CONTRIBUTION TO THE KNOWLEDGE OF THE GENUS CALOPLACA IN CENTRAL EUROPEAN RUSSIA

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Abstract. The paper provides data on 21 Caloplaca Th. Fr. species from central European Russia. Two species are new for Russia: C. atroflava (Turner) Mong. s.l. and C. soralifera Vondrák & Hrouzek. A further seven are new for European Russia [C. flavocitrina (Nyl.) H. Olivier, C. inconnexa (Nyl.) Zahlbr., C. marmorata (Bagl.) Jatta, C. oasis (A. Massal.) Szatala] or central European Russia [C. dichroa Arup, C. interfulgens (Nyl.) J. Steiner, C. monacensis (Leder.) Lettau]. Short taxonomic notes together with information on habitat and distribution are provided for the newly recorded species. An additional twelve Caloplaca species recognized in the area are also briefly presented.

Key words: biodiversity, distribution, lichenized Ascomycota, new records, steppe zone, Teloschistaceae

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INTRODUCTION

According to the lichen checklist of Russia, 136 species of the genus Caloplaca Th. Fr. are known from the country (Urbanavichus & Andreev 2010). During the last four years at least 15, including some newly described species, have been added to the list (Vondrák 2010; Urbanavichus et al. 2011; Urbanavichus & Urbanavichene 2012; Kondratyuk et al. 2013, 2014; Urbanavichus & Ismailov 2013; Vondrák et al. 2013). In central European Russia the genus Caloplaca is represented by 34 species (Urbanavichus & Andreev 2010; Muchnik & Šliwa 2013). This area is very diverse, with steppe, forest-steppe and various forest formations (e.g., broadleaved, coniferous-broadleaved and taiga forests). Among the vegetation zones, rocky steppe is the most important for Caloplaca species. Steppes, widespread throughout the Lipetsk, Orel, Ryazan and Voronezh regions, are characterized by limestone or sandstone (basenrich siliceous) outcrops. Such sun-exposed and calcareous habitats are hotspots of Caloplaca diversity. Despite the natural uniqueness of the area, the lichen biota is insufficiently known, with little recent data on lichen biodiversity (e.g., Gudivicheva 2011; Muchnik & Šliwa 2011, 2013; Muchnik & Konoreva 2012a, b).

This paper presents data on 21 mostly calciophilous Caloplaca species. Two species are reported as new for the country: C. atroflava (Turner) Mong. s.l. and C. soralifera Vondrák & Hrouzek. A further seven are recorded as new for European Russia [C. flavocitrina (Nyl.) H. Olivier, C. inconnexa (Nyl.) Zahlbr., C. marmorata (Bagl.) Jatta, C. oasis (A. Massal.) Szatala] or central European

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Russia [C. dichroa Arup, C. interfulgens (Nyl.) J. Steiner, C. monacensis (Leder.) Lettau]. Brief taxonomic comments, habitat preferences and distribution data are given for the newly recorded species, and 12 rare or otherwise interesting Caloplaca species are briefly presented.

**Material and methods**

The material was collected mostly by the first author in the Lipetsk, Orel, Ryazan and Voronezh regions of central European Russia between 1989 and 2013. The lichens are from steppe and taiga natural zones, mainly from calcareous rocky substrates. The study area was described in detail in Muchnik and Sliwa (2011, 2013) and Muchnik and Konoreva (2012a).

Lichens were identified by routine microscopic and laboratory techniques and by comparison with reference materials studied at KRAM and KPABG.

**Nomenclature.** According to the most recent classification of Teloschistaceae by Arup et al. (2013), the recognized species belong to the following genera: Athallia Arup, Frödén & Sochting [C. holocarpa (Hoffm.) A. E. Wade], Calogaya Arup, Frödén & Sochting [C. lobulata (Flörke) Hellb., C. pusilla (A. Massal.) Zahlbr.], Caloplaca Th. Fr. [C. monacensis (Leder.) Lettau, C. stillicidorum (Vahl.) Lyng], Flavoplaca Arup, Sochting & Frödén [C. dichroa Arup, C. flavocitrina (Nyl.) H. Olivier, C. oasis (A. Massal.) Szatala, C. polycarpa (A. Massal.) Zahlbr.], Leproplaca (Nyl.) Hue [C. chry sodeta (Vain. ex Räsänen) Dombr., C. cirrochroa (Ach.) Th. Fr.], Pyrenodesmia A. Massal. s.l. [C. atroflava (Turner) Mong. s.l., C. soralifera Vondrak & Hrouzek, Variospora Arup, Frödén & Sochting [C. velana (A. Massal.) Du Rietz] and Xanthocarpia A. Massal. & D. Not. [C. crenulatella (Nyl.) H. Olivier, C. interfulgens (Nyl.) J. Steiner, C. marmorata (Bagl.) Jatta]. For some of the discussed species, however, there are no appropriate new combinations provided, so the traditional names for all of species were followed in this paper.

Cited specimens are available at KRAM, KPABG, LE, OHHI, RSU, VOR and VU.

**Species new for Russia or its regions**

**Caloplaca atroflava** (Turner) Mong. s.l.

This species belongs to the problematic C. xerica group (sensu Vondrak et al. 2012) and its taxonomy is not fully clarified. The studied specimens represent the blastidiate variant of the taxon, which is more widely distributed than the non-sorediate morphotypes. The area of distribution of the blastidiate morphotype includes Europe as well as Central Asia and North America (Vondrak, unpublished). New for Russia.

**Specimens examined:** RUSSIA. VORONEZH reg. Bogucharsky district, near Monastyrschina village, 49°49.90′N, 40°55.25′E, alt. 119 m, on sandstone outcrops on steppe slope, 16 June 1994, E. Muchnik s.n. (VOR); Semiluksky district, near Gubaryovo village, Chernyshova Gora Nature Monument, 51°46.050′N, 39°02.033′E, alt. 147 m, on sandstone outcrops on steppe slope, 20 July 1989, E. Muchnik s.n. (LE).

**Caloplaca dichroa** Arup

The species belongs to the C. citrina group (Arup 2006) and previously was often mistaken for C. coronata. It differs by having tinier, blastidiate vegetative diasporas and the occasional presence of sandglass-type spores. Caloplaca coronata was also recognized in the area.

Widespread throughout Europe (Arup 2006; Vondrak et al. 2009) and previously reported in Russia from the Sea of Azov coast (Vondrak et al. 2009) and the Leningrad region (Vondrak et al. 2010). A new record for central European Russia.

**Specimens examined:** RUSSIA. LIPETSK region. Eletsky district, Eletsky Landscape Reserve, Demo vskiyi Kichy site, 52°34.552′N, 38°21.203′E, alt. 186 m, on limestone rock, 5 July 2012, E. Muchnik s.n. (VU); Zadonsky district, Galichya Gora State Reserve, 52°39.338′N, 38°59.410′E, alt. 147 m, on limestone rock, 30 June 2012, E. Muchnik s.n. (LE).

**Caloplaca flavocitrina** (Nyl.) H. Olivier

This is one of the ecologically broadest species within the C. citrina group. It is common on base-rich rocks, concrete and dust-impregnated bark. Records of C. citrina (Hoffm.) Th. Fr. from the region (Muchnik 2005, 2013; Gudovicheva 2011; Notov et al. 2011; Muchnik & Konoreva 2012a) may refer to this taxon.

**Caloplaca flavocitrina** is known throughout Europe (Arup 2006; Vondrak et al. 2009). In Russia it was previously reported from the Black

Specimens examined: RUSSIA. Ryazan region. Kasimovsky district, Scherbatovskie izvestnyaki Nature Monument, 54°48.298′N, 41°44.193′E, alt. 120 m, on limestone rock, 9 July 2009, E. Muchnik s.n. (RU); Eletsky district, Eletsky Landscape Reserve, Dernovskiye Kichy site, 52°34.552′N, 38°21.203′E, alt. 186 m, on limestone rock, 5 July 2012, E. Muchnik s.n. (LE).

Caloplaca inconnexa (Nyl.) Zahlbr.

Usually parasitic on the thallus of Acarospora cervina (Ach.) A. Massal., it occurs on calcareous rocks in Central and Mediterranean Europe (Vondrák & Wirth 2013; Vondrák et al. 2007). In Russia it was previously reported from the Caucasus (Urbanavichus & Andreev 2010). A new record for European Russia.

Specimens examined: RUSSIA. Lipetsk region. Krasninsky district, Nizovie Korytina sukhodola Nature Monument, on limestone outcrop on steppe slope, 23 July 1994, E. Muchnik s.n. (VOR); Lebedyansky district, Nizovya balky Pavelka Nature Monument, 52°53.556′N, 39°06.699′E, alt. 147 m, on limestone outcrop on steppe slope, 3 July 2012, E. Muchnik s.n. (LE). Orel region. Novosilsky district, near Vyazhy village, on bank of Zusha River, 53°01.064′N, 36°55.312′E, alt. 187 m, on limestone outcrop on steppe slope, 6 June 2013, E. Muchnik s.n. (OHHI).

Caloplaca interfulgens (Nyl.) J. Steiner

This species traditionally belongs to the C. lactea group (Navarro-Rosinés & Hladun 1996). It differs from other species within the group occurring in the area (C. cremlatella, C. lacteoides, C. marmorata) by having a yellow, well-developed thallus (Fig. 1). Caloplaca interfulgens superficially resembles some Teloschistaceae crusts within the genus Variospora. It was recently studied in detail by Vondrák et al. (2013).

Caloplaca interfulgens is known from desert or steppe in the Mediterranean region and Asia (Iran, Turkey, Kazakhstan), and some Central European localities (Navarro-Rosinés & Hladun 1996; Vondrák et al. 2011). In Russia the species was reported from the Orenburg region (Vondrák et al. 2013) but it seems to be common on calcareous rocks on the steppes of European Russia. A new record for central European Russia.

Specimens examined: RUSSIA. Lipetsk region. Eletsky district: Eletsky Landscape Reserve, Dernovskiy Kichy site, 52°34.552′N, 38°21.203′E, alt. 186 m, on limestone rock, 5 July 2012, E. Muchnik s.n. (VU); Pazhen Nature Monument, 52°36.00′N, 38°26.012′E, alt. 179 m, 2 May 2002, E. Muchnik s.n. (VOR); Lebedyansky district, Nizovya Krasivoj Mechy Nature Monument, Kurapovskiye skaly site, 52°57.530′N, 39°01.829′E, alt. 144 m, on limestone rock, 1 July 2012, E. Muchnik s.n. (VU); Zadonsky district, Galichya Gora State Reserve, Galichya Gora site, 52°39.338′N, 38°59.410′E, alt. 147 m, on limestone rock, 30 June 2012, E. Muchnik s.n. (VU).

Caloplaca marmorata (Bagl.) Jatta

Characterized by its endolithic thallus, red apothecia and thin spore septa. For comparison with other similar species see Navarro-Rosinés and Hladun (1996) and Wilk (2012). Caloplaca marmorata, a calcareous species, is reported mostly from limestone and dolomite in warm regions.

Widespread throughout Europe, the Near East and North Africa (Navarro-Rosinés & Hladun 1996; Vondrák et al. 2007, 2011), and also reported from North America (Wetmore 2007). In Russia it was previously reported from southern
Siberia (Makryi 2008) and the northeast Caucasus (Urbanavichus & Ismailov 2013). New for European Russia.

**Specimens examined:** RUSSIA. LIPETSK REGION. Lebedyansky district, Nizovya Krasivoy Mechy Nature Monument, Kurapovskiy skaly site, 52°57.530′N, 39°01.829′E, alt. 144 m, on limestone rock, 1 July 2012, E. Muchnik s.n. (LE). RIAZAN REGION. Shilovsky district, near Lubonos village, on high bank of Lubonos River, 54°33.149′N, 41°21.901′E, alt. 136 m, on limestone on stony steppe slope, 14 July 2011, E. Muchnik s.n. (RSU).

**Caloplaca monacensis** (Leder.) Lettau

An epiphytic species belonging to the *C. cerina* group (sensu Šoun et al. 2011) and *Caloplaca s.str.* (sensu Arup et al. 2013). It differs from other species within the group by its distinctly granular thallus without vegetative propagules. It might be confused with *C. cerina* s.l. (thallus smooth, without granules) and *C. chlorina* (thallus with soralia and blastidia; mostly saxicolous).

Widespread throughout Europe, occurring on solitary trees and in open deciduous or mixed forests (Šoun et al. 2011). In Russia it was previously reported from the European part of the Orenburg region (Šoun et al. 2011). New for central European Russia.


**Caloplaca oasis** (A. Massal.) Szatala

A normally parasitic lichen growing on the endolithic thalli of *Verrucaria s.l.* but also known as free-living. For comparison with the similar taxa *C. holocarpa* and *C. polycarpa* see Arup (2009). The latter two species were also recognized in the area (see below).

Widespread throughout Europe (Arup 2009) and the Near East (e.g., Temina & Brodo 2013). In Russia it was previously reported from northern Ural (Urbanavichus & Urbanavichene 2010). New for European Russia.

**Specimens examined:** RUSSIA. LIPETSK REGION. Eletsky district, bank of Yasnok River, near Baranovo village, 52°32.724′N, 38°05.455′E, alt. 181 m, on limestone rock in broadleaved forest, 21 July 1994, E. Muchnik s.n. (VOR). Krasninsky district, Sokolskaya gora Nature Monument, above bank of Don River, 52°47.868′N, 38°58.134′E, alt. 150 m, on limestone rock on steppe slope, 27 June 2012, E. Muchnik s.n. (LE). Lebedyansky district, Nizovya Krasivoy Mechy Nature Monument, Kurapovskiy skaly site, 52°57.530′N, 39°01.829′E, alt. 144 m, on limestone rock, 1 July 2012, E. Muchnik s.n. (LE).

**Caloplaca soralifera** Vondrák & Hrouzek

It belongs to the sorediate *Caloplaca* representatives lacking anthraquinones in the thallus (Vondrák & Hrouzek 2006). For comparison with other similar taxa see literature cited in this paragraph. A calcareous species occurring mostly on artificial substrates, less often on calcareous rocks, usually at sun-exposed sites (Vondrák & Hrouzek 2006). It seems to be a rather common but undercollected species in Europe. Also reported from North America (Wetmore 2009). For distribution data see Vondrák and Hrouzek (2006), Arup (2011), and Wilk & Śliwa (2012). New for Russia.

**Specimens examined:** RUSSIA. LIPETSK REGION. Terbinsky district: Romanov les Nature Monument, on bank of River Olym, 52°09.571′N, 38°04.894′E, alt. 158 m, on limestone outcrop at shaded site, 20 July 1994, E. Muchnik s.n. (LE). Apukhtinskiye peschaniki Nature Monument, 52°09.925′N, 38°06.760′E, alt. 200 m, on sandstone, 4 July 2012, E. Muchnik s.n. (LE).

**Further rare or interesting Caloplaca species recognized from the area**

**Caloplaca aff. atroalba** (Tuck.) Zahlbr.

This easily overlooked species is characterized by having dark brown apothecia, a creamy or brownish grey thallus and very thin spore septa. Morphologically and anatomically it is very similar
to the North American species *C. atroalba* but recent molecular studies indicate that the European specimens are separate from the North American *C. atroalba* and belong to undescribed taxa. The taxonomy and phylogeny of the group will be published separately (Vondrak *et al.*, in prep.). The European records of the taxon recently published from Poland and Ukraine (Wilk 2011, 2012) are conspecific with the examined material.

The only record for Russia was noted by Muchnik and Konoreva (2012b) but with no locality data provided.

**Specimen examined:** RUSSIA. Ryazan region. Miloslavsky district, valley of Kochurovka River, near Voyeykovo village, Kochurovskie skaly Nature Monument, 53°25.923′N, 39°10.738′E, alt. 152 m, on limestone rock, 28 May 2009, *E. Muchnik* s.n. (RSU).

*Caloplaca chrysodeta* (Vain. ex Räsänen) Dombr.

A rare species in central European Russia, previously reported elsewhere from the Galichya Gora State Reserve: Pluschan (Muchnik & Śliwa 2013), Tver region (Notov *et al.* 2011) and the Republic of Tatarstan (Evstigneeva 2007).

**Specimen examined:** RUSSIA. Ryazan region. Miloslavsky district, valley of Kochurovka River, near Voyeykovo village, Kochurovskie skaly Nature Monument, 53°25.923′N, 39°10.738′E, alt. 152 m, on limestone rock, 28 May 2009, *E. Muchnik* s.n. (RSU).

*Caloplaca cirrochroa* (Ach.) Th. Fr.

This is the second record of the species for central European Russia. Previously it was reported from the Tver region (Notov *et al.* 2011).

**Specimen examined:** RUSSIA. Lipetsk region. Krasninsky district, Galichya Gora State Reserve, Galichya Gora site, 52°39.338′N, 38°59.410′E, alt. 147 m, on limestone, 30 June 2012, *E. Muchnik* s.n. (RSU).

*Caloplaca crenulatella* (Nyl.) H. Olivier

The taxon is accepted here in the broad sense (*s.l.*) according to Vondrak *et al.* (2011). Phenotypically variable and probably comprising several species.

**Specimens examined:** RUSSIA. Lipetsk region. Eletsky district, Pazhen Nature Monument, stony steppe slope, on limestone, 2 May 2002, *E. Muchnik* s.n. (VU); Zadonsky district: near Donskoye village, Galychya Gora State Reserve, Galychya Gora area, on limestone, 16 Aug. 1961, *V.V. Matyushenko* s.n. (VU), near Lipovka village, stony steppe slope, on limestone, 11 July 2005, *L.N. Skolzneva* s.n. (VU). Ryazan region. Mikhailovsky district, 0.5 km east of ‘Zavidovsky doliny complex’ Nature Monument, 54°14.361′N, 38°47.054′E, stony steppe slope, on limestone, 27 May 2011, *E. Muchnik & L.A. Konoreva* s.n. (RSU); Putyatinsky district, Knyaginya village, 54°08.775′N, 40°45.171′E, 139 m, on concrete, 30 May 2010, *E. Muchnik & L.A. Konoreva* s.n. (RSU); Shilovsky district, near Lubonos village, 54°33.149′N, 41°21.901′E, alt. 136 m, high bank of Lubonos River, stony steppe slope, on limestone, 14 July 2011, *E. Muchnik* s.n. (RSU).

*Caloplaca holocarpa* (Hoffm.) A. E. Wade

Abundant throughout the area and known from many regions of central European Russia. Arup (2009) clarified the identity of *C. holocarpa* *s.str.* and separated it from the similar *C. oasis* and *C. pyracea*. Perhaps a common species in the region but only one specimen is confirmed so far.

**Specimen examined:** RUSSIA. Lipetsk region. Krasninsky district, Galichya Gora State Reserve, Bykova Sheya area, 52°55.942′N, 39°03.938′E, alt. 137 m, on sandstone, 29 June 2012, *E. Muchnik* s.n. (VU).

*Caloplaca lacteoides* Nav.-Ros. & Hladun

The species produces the biggest spores within the traditional *C. lactea* group. Further diagnostic features observed in the examined material are round cells in the paratheicium, a huge capitulate and simple paraphyses (Navarro-Rosinés & Hladun 1996).

Known from Spain, France, Israel, Syria and Turkey (Navarro-Rosinés & Hladun 1996). The only record for Russia was noted by Muchnik and Konoreva (2012b) but with no locality data provided.

**Specimens examined:** RUSSIA. Ryazan region. Kasimovsky district, right bank of River Oka near Scherbatovka village, Scherbatovskie izvestnyaki Nature Monument, 54°48.298′N, 41°44.193′E, alt. 120 m, on limestone, 2008, *L.F. Volosnova* s.n. (RSU, KRAM).
**Caloplaca lobulata** (Flörke) Hellb.

Two records of *C. lobulata* from the Voronezh region were confirmed in the present study. Elsewhere it has been reported from many continental regions of Eurasia.


**Caloplaca polyacarpa** (A. Massal.) Zahlbr.

A little-known species found in central European Russia, though probably not very rare. Previously reported from the Ryazan region by Muchnik and Śliwa (2013).

**Specimens examined:** RUSSIA. Lipetsk region. Eletsky district, Pazhen Nature Monument, stony steppe slope, on limestone, 2 May 2002, *E. Muchnik* s.n. (VU); Lebedyansky district, Nizovya Krasivoy Mechy Nature Monument, Kuravpovskiy skaly site, 52°57.530′N, 39°01.829′E, alt. 144 m, on limestone rock, 1 July 2012, *E. Muchnik* s.n. (VU); Zadonsky district: Nizovya reki Chichyora Nature Monument, above bank of Don River, 52°47.868′N, 38°58.134′E, alt. 150 m, steppe slope, 27 June 2012, *E. Muchnik* s.n. (VU). Lipetsk region. Krasninsky district, Sokolskaya gora Nature Monument, 54°24.045′N, 41°54.611′E, alt. 111 m, stony steppe slope, on carbonate soil, 2 June 2010, *E. Muchnik* s.n. (RSU).

**Caloplaca stillicidiorum** (Vahl) Lynge

Rather scattered throughout the area, especially occurring in central European Russia. Previously treated as a synonym of *C. cerina*, but Šoun *et al.* (2011) recognized it as distinct species.

**Specimen examined:** RUSSIA. Ryazan region. Sasovsky district, near Temogenevo village, Temgenevskiy izvestnyaki Nature Monument, 54°24.045′N, 41°54.611′E, alt. 111 m, stony steppe slope, on carbonate soil, 2 June 2010, *E. Muchnik* s.n. (RSU).

**Caloplaca velana** (A. Massal.) Du Rietz

The taxon is rarely reported from central European Russia; it is known from the Tula (Gudovicha 2011) and Tver regions (Notov *et al.* 2011). However, as its taxonomy is not yet clarified, the taxon is treated here in its broad sense (*s.l.*).

**Specimen examined:** RUSSIA. Lipetsk region. Eletsky district, Galychya Gora State Reserve, area Vor-golskiye scaly, Kopchyonyi Kamens plot, on limestone, 2 May 2002, *E. Muchnik* s.n. (VU).

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**Caloplaca rasaenennii** Breck.

Rare in central European Russia, previously found by L. A. Konoreva in the Belgorod region (specimen in KPABG) but not yet published.


**Caloplaca stillicidiorum** (Vahl) Lynge

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**Specimen examined:** RUSSIA. Ryazan region. Sasovsky district, near Temgenevo village, Temgenevskiy izvestnyaki Nature Monument, 54°24.045′N, 41°54.611′E, alt. 111 m, stony steppe slope, on carbonate soil, 2 June 2010, *E. Muchnik* s.n. (RSU).

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**Specimen examined:** RUSSIA. Lipetsk region. Eletsky district, Galychya Gora State Reserve, area Vor-golskiye scaly, Kopchyonyi Kamen plot, on limestone, 2 May 2002, *E. Muchnik* s.n. (VU).

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