

## New records of lichens and lichenicolous fungi from the Tver Region

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**Abstract.** Eight species of lichens and five parasitic (mainly lichenicolous) fungi are reported for the first time for the Tver Region. The lichens *Bacidina neosquamulosa* and *Bellemerea cinereo-rufescens* are new to Central European Russia. Data on localities and habitats in the Tver Region are provided for all species; nearest known localities in European Russia and distinguishing characters of the species are briefly discussed.

**Keywords:** *Bacidina neosquamulosa*, *Bellemerea cinereo-rufescens*, Central European Russia.

## Новые находки лишайников и лихенофильных грибов в Тверской области

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**Резюме.** Впервые для Тверской обл. приведены восемь видов лишайников и пять видов паразитических (преимущественно лихенофильных) грибов. Лишайники *Bacidina neosquamulosa* и *Bellemerea cinereo-rufescens* являются новыми для центральной части Европейской России. Для всех видов отмечены местонахождения и местообитания в Тверской обл., указаны ближайшие местонахождения в Европейской России и отличия от наиболее близких видов.

**Ключевые слова:** *Bacidina neosquamulosa*, *Bellemerea cinereo-rufescens*, Россия, центральная часть Европейской России.

The special lichen investigations in the Tver Region started in the beginning of 20<sup>th</sup> century and significantly intensified in the beginning of 21<sup>st</sup> century (see Notov *et al.*, 2011). Comprehensive information on the diversity of lichen-forming, lichenicolous and allied fungi could be obtained from annotated catalogues of the Tver Region (Notov *et al.*, 2011) and Central Forest State Nature Biosphere Reserve (Notov *et al.*, 2016b), as well as from some recent papers (e. g., Zhurbenko, Notov, 2015; Notov *et al.*, 2016a; Notov, Himelbrant, 2017; Czernyadjeva *et al.*, 2018); altogether 600 species have been reported from the region until now.

The specimens were collected by A. A. Notov in 2005–2018, and are deposited in the lichen herbaria of Komarov Botanical Institute of the Russian Academy of Sciences (LE) and Botanical Museum of University of Helsinki (H). Lichenicolous fungi are marked with #. The nomenclature of taxa generally follows Nordin *et al.* (2011), in the case of *Agonimia flabelliformis* the special paper (Guzow-Krzemińska *et al.*, 2012) was used. The data on nearest localities in Central European Russia or European Russia (regional subdivision see in Flora..., 2017), as well as most important identification characters, are provided for all species.

**Agonimia flabelliformis** J. P. Halda, Czarnota et Guzow-Krzem. — Toropets District, vicinity of Krasnopolets, 56°49'42.0"N, 31°21'09.8"E, 172 m a. s. l., end of the 18<sup>th</sup> century old park (previously manor of Kushelevy-Bezborodko), on bark of old *Quercus robur* L., 25 VII 2016, Notov (Нотов), det. Himelbrant (Гимельбрант), H.

The nearest known locality in European Russia is in the Tula Region (Gudovicheva *et al.*, 2015). Recently described lichen, differs (even in a sterile form) from other *Agonimia* species by thallus consisting of very typical flabelliform or coralloid squamules (Guzow-Krzemińska *et al.*, 2012). Our specimen is represented by sterile thallus.

**Bacidina chloroticula** (Nyl.) Vězda et Poelt — Konakovo District, Zavidovo National Park, vicinity of Starikovo, 56°37'04.6"N, 36°10'13.9"E, 143 m a. s. l., swampy black alder forest with birch, spruce, and grasses, on bark of roots of fallen birch, 1 V 2017, Notov (Нотов), det. Stepanchikova (Степанчикова), LE.

The nearest known localities in European Russia are in the Leningrad (Stepanchikova *et al.*, 2011), Vladimir (Zhdanov, Volosnova, 2012), Tula (Gudovicheva, Himelbrant, 2012) and Yaroslavl (Muchnik *et al.*, 2018) regions. *B. chloroticula* differs from other species of the genus by small (up to 0.2 mm) pale apothecia, lacking internal pigmentation, thin gray-green scurfy granular thallus, and immersed white pycnidia with curved conidia 30–43 µm long (Smith *et al.*, 2009).

**B. neosquamulosa** (Aptroot et Herk) S. Ekman — Konakovo District, Zavidovo National Park, vicinity of Starikovo, 56°36'09.0"N, 36°10'26.4"E, 143 m a. s. l., swampy black alder forest, on bark of black alder together with *Anisomeridium polypori* (Ellis et Everh.) M. E. Barr and *Chaenotheca hispidula* (Ach.) Zahlbr., 25 V 2018, Notov (Нотов), det. Stepanchikova (Степанчикова), H.

New to Central European Russia. The nearest known locality in European Russia is in the Leningrad Region (Himelbrant *et al.*, 2017). *B. neosquamulosa* differs from other species of the genus by the thallus consisting of deeply incised granular microsquamules, typically developing isidia, and colorless hypothecium (Smith *et al.*, 2009).

**Bellemeria cinereorufescens** (Ach.) Clauzade et Cl. Roux — Toropets District, vicinity of Rogachevo, 56°51'15.7"N, 31°21'08.3"E, 185 m a. s. l., boulder bed of stream valley, on granite boulder together with *Aspicilia cinerea* (L.) Körb., *Porpidia crustulata* (Ach.) Hertel et Knoph, and *Rhizocarpon hochstetteri* (Körb.) Vain., 25 VII 2016, Notov (Нотов), det. Himelbrant (Гимельбрант), H.

New to Central European Russia. The nearest known locality in European Russia is in the Leningrad Region (Kuznetsova *et al.*, 2007). *B. cinereorufescens* differs from other species of the genus by gray, verrucose-areolate thallus, short hymenium, and absence on norstictic acid (Foucard, 2001).

**#Chaenothecopsis rubescens** Vain. — Zharkovsky District, vicinity of Cheretnoye, Schuchie Lake, 55°45'01.7"N, 32°11'17.9"E, 183 m a. s. l., broadleaved forest with elm, linden and oak near the mouth the Arlava River, on bark of old linden, associated with *Trentepohlia* sp., together with *Arthonia arthonioides* (Ach.) A. L. Sm., *Chaenotheca chrysocephala* (Turner ex Ach.) Th. Fr., *C. trichialis* (Ach.) Th. Fr., and *Chaenothecopsis savonica* (Räsänen) Tibell, 18 VII 2018, *Notov* (Нотов), det. *Himmelbrant* (Гимельбрант), LE.

The nearest known locality in European Russia is in the Kaluga Region (Gudovicheva *et al.*, 2015). *C. rubescens* is characterized by non-septate medium brown ascospores, presence of yellowish to red pigment in apothecia which reacts K<sup>+</sup> persistently red, and the association with *Trentepohlia* algae (Tibell, 1999).

**Lecania hutchinsiae** (Nyl.) A. L. Sm. — Udomlya District, 2 km S of Moldino, 57°44'N, 35°15'E, 152 m a. s. l., the Moldinka River bank, on granite together with *Verrucaria* sp., 15 XI 2005, *Notov* (Нотов), det. *Himmelbrant* (Гимельбрант), H.

The nearest known locality in European Russia is in the Republic of Mordovia (Urbanavichene, Urbanavichus, 2015). *L. hutchinsiae* is characterized by thin thallus, strongly convex apothecia with soon excluded thalline margin containing few algal cells, and 1-septate ascospores (Foucard, 2001; Smith *et al.*, 2009).

**Lecanora aitema** (Ach.) Hepp — Andreapol District, vicinity of Zhogodovo, 56°51'15.1"N, 31°38'06.3"E, elevation 163 m a. s. l., old-growth mixed forest with elm, oak, aspen, spruce and gray alder along the stream flowing into Lake Nagovje, on wood of branches of dead old elm, 27 IV 2011, *Notov* (Нотов), det. *Himmelbrant* (Гимельбрант), H.

The nearest known locality in European Russia is in the Leningrad Region (Stepanchikova *et al.*, 2011). *L. aitema* differs from closely related *L. symmicta* (Ach.) Ach. by dark green, brown, red-brown to black apothecia and N<sup>+</sup> red reaction of epithecium (Foucard, 2001; Smith *et al.*, 2009).

**Leptogium byssinum** (Hoffm.) Zwackh ex Nyl. — Vyshny Volochyok District, vicinity of Voybutskaya Gora, 57°07'07.6"N, 34°51'30.5"E, 251 m a. s. l., overgrowing sandy soil near the limestone quarry, 20 IV 2010, *Notov* (Нотов), det. *Himmelbrant* (Гимельбрант), H.

The nearest known locality in European Russia is in the Republic of Tatarstan (Evstigneeva, 2007). *L. byssinum* is characterized by thin blue-gray to brown-black minute granular thallus, apothecia with plane disc and distinct margins, as well as asci with 4–8 muriform ellipsoid spores (Smith *et al.*, 2009).

**#Lichenostigma maureri** Hafellner — Zharkovsky District, vicinity of Zharkovsky, near the junction of the rivers Shesnitsa and Mezha, floodplain oak forest, 55°50'31.1"N, 32°14'44.5"E, 176 m a. s. l., on thallus of *Bryoria capillaris* (Ach.) Brodo et D. Hawksw.

on old oak, 21 VIII 2018, *Notov* (Нотов), det. *Himelbrant* (Гимельбрант), LE; Kalinin District, Zavidovo National Park, 56°22'31.6"N, 35°53'52.7"E, 140 m a. s. l., on thallus of *B. capillaris*, 12 X 2018, *Notov* (Нотов), det. *Himelbrant* (Гимельбрант), LE.

The nearest known localities are in the Vladimir (Zhurbenko, Zhdanov, 2013), Kostroma (*Himelbrant et al.*, 2018a) and Leningrad (*Kuznetsova et al.*, 2012) regions. This widely distributed species is characterized by having multicellular conidia and inhabiting thalli of different pendulous macrolichens (*Zhurbenko*, 2009).

**Phaeophyscia endophoenicea** (Harm.) Moberg — Toropets District, Khvorostovo, 56°23'22.9"N, 31°42'11.5"E, 217 m a. s. l., end of the 18<sup>th</sup> century old park (previously manor of Kushelev), alley along the road, on bark of old ash, together with *Pachyphiale fagicola* (Hepp) Zwackh., 22 VII 2016, *Notov* (Нотов), det. *Himelbrant* (Гимельбрант), H.

The nearest known locality is in the Leningrad Region (*Kuznetsova et al.*, 2016). *P. endophoenicea* differs from other sorediate corticolous species of the genus by the presence of orange pigment (skyrin) in the lower part of medulla and predominantly marginal soralia (*Smith et al.*, 2009).

**#Pronectria robergei** (Mont. et Desm.) Lowen — Kuvshinovo District, vicinity of Bolshoj Borok, left bank of the Osuga River, steep bank, 56°58'47.1"N, 34°28'43.9"E, 189 m a. s. l., on thallus of *Peltigera didactyla* (With.) J. R. Laundon, together with *Enchylium tenax* (Sw.) Gray, 12 VII 2018, *Notov* (Нотов), det. *Himelbrant* (Гимельбрант), *Stepanchikova* (Степанчикова), LE.

Our specimen represents teleomorph only. Very widespread lichenicolous fungus; the nearest known localities are, for example, in the Kaluga, Tula (*Gudovicheva, Himelbrant*, 2012) and Leningrad (*Kuznetsova et al.*, 2007) regions. *P. robergei* (teleomorph) differs from other species of the genus by smaller asci 42–67 × 7–12 µm and spores 6.5–11.5 × 3.0–6.5 µm (*Puolasmaa et al.*, 2012).

**#Sclerococcum microsporum** (Etayo) Ertz et Diederich — Zharkovsky District, near mouth of Chernushka River, 55°51'55.2"N, 32°21'14.9"E, 176 m a. s. l., oaks along the river, on bark of old oak, 17 VII 2018, *Notov* (Нотов), det. *Stepanchikova* (Степанчикова) and *Himelbrant* (Гимельбрант), LE. Our specimen grows together with unidentified crustose epiphytic lichen and probably parasitizing on it.

The only known locality in Russia is in the Bryansk Region (*Muchnik, Konoreva*, 2017 as *Dactylospora microspora* Etayo). Probably lichenicolous fungus, characterized by dark brown, well-developed hypothecium, brown epithecium, multispored asci with 24–40(80) 1-septate brown ascospores (4)5–7(8) × 2–3(5) µm (*Hawksworth*, 1994).

**#Xanthoriicola physciae** (Kalchbr.) D. Hawksw. — Kalinin District, Zavidovo National Park, Selino, 56°28'46"N, 36°01'48"E, 114 m a. s. l., on apothecia of *Xanthoria parietina* (L.) Th. Fr. growing on bark of old poplar, 5 VIII 2008, *Notov* (Нотов), det. *Himelbrant* (Гимельбрант), H.

The nearest known locality is in the Leningrad Region (*Stepanchikova et al.*, 2011; *Himelbrant et al.*, 2018b) and the Republic of Mordovia (*Urbanavichene, Urbana-*

vichus, 2015). Anamorphic lichenicolous fungus which causes specific blackening of apothecia (and rarely thallus) of *Xanthoria parietina* in result of developing mycelium and producing globose dark brown conidia in hymenium (Hawksworth, Punithalingam, 1973).

Among listed above eight species of lichens and five species of parasitic (mainly lichenicolous) fungi from the Tver Region *Bellemeria cinereorufescens* and *Bacidina neosquamulosa* are reported for the first time for the Central European Russia, the other species are new to the Tver Region.

The significant part of recorded species were found in limits of the Valdai Upland (*Agonimia flabelliformis*, *Bellemeria cinereorufescens*, *Chaenothecopsis rubescens*, *Lecania hutchinsiae*, *Sclerococcum microsporum*). Further investigations on this territory will improve our knowledge about rare lichens inhabiting broadleaved forests and erratic boulders (Notov *et al.*, 2016c). Other territories promising for study are remote protected areas, subjected to relatively weak anthropogenic disturbance: four of mentioned species (*Bacidina chlorotricula*, *B. neosquamulosa*, *Lichenostigma maureri*, *Xanthoriicola physciae*) are reported from Zavidovo National Park. Of special interest are also landscapes with calcareous rocky outcrops, such as Vyshnevolotsko-Novotorzhsky shaft, where *Leptogium byssinum* was found. The lichenicolous fungi are worthy of investigation. The Tver Region is characterized by significant diversity of landscapes and vegetation and could be used as model territory appropriate for evaluation of lichen diversity on the border of Central and North-West European Russia.

Nowadays the list of lichens and allied fungi of the Tver Region counts 613 species from 200 genera, which is significantly more than in neighboring regions, e. g., Moscow (396 species), Novgorod (356), Pskov (342), and Yaroslavl (305) (Tagirdzhanova *et al.*, 2014; Muchnik, 2016; Istomina *et al.*, 2018; Muchnik *et al.*, 2018). Among them 50 species of calicioid lichens and fungi, 36 lichenicolous fungi, and 20 arthonioid lichens are known from the Tver Region. High diversity of these taxa which are hard to find and taxonomically complicated, shows high variety of suitable biotopes, as well as comprehensive level of investigations. The richest territories in the region are the areas with high heterogeneity and continuity of forests, wetlands and floodplain communities: Central Forest Nature Reserve (388 species) and Zavidovo National Park (346 species) (Notov *et al.*, 2011, 2016a, 2016b, 2016c). Central Forest Nature Reserve is particularly valuable due to the presence of old-growth spruce and broadleaved-spruce forests which harbor a high diversity of indicator species and habitat specialists (Notov *et al.*, 2016b, 2016c). Also interesting is southwestern part of Valdai Upland where broadleaved, particularly oak forests can be found (Notov *et al.*, 2016c; Notov, Himelbrant, 2017). Quite original are lichen biota of Vyshnevolotsko-Novotorzhsky moraine shaft and Rzhevsko-Staritskoe Povolzhie which include many species related to calcareous rocks and arid climate (Notov *et al.*, 2011).

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