* Berk. et M. A. Curtis, 1868; *L. fastuosus* Kalchbr. et MacOwan, 1881; *L. fallax* Speg., 1883; *L. castaneus* Ellis et Maclbr., 1896; *L. holumbrius* De Seynes, 1897; *L. fissus* P. Henn., 1897; *L. natalensis* Van der Byl, 1924; *L. thomensis* Coutinho, 1925; *L. pseudociliatus* Raithelhuber, 1974).

Provisional position: *Lentinus hirtiformis* Murrill, N. Am. Fl. 9: 293, 1915; *L. courtetianus* Har. et Pat., Bull. Mus. Hist. Nat. Paris 15: 88, 1909 (Zmitrovich, Malysheva, 2013).
Species irradiating into temperate zones. Two species, being widespread in subtropical and tropical regions, have been irradiated into temperate zones of the northern and partly southern hemispheres. They are characterized by less xeromorphic habitus in comparison to strictly tropical species and demonstrate pseudodimisticism even at rather advanced developmental stages. Both species are distributed throughout Russia: *P. conchatus* and *P. lecomtei* (see below).

Key to temperate species

1. Upperside matt-subtomentose, soon glabrescent, finally glabrous, with formation of fine appressed squamules; basidia 20–35 × 4.5–6 μm; basidiospores 5–6.5 × 2.2–3.5 μm, ellipsoid-cylindrical ...................... 1. *P. conchatus*
   - Upperside tomentose, then strigose; basidia 15–20 × 3.5–5 μm; basidiospores 4.5–6 × 2.5–3.7 μm, mostly ovoid .......................... 2. *P. lecomtei*

1. *Panus conchatus* (Bull.) Fr., 1838, Epicr. Syst. Mycol.: 396.

≡ *Agaricus conchatus* Bull., 1877, Herb. Fr. 7: tab. 298 : Fr., 1821, Syst. Mycol.: 1: 181.
≡ *A. carneotomentosus* L., 1753, Sp. pl. 2: 1171.
≡ *A. flabelliformis* Schaeff., 1774, Fung. bavar. palat. nasc. 4: 20.
≡ *A. carneotomentosus* Batsch, 1783, Elench. fung.: 89.
≡ *A. mesentericus* Batsch, 1783, Elench. fung. (Halle): 91.
≡ *A. carnosus* Bolton, 1792, Hist. fung. Halifax, App. 3: 146.
≡ *A. flabellatus* J. F. Gmel., 1792, Syst. Nat. 2(2): 1410.
≡ *A. inconstans* Pers., 1800, Comm. Schaeff. Icon. Pict.: 17.
≡ *A. fornicatus* Pers., 1801, Syn. meth. fung. 2: 475.
≡ *A. torulosus* Pers., 1801, Syn. meth. fung. 2: 475.
≡ *Pleurocystis fornicatus* Gray, 1821, Nat. Arr. Brit. Pl. 1: 615.
≡ *Panus monticola* Berk., 1851, Hooker’s J. Bot. Kew Gard. Misc. 3: 46.
≡ *P. vaporarius* Bagl., 1865, Comm. Soc. crittog. Ital. 2(fasc. 2): 264.
≡ *Lentinus percomis* Berk. et Broome, 1875, J. Linn. Soc., Bot. 14(no. 73): 42.
≡ *L. brezadolae* Schulzer, 1885, Hedwigia 24(4): 141.
≡ *Panus flabelliformis* Quél., 1888, Fl. Mycol. France (Paris): 325.

= *Lentinus obconicus* Peck, 1906, Bull. Torrey bot. Club 33(4): 215.

Icon.: Malkovský (1932: fig. 1–4, ut *Panus flabelliformis*); Phillips (1981: fig. 267d); Pegler (1983: fig. 35); Hansen, Knudsen (1992: fig. 2 ut *Lentinus conchatus*); Courtecuisse, Duhem (1994: fig. 135); Zmitrovich et al. (2004: fig. 25); Knudsen, Vesterholt (2008: 73D).

Basidiocarp solitary or caespitose, medium-sized, originating from a woody substratum, of lentioid habitus. Pileus 1.5–15 cm diam., tough fleshy, then coriaceous, planate or depressed, often conchoid or cyathiform. Upperside pinkish-lilac to vinaceous-purple when young, then fading from the centre to pale-clay, ochraceous-brown or cinnamon, matt-subtomentose, soon glabrescent, finally smooth and shiny or cracking at the centre to form indefinite, appressed squamules. Margin sharp, thin, inrolling, slightly undulate or lobed, pruinose when young, occasionally strigose. Stipe central to lateral, 0.5–4 × 0.5–3 cm, cylindrical to bulbous, sometimes tapering at the base, solid; surface initially tinted violaceous then fading to leave a pale grey, velutinate to short strigose tomentum, pubescent at the base, finally glabrous. Context tough fleshy, then coriaceous, 1–15 mm thick at the disk, ivory-white. Hymenophore lamellate. Gills deeply decurrent with a ridge extending down the stipe, often slightly anastomosing over the stipe surface, at first violaceous or purplish then cream colour, pinkish towards the edge; initially very narrow but eventually becoming broader, 2–4.5 mm wide, very crowded, with lamellulae of four lengths; edge entire (Fig. 1).

Hyphal system dimitic with rather prolonged pseudodimistic stage. Generative hyphae 2–4.5 μm diam., non-inflating, hyaline, thin-walled, branched, with large clamp connections. Skeletal hyphae 2–5 μm diam., unbranched, sinuose, hyaline, thick-walled, the pseudoskeletal hyphae of the same diameter, with clamp connections, and refractive contents predominate in young basidiocarps. Pileipellis an epicutis, 45–90 μm thick, of repent, radially parallel generative hyphae 3–5 μm diam. with a golden-brown wall. Hymenophoral trama irregular, hyaline, of radiate construction, similar in structure to the context. Gills-edge sterile, with conspicuous, crowded, clavate to sublageniform cheilocystidia 24–60 × 7–16 μm, hyaline, thin- to thick-walled. Pleurocystidia (pseudocystidia) abundant, 25–70 × 5–10(12) μm, narrowly clavate, often sinuous and constricted, thick-walled, originating deep in the subhymenial layer and projecting 5–20 μm above the basidia. Basidia 20–35 × 4.5–6 μm,
clavate-cylindrical, 4-spored, with a basal clamp. Basidiospores 5–6.5 × 2.2–3.5 μm, ellipsoid-cylindrical, hyaline with few contents, thin-walled.

On dying trees, fallen logs and branches, stumps of many hardwoods, causing a white rot.

Substrata: on many hardwoods, especially Betula spp. and Populus tremula, rarely on conifers (Pinus sylvestris).

Cultural characteristics: Hibbett et al. (1993); Johnson, Methven (1994); Grand (2004).

General distribution: EUROPE (Austria, Belarus, Belgium, Bulgaria, Denmark, Estonia, Finland, France, Germany, Latvia, Lithuania, Norway, Russia, Scotland, Spain, Sweden, Ukraine); AFRICA (Ethiopia); ASIA (Armenia, Georgia, Japan, Korea, Russia); NORTH AMERICA (Canada, Mexico, USA), CENTRAL AMERICA (Costa Rica); SOUTH AMERICA (Equador); AUSTRALIA and OCEANIA (Australia) (Pegler, 1983; Panus conchatus., 2018).

Distribution in Russia: see Table 1.

Exsiccate examined. Panus torulosus: “Sweden, Bohuslan, Uddevalla, Sarven Lake, on stump of Betula sp., X 1947. S. Woldmar LE 3722 (S. Lundell et J. A. Nannfeldt. Fungi exsiccati Suecici praeertim Upsalienses, N 1771)” – “Sweden, Västergötland, Göteborg, Naturparken, on stump of Betula sp., 20 IX 1960. F. Karlvall LE 3723 (S. Lundell et J. A. Nannfeldt. Fungi exsiccati Suecici praeertim Upsalienses, N 2865)” – “Sweden, Småland, Femsjö parish, on stump of Betula sp., 28 IX 1959. F. Karlvall LE 3721 (S. Lundell et J. A. Nannfeldt. Fungi exsiccati Suecici praeertim Upsalienses, N 2865)” – “Russia, Khabarovsk Region, Ragozhino vicinities, on Quercus sp., 03 VI 1910. M. Korotkiy (M. Korotkiy. Museum Botanicum Academiae Scientiarum Petropolitanae, N 73).” – “England, 15 III 1989. F. B. Delange LE 24071, LE 24074 (R. B. G. K. Richmond. Herbarium path/mixed debris England, N 73).” – “USSR, Bashkortostan Republic, Bashkirsky Reserve, Drozdov Log vicinities, on stump of Pinus sylvestris, VIII 1948. E. A. Selivanova-Gorodkova LE 3703 (E. A. Selivanova-Gorodkova. Plantae australiuralenses, N 459)”.

Association with Trametes multicolor. According to our observations made on the Karelian Isthmus clear cuttings, Panus conchatus often settles on stumps, primarily colonized by Trametes multicolor (Schaeff.) Jülich (Fig. 2). Within ten records made for Betula stumps on the Karelian Isthmus clear cuttings, seven ones have contained an indication of the joint presence of Panus conchatus and Trametes multicolor. The latter species is an active producer of laccase and is characterized by high growth rate (Zmitrovich et al., 2017). Apparently, their primary delignification and moistening of wood by T. multicolor creates a niche for Panus conchatus, carrying out a deeper substrate delignification. The pair in question certainly echoes with another pair, Antrodiella pallescens/Fomes

Fig. 1. The most typical laterally attached morphotype of Panus conchatus (Kalinovskaya 4552M/12): 1 – an upperside view; 2 – a hymenophore. Scale bar – 1 cm.

Fig. 2. Association of Panus conchatus with Trametes multicolor-coll. (Zmitrovich 2014-12).
fomentarius, described for dead wood in boreal forests (Spirin, 2002).

**Nomenclature.** Two names sanctioned by Fries (1821) were considered in the literature as a fit basionyms of this species, *Agaricus conchatus* (Bulliard, 1787) and *A. torulosus* (Persoon, 1801). Since both names are sanctioned by Fries and there is no any doubt in their synonymy, the combination based on *A. conchatus* name, i.e. *Panus conchatus* (Fries, 1838), has a priority.

**Intraspecific variability.** As a neutral type of this species (*P. conchatus var. conchatus*) the more or less lateral ecotype with conchiform pileus and rather dark wine-red to lilac-brown surface is considered by default. Two main deviations from such neutral type were described: 1) the chromatic one, characterized by light-colored (red or clay-yellow), usually conchiform pilei (*P. conchatus var. inconstans*) and 2) the growth one, characterized by entral (often bulbous) stipe, funnel-shaped cap and strongly inrolled margin (*P. conchatus var. torulosus*).

*Panus conchatus* var. *inconstans* (Pers.) Zmitr., Bondartseva, Perevedentseva, Myasnikov et Kovalenko, **comb. nov.** (MB 824338). – Basionym: *Agaricus inconstans* Pers., 1800, Comm. Schaff. Icon. Pict.: 17.

= *A. conchatus* var. *carneotomentosus* Fr., 1832, Syst. Mycol. (Index): 11.

Persoon (1800) has characterized this taxon as follows: «Subcespitosus, pileo carnoso tenaci depresso integro, aut dimidiato lobato flexuoso, ex alutaceo subrufescente, lamellis subramosis basi crispis albis subrutilesque, stipte brevi sublateralis».

**Icon.:** Malkovský (1932: fig. 5, ut *Panus flabelliformis*).

From type variety differs by clay-buff, carneous of rufescent color of the upperside. Basidiocarps of conchoid appearance, the stipe often reduced and then the hymenophore is subporoid at the base. The microstructures vary as in a neutral type.

*Panus conchatus* var. *torulosus* (Pers.) Zmitr., Bondartseva, Perevedentseva, Myasnikov et Kovalenko, **comb. nov.** (MB 824339). – Basionym: *Agaricus torulosus* Pers., 1801, Syn. meth. fung. 2: 475.

**Icon.:** Malkovský (1932: fig. 2, 3, 6 ut *Panus flabelliformis*).

From type variety differs by funnel-shaped basidiocarps on a central stipe, often with bulbous base, and inrolled undulating margin. The microstructures vary as in a neutral type (Fig. 3).
2. *Panus lecomtei* (Fr.) Corner, 1981, Beih. Nova Hedwigia 69: 90.

≡ *Lentinus lecomtei* Fr., 1825, Syst. Orb. Veg. 1: 77.

≡ *Agaricus strigopus* Pers. in Gaudichaud-Beaupré in Freycinet, 1827, Voy. Uranie., Bot.: 167.

≡ *A. hirtus* Secr., 1833, Mycogr. Suisse 2: 452.

≡ *A. macrosporus* Mont., 1837, Annls Sci. Nat., Bot., sér. 2 8: 370.

≡ *Panus rudis* Fr., 1838, Epicr. Syst. Mycol.: 398.

≡ *Lentinus capronatus* Fr., 1838, Epicr. Syst. Mycol.: 389.

≡ *A. sainsonii* Lév. in Demidov, 1842, Voyage dans la Russie Meridionale et la Crimeé, par la Hongrie, la Valachie et la Moldavie 2: 85.

≡ *Lentinus chaetophorus* Lév., 1844, Annls Sci. Nat. Bot. 2: 177.

≡ *L. melanophyllus* Lév., 1844, Annls Sci. Nat. Bot. 2: 175.

≡ *Panus lamyanus* Mont., 1856, Syll. gen. sp. crypt.: 147.

≡ *P. hoffmannii* Fr. in Hoffmann, 1867, Icon. Anal. Fung., Abbild. Beschr. Pilz. 1(4): 94.

≡ *Lentinus sparsibarbis* Berk. et M. A. Curtis, 1869, J. Linn. Soc., Bot. 10(no. 45): 301.

≡ *L. substrigosus* Henn. et Shirai in Hennings, 1900, Bot. Jb. 28(3): 270.

≡ *Panus semirudis* Singer, 1936, Beih. Botan. Centrallbl. B 56: 142.

≡ *P. fragilis* O. K. Mill., 1965, Mycologia 57(6): 943.

≡ *P. neostrigosus* Drechsler-Santos et Wartchow, 2012, J. Torrey bot. Soc. 139(4): 438.

Icon.: Malkovský (1932: fig. 10–12, ut *P. rudis*); Zerova (1974: tab. 90, 1 ut *P. rudis*); Pegler (1983: fig. 31, ut *Lentinus strigosus*); Zmitrovich et al. (2004: Tab. 4, a, b ut *Panus rudis*); Bulakh (2015: fig. 418).

Basidiocarp solitary or caespitose, medium-sized, originating from a woody substratum, of lentoid habitus. Pileus 1.5–12 cm diam., tough fleshy, then coriaceous, convex, then depressed to infundibuliform, or laterally attached and flabelliform to spatulate. Upperside ivory-white to stromatic, then strigose (hairs 1–2 mm long), without a clear zonation. Margin thin, inrolling, slightly undulate or lobed, strongly strigose. Stipe eccentric to lateral, 0.5–3.8 × 0.3–1.5 cm, cylindric to bulbous, solid, sometimes reduced; surface concolorous with the pileus, tomentose-strigose. Context tough fleshy, then coriaceous, 1–7 mm thick at the disk, ivory-white. Hymenophore lamellate. Gills deeply decurrent, ivory-white to ochraceous-buff, sometimes with violaceous tints; initially very narrow but eventually becoming broader, 1–2 mm wide, very crowded, with lamellulae of four lengths; edge entire (Fig. 4).

Hyphal system dimitic with expressed pseudodimitic stage. Generative hyphae 2–4 μm diam., non-inflating, hyaline, thin-walled, branched, with large clamp connections. Skeletal hyphae 2–7.5 μm diam., unbranched, sinuose, hyaline, thick-walled to subsolid, the pseudoskeletal hyphae of the same diameter, bearing clamp connections and refractive contents, are abundant in young basidiocarps. Pileipellis a trichodermal epicutis, 25–45 μm thick, of repent, radially parallel generative hyphae 3–7.5 μm diam. with a golden-brown wall. Hymenophoral trama irregular, hyaline, of radiate construction, similar in structure to the context.

Fig. 4. The most typical laterally attached morphotype of *Panus lecomtei* (Myasnikov 4472A/15): 1 – an upperside view; 2 – a hymenophore. Scale bar – 1 cm.
Gills-edge sterile, with conspicuous, crowded, clavate to sublageniform cheilocystidia 18–35 × 4–6 μm, hyaline, thin- to thick-walled. Pleurocystidia (pseudocystidia) abundant, 25–55 × 9–13 μm, narrowly clavate, often sinuous and constricted, thick-walled, originating deep in the subhymenial layer and projecting up to 40 μm above the basidia. Basidia 15–20 × 3.5–5 μm, clavate-cylindrical, 4-spored, with a basal clamp. Basidiospores 4.5–6 × 2.5–3.7 μm, ovoid to ellipsoid-cylindrical, hyaline with few contents, thin-walled.

On dying trees, fallen logs and stumps, causing a white rot.

**Substrata**: On many hardwoods, especially *Carpinus betulus*, *Betula* spp., *Fagus sylvatica*, *Quercus* spp., rarely on conifers (*Larix* spp.).

**Cultural characteristics**: Hibbett et al. (1993); Grand (2004); Vargas-Isla, Ishikawa (2008); Petre, Tănase (2013).

**General distribution**: EUROPE (Bulgaria, Estonia, France, Germany, Hungary, Portugal, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Ukraine); AFRICA (Madagascar, Mayotte, Uganda, Zaire); ASIA (India, Iran, Japan, Malaysia, Myanmar (Burma), Nepal, Pakistan, Philippines, Russia, Sri Lanka, Taiwan, Thailand, Turkey); NORTH AMERICA (Canada, Mexico, USA), CENTRAL AMERICA (Costa Rica, Cuba, Guatemala, Honduras, Nicaragua, Panama, Puerto Rico); SOUTH AMERICA (Argentina, Brazil, Colombia, Guiana, Paraguay, Peru, Venezuela); AUSTRALIA and OCEANIA (Galapagos, Norfolk Island, Papua New Guinea, Australia) (Pegler, 1983; Panus neostrigosus .., 2018).

**Distribution in Russia**: see Table 2.

**Exsiccatcs examined**: *Agaricus saisonii*: “Russia, 1842. A. Demidoff LE 5848 (J. Leveillé. Voyage dans la Russie Meridionale et la Crimeé, N 85)”. – *Lentinus lecomtei*: “USA, Ohio, VII 1883. W. A. Kellermann LE 5849 (Rabenhorst–Winter. Fungi Europaei, N 2940)”. – *Panus saisononii*: “Russia, Bashkortostan Republic, Bashkirsky reserve, Drozdov Log vicinities, on stump of *Betula* sp., 8 IX 1946 E. A. Selivanova-Gorodkova LE 5838 (E. A. Selivanova-Gorodkova. Plantae australiuralenses, N 2427)”. – “Russia, Bashkortostan Republic, Bashkirsky reserve, Drozdov Log vicinities, on stump of *Betula* sp., 8 IX 1946 E. A. Selivanova-Gorodkova LE 5834 (E. A. Selivanova-Gorodkova. Plantae australiuralenses, N 2429). – *Panus saisononii*: “Austria, Salzburg, IX 1868 Dr. Sauter LE 5855 (Rabenhorst–Winter. Fungi Europaei, N 1207)”. – “Austria, Salzburg, on fallen trunk of *Fagus*. Dr. Sauter LE 5850 (F. Thümen. Fungi austriaci, N 212)”.

**Nomenclature**. Two names in application to this peculiar species persisted in the literature for a long time, *Lentinus strigosus* and *Panus rudis*. Since, as it was shown, this species does not belong to the *Lentinus* s. str. (Zmitrovich, Malysheva, 2013; Zmitrovich, Kovalenko, 2016), it became necessary a nomenclatural adaptation of species name within the *Panus*. Because of the name *P. strigosus* Berk. et M. A. Curtis was preoccupied by Berkeley and Curtis (1859) in application to another species, the name *P. rudis* (Fries, 1838) continued to be persisting. Drechsler-Santos et al. (2012) proposed new name *Panus neostrigosus* without any nomenclature analysis, and this name was taken as a basis for GBIF (*Panus* neostrigosus .., 2018). At the same time, Corner (1981) already made a combination *P. lecomtei*, basing on the description by Fries *Lentinus lecomtei* in his earlier work (Fries, 1825).

**Intraspecific variability**. As a neutral type of *Panus lecomtei* (*P. lecomtei var. lecomtei*), the ectotype having small eccentric to lateral minute and often spalled stipe is considered by default. However, the stipe shape and size are variable. The stipe can be either central – minute, with a bulbous base (*P. lecomtei var. semirudis*), or strongly elongated (*P. lecomtei var. stipitata*).

*Panus lecomtei* var. *semirudis* (Singer) Zmitr., Bondartseva, Perevedentseva, Myasnikov et Kovalenko, *comb. nov.* (MB 824340). – Basionym: *Panus semirudis* Singer, 1936, Beih. Botan. Centralbl., Abt. B 56: 142.

From type variety is distinguished by short, but strong and often bulbous stipe of central or sub-central position. Upperside is moderately strigose to glabrous at the center, color usually fading to ochraceous-brown. The microstructures vary as in a neutral type (Fig. 5).
Panus lecomtei var. stipitatus (Malk.) Zmitr., Bondartseva, Perevedentseva, Myasnikov et Kovalenko, **comb. nov.** (MB 824341). – Basionym: Panus rudis var. stipitata Malk., 1932, Annls mycol. 30(1/2): 40.

**Icon.**: Malkovský (1932: fig. 12, ut Panus rudis var. stipitata).

From type variety is distinguished by long lateral or eccentric stipe and spathulate pilei. Upperside is strongly strigose, color usually fading to cinnamon. The microstructures vary as in a neutral type (Fig. 6).

The problem of *Lentinus martianoffianus*. This problematic species was described by Thümen (1877) with reference to Kalchbrenner, and its authentic material kept in Kew Herbarium (K). There is a single specimen, collected on *Populus balsamifera* by Martianoff near Minussinsk in 1880 and distributed within exsiccate series by Thümen (Fung. Exot. Dec. 21).

The Kew material was studied by Pegler (1983) and described as follows: “Imbricate. Pileus laterally attached, 3–5 cm diam., thin, coriaceous, irregularly flabelliform, depressed; surface pale yellowish rufous, uniformly velutinate-strigose becoming hispid towards the margin; margin irregular, deeply lobed, faintly sulcate, densely ciliate with hair-like squamules, 1–2 mm long. Lamellae decurrent, pallid, narrow, about 1 mm wide, very crowded, with lamellulae of three lengths; edge entire. Stipe lateral, 1–1.5 cm × 8–12 mm, short, cylindric or compressed, solid; surface concolorous with the pileus, densely strigose, glabrescent. Context up to 2 cm

**Fig. 5.** *Panus lecomtei* var. semirudis (LE 3660): 1 – hymenophore; 2 – upperside view; 3 – fibrohypha; 4 – generative hyphae; 5 – cheilocystidia; 6 – pseudocystidium; 7 – basidia; 8 – basidiospores. Scale bars: 1, 2 – 1 cm, 3–8 – 10 μm.

**Fig. 6.** *Panus lecomtei* var. stipitatus (Myasnikov 4350A/16): 1 – upperside view; 2 – hymenophore. Scale bar – 1 cm.
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Table 1

| Region                        | Substrata                  | Date of collection | Collector         | Herbarium numbers |
|-------------------------------|----------------------------|--------------------|-------------------|-------------------|
| European part                 |                            |                    |                   |                   |
| Karelia Republic              | Betula pubescens           | 08 X 1950          | A. S. Bondartsev  | LE 3704           |
| Leningrad Region              | unidentified substrate     | 19 VIII 1960       | M. A. Bondartseva | LE 3702           |
| Leningrad Region              | Betula pubescens           | 20 VII 2014        | I. V. Zmitrovich  | LE 287527         |
| Leningrad Region              | Populus tremula            | 05 VIII 2001       | I. V. Zmitrovich  | LE 212955         |
| Leningrad Region              | Betula sp.                 | 23 VI 1997         | O. V. Morozova    | LE 215053         |
| Leningrad Region              | unidentified substrate     | 07 X 2007          | N. V. Psurtseva   | LE 265028         |
| Leningrad Region              | unidentified substrate     | VIII 1918          | V. P. Savich     | LE 3716           |
| Mari El Republic              | Betula sp.                 | 14 VI 1938         | B. P. Vasilkov   | LE 3708           |
| Mari El Republic              | Populus sp.                | 03 VII 1935        | B. P. Vasilkov   | LE 3713           |
| Moscow Region                 | Betula sp.                 | 19 VIII 1925       | L. A. Lebedeva   | LE 3715           |
| Moscow Region                 | unidentified substrate     | 17 VI 2016         | O. V. Anisimova  | LE 315401         |
| Orel Region                   | Betula sp.                 | 06 VIII 1912       | A. S. Bondartsev | LE 3718           |
| Pskov Region                  | unidentified substrate     | 23 VII 2002        | O. V. Morozova   | LE 217599         |
| Saint Petersburg              | unidentified substrate     | 27 IX 1994         | O. V. Morozova   | LE 227995         |
| Stavropol Territory           | unidentified substrate     | 15 VIII 1925       | A. I. Lobik     | LE 3711           |
| Tver Region                   | unidentified substrate     | VII 1924           | L. A. Lebedeva   | LE 3712           |
| Vologda Region                | Betula sp.                 | 25 VIII 2002       | E. S. Popov      | LE 246368         |
| Ural Region                   |                            |                    |                   |                   |
| Perm Territory                | Populus tremula            | 15 VIII 1994       | L. G. Perevedentseva | PERM 118-3     |
| Siberia                       |                            |                    |                   |                   |
| Irkutsk Region                | Populus tremula            | 15 VIII 1983       | A. E. Kovalenko  | LE 18116          |
| Irkutsk Region                | Betula sp.                 | 20 VIII 1947       | B. P. Vasilkov   | LE 3710           |
| Irkutsk Region                | Betula sp.                 | 26 VIII 1947       | B. P. Vasilkov   | LE 3714           |
| Irkutsk Region                | Betula sp.                 | 27 VIII 1947       | B. P. Vasilkov   | LE 3707           |
| Krasnoyarsk Territory         | Betula sp.                 | 11 IX 1965         | A. L. Yavorskiy  | LE 3705           |

thick at the base, very thin over the hymenophore, white, consisting of a dimitic hyphal system with skeletal hyphae. Generative hyphae 2–5 μm diam., not inflating, hyaline, branched, thin-walled or occasionally with a slightly thickened wall, and clamp-connexions. Skeletal hyphae 2–6 μm diam., unbranched, hyaline, with a thickened wall (up to 2 μm) and a narrow lumen, intercalary and terminal in origin, finally tapering to an obtusely rounded apex. Spores 4.7–6.2 × 1.7–2.5 μm, Q = 2.37, narrowly cylindric, at times arcuate, hyaline, thin-walled, with few contents. Basidia 16–22 × 4.5–5.5 μm, clavate, bearing four sterigmata. Lamella-edge sterile, forming a narrow zone of small, inconspicuous cheilocystidia, together with scattered metuloids. Cheilocystidia 16–24 × 3.5×5 μm, basidioid, sinuous fusoid, often constricted, with a rounded apex, hyaline, thin-walled. Metuloids scattered to numerous, on both sides and edge of lamellae, 26–45 × 7–12 μm, inflated clavate to fusoid-submucronate, usually with a thickened wall (1–2.5 μm) and resinous, yellowish brown contents, projecting to 25 μm beyond the basidia, sometimes surrounded by a sheath of thin-walled, generative hyphae, 2–5 μm diam. Hymenophoral trama irregular, hyaline, of radiculate construction, comprising mostly of generative hyphae. Subhymenial layer well developed, 14–20 μm wide, tightly interwoven. Pileipellis a disrupted and irregular trichodermal palisade, forming fascicles of unbranched, sclerified generative hyphae, 4–6 μm diam., with an obtusely rounded apex” (Pegler, 1983).

Since the molecular testing of any Kew material is prohibited, only the morphological description may be considered on, which unambiguously indicates the close relationships of this taxon with Pa

nus lecomtei-coll. Only basidiospores are something diverse, since are not ovoid, but rather ellipsoid-cylindrical. Malkovský (1932) has considered Lentinus martianoffianus as a synonym of Panus rudis, whereas Pegler (1983) has abstained from synonymization procedure. In any case, this taxon belongs to the genus Panus, although there have been attempted to associate this name with the Lentinus.
**Table 2**

Herbarium data on distribution of *Panus lecomtei* over Russian territory and its substrate preferences

| Region                        | Substrata                  | Date of collection | Collector          | Herbarium numbers |
|-------------------------------|----------------------------|--------------------|--------------------|-------------------|
| European part                 |                            |                    |                    |                   |
| Adygeya Republic              | *Fagus sylvatica*          | V 1910             | N. Shestunov       | LE 5815, LE 5817, LE 5827 |
| Kirov Region                  | *Fagus sylvatica*          | 18 IX 2003         | N. V. Psurtseva    | LE 241942         |
| Krasnodar Territory           | unidentified substrate     | 23 VII 1921        | M. K. Khokhrayakov | LE 5799           |
| Krasnodar Territory           | unidentified substrate     | 13 VIII 2003       | N. V. Psurtseva    | LE 227998         |
| Mari El Republic              | unidentified substrate     | 31 VII 1979        | A. E. Kovalenko    | LE 5837           |
| Krasnodar Territory           | unidentified substrate     | 17 VII 1976        | A. E. Kovalenko    | LE 5829           |
| Leningrad Region              | *Betula pubescens*         | 06 VII 1998        | I. V. Zmitrovich   | LE 214737         |
| North Ossetia–Alainia Republic| *Carpinus betulus*         | 15 V 1925          | Z. Chernetskaya    | LE 5813           |
| Penza Region                  | *Betula sp.*               | 27 VII 1921        | Shtukenberg        | LE 5841           |
| Ryazan Region                 | unidentified substrate     | IX 1960            | G. K. Milberg      | LE 5828           |
| Stavropol Territory           | unidentified substrate     | 24 VIII 1915       | A. I. Lobik        | LE 5836           |
| Voronezh Region               | unidentified substrate     | 1946               | V. Ya. Chustukhin  | LE 5833           |
| Perm Territory                | *Betula pendula*           | 25 VIII 1980       | L. G. Perevedentseva | PERM 118-1 |
| Perm Territory                | *Betula pendula*           | 30 VIII 1985       | L. G. Perevedentseva | PERM 118-2 |
| Perm Territory                | *Betula pendula*           | 22 VIII 1999       | L. G. Perevedentseva | PERM 118-4 |
| Perm Territory                | *Betula pendula*           | 04 VIII 2004       | L. G. Perevedentseva | PERM 118-5 |
| Perm Territory                | *Betula pendula*           | 17 VIII 2008       | N. V. Psurtseva    | LE 254518         |
| Altai Republic                | *Betula sp.*               | 18 VIII 2008       | N. V. Psurtseva    | LE 254519         |
| Altai Republic                | *Betula sp.*               | VIII 1937          | R. Singer          | LE 5842           |
| Chita Region                  | unidentified substrate     | 08.1910            | no data            | LE 5812           |
| Irkutsk Region                | *Betula sp.*               | 20 VIII 1921       | T. Smirnov         | LE 5804           |
| Irkutsk Region                | *Betula sp.*               | 04 IX 1947         | B. P. Vasilkov     | LE 5805           |
| Tumen Region                  | unidentified substrate     | 20 VI 1914         | Varentsov          | LE 5831           |
| Yakutia Republic              | *Larix sp.*                | 10VIII1908         | N. A. Palchevskiy  | LE 5844           |
| Amur Region                   | *Quercus sp.*              | 17VIII1959         | B. A. Tomilin      | LE 5791           |
| Amur Region                   | unidentified substrate     | 13VII1910          | M. Korotkiy       | LE 3663           |
| Primorye Region               | unidentified substrate     | 1913               | V. L. Komarov      | LE 3664           |
| Primorye Region               | unidentified substrate     | 1913               | V. L. Komarov      | LE 3640           |
| Primorye Region               | *Betula dahurica*          | 19VIII1934         | B. Kolesnikov     | LE 5797           |
| Primorye Region               | *Quercus sp.*              | 15 VII 1952        | E. V. Volkova     | LE 5808           |
| Sakhalin Region               | *Larix decidua*           | 1960               | B. P. Vasilkov     | LE 5839           |
| Sakhalin Region               | *Sorbus aucuparia*         | 29 VIII 1954       | M. G. Tarabaev     | LE 5820           |

*Conclusion*

The *Panus* represents rather well-delimited genus belonging to merulioid phylogenetic radiation, whose morphotype on essential features of its organization is trametoid, but superficial habitual features make it closer to the lentinoid one. One of its essential features is the abundance of fibrohyphae which forms a *textura intricata*, slowly growing basidiocarps and strictly lamellate hymenophore. Apparently, such an adaptive structure was generated under the influence of arid and warm climate conditions at the different regions of the planet, and only 2 species, *Panus conchatus*, and *P. lecomtei*, have been irradiated into temperate latitudes, including Russian territory. The substrate spectrum of these fungi is determined by their insensitivity to the substrate moistening and best ability to colonize...
hardwood, so the greatest number of their finds can be made on stumps and large remnants of stands-formers of corresponding forest areas. In Russia, a reliable association of Panus species to Betula spp. and Populus spp. was revealed. An ectopic differentiation of the genus Panus is related to the quality of substrate colonized. The basidiocarps, growing over top cuts of the stumps, are characterized by strong central stipe (Panus conchatus var. torulosus, Panus lecomtei var. semirudis), whereas basidiocarps with sublateral attachment are common on fallen logs. Certain chromatic aberrations (Panus conchatus var. inconstans) are associated with an insolation regime of the habitat. During last years, the Panus representatives have attracted an interest in biomed research development. Their resource potential estimation should proceed from the fact that within Russian territory, such areas as Middle Belt of European Russia, North Caucasus, Altai and other regions of Southern Siberia are promising for replenishing the strains of Panus conchatus and Panus lecomtei.

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