MYCOTAXON

*Volume 111, pp. 241–250* *January–March 2010*

# The identity of type specimens in BP of some names in *Caloplaca*

Jan Vondrák[1], Alexander Khodosovtsev[2], László Lőkös[3], Olga Merkulova[4]

*j.vondrak@seznam.cz*
*[1]Department of Botany, Faculty of Science, University of South Bohemia Branišovská 31, CZ-370 05, České Budějovice, Czech Republic*

*khodosovtsev@ksu.ks.ua*
*[2]Department of Botany, Kherson State University 27 40 Rokiv Zovtnya, 27, Kherson, Ukraine*

*lokos@bot.nhmus.hu*
*[3]Department of Botany, Hungarian Natural History Museum H-1476 Budapest, Pf. 222, Hungary*

*mer.os@mail.ru*
*[4]Institute of Steppe (Urals Branch of Russian Academy of Sciences) Pionerskaya st. 11, Orenburg, RF-460000, Russia*

**Abstract** — Type materials held in BP of 16 specific and intraspecific names now placed in *Caloplaca* are appraised here. The names *Caloplaca balatonica*, *C. cerinella* f. *aggregata*, *C. lactea* var. *subimmersa*, *C. lactea* f. *densa*, *C. lallavei* f. *fulva*, *C. vitellinaria*, *C. vitellinoides,* and *Gasparrinia granulosa* f. *flavovirens* are reduced into synonymy of older names. We did not find any older synonyms for the names *Caloplaca brachyspora*, *C. flavovirescens* var. *persica*, *C. gyalolechiiformis*, *C. hungarica,* and *C. servitiana*. The identity of the names *C. lojkae*, *C. variabilis* f. *densa*, and *C. variabilis* f. *geographica* is presently unclear. *Caloplaca pseudocitrina* is reduced into synonymy with *C. gyalolechiiformis*. *Caloplaca servitiana* is considered to be different from another "black-fruiting" corticolous species *C. oleicola*. Lectotypes are designated for *Caloplaca brachyspora*, *C. lojkae,* and *C. servitiana*.

**Key words** — Hungary, Mereschkowsky, Szatala, *Teloschistaceae*

## Introduction

The Hungarian Natural History Museum in Budapest (BP) has a number of type collections of little-known lichen names. We selected type material of 16 specific and intraspecific names recently placed in *Caloplaca* (*Teloschistaceae*) for study. Authors of these names are Szatala (12), Mereschkowsky (1), Magnusson (1), Servít & Nádvorník (1) and Verseghy (1). Most of the names

are here reduced to synonymy of other names, but *Caloplaca brachyspora*, *C. flavovirescens* var. *persica*, *C. gyalolechiiformis*, *C. hungarica,* and *C. servitiana* represent well defined taxa.

## Materials and methods

The following characters were investigated in type materials: character and colour of thalli, size and colour of apothecia, size of ascospores and width of septa; spore length / width ratios and septum width / spore length ratios were calculated. Other characters (e.g. excipular structure or size of vegetative diaspores) were studied for only some of the species. The measurements are given as (min.–)X±SD(–max.), where X = mean value and SD = standard deviation. Total numbers of measurements are given in brackets [n]. Photographs were made of both the collections studied and their labels; images are archived at: http://botanika.bf.jcu.cz/lichenology/index. php?pg=5&func=cat&idx=4.

## The names

The accepted name for each taxon is presented in bold font.

1. *Caloplaca balatonica* Szatala, Ann. Hist.-Nat. Mus. Natl. Hungarici, s.n. 7: 275 (1956)

   Type: [Hungaria, Balatonicum, Kővágóörs, ad rup. arenac., 6.8.1940, leg. V. Kőfaragó-Gyelnik]; BP_27077, holotype.

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

The type specimen possesses a very thin greyish (in spots yellowish) thallus and orange-red apothecia, c. 0.3–0.5 mm in diam. Ascospores are (11.0–)12.4±0.8(–13.75) × (6.5–)7.9±0.9(–9.0) µm in size [10]; spore length / width ratio: (1.3–)1.6±0.2(–1.9). Ascospore septa (5.0–)5.9±0.4(–6.25) µm wide [10]; septum width / spore length: (0.36–)0.47±0.04(–0.51). It grows on a siliceous substrate together with *Acarospora fuscata* (Nyl.) Arnold and *Candelariella vitellina* (Hoffm.) Müll. Arg. Its morphological and ecological characters agree well with *Caloplaca holocarpa* and we propose to reduce *C. balatonica* into synonymy with *C. holocarpa*.

2. ***Caloplaca brachyspora*** Mereschk., Lich. Ross. Exs., fasc. 22, no. 276 (1913)

   Lectotype, designated here: Ukraine. Crimea: [ad lapides calcareas in sylvis ombrosis monasterii Kozma Demian, in Peninsula Taurica, leg. & det. C. Mereschkowsky 1910], BP_27078 (KW, LE, isolectotypes).

We examined syntypes (Mereschkowsky: Lichenes Rossiae Exsiccati 276) in BP, KW and LE and consider them identical. We selected the specimen in BP as a lectotype.

The syntypes superficially resemble *Caloplaca ferrarii* (Bagl.) Jatta; they have orange apothecia, c. 0.5–0.7 mm in diam., with paler margin on a very thin, ± endolithic, pale-grey thallus. Their ascospores are, however, distinctly shorter than in *C. ferrarii*; in the BP specimen, (8.0–)9.4±1.0(–11.25) × (5.0–)5.8±0.8 (–7.5) µm in size [10]; spore length / width ratio: (1.1–)1.6±0.3(–2.05). Ascospore septa (2.25–)2.55±0.2(–3.0) µm wide [10]; septum width / spore length: (0.36–)0.47±0.04(–0.51). Although this species is so far (for 100 years) known only from the type locality, it is well characterized and we have not found any other conspecific taxa.

3. *Caloplaca cerinella* f. *aggregata* Szatala, Ann. Hist.-Nat. Mus. Natl. Hungarici, s.n. 7: 274 (1956)

Type: Hungary. [Miskolc: ad Görömbölytapolca, supra corticem Aceris tatarici, leg. Fr. Hazslinszky]; BP_27140, holotype.

= ***Caloplaca cerinella*** (Nyl.) Flagey

The type material is typical *Caloplaca cerinella* with small yellow apothecia (< 0.3 mm in diam.), short asci (45–55 µm long) containing 14–15 ascospores; ascospores small, (7.0–)10.1±1.5(–12.0) × (5.5–)6.3±0.5(–7.0) µm in size [10]; spore length / width ratio: (1.1–)1.6±0.25(–2.0). Ascospore septa (3.0–) 4.75±0.7(–5.5) µm wide [10]; septum width / spore length: (0.42–)0.47±0.04 (–0.54).

4. ***Caloplaca flavovirescens* var. *persica*** Szatala, in Rechinger, Ann. Naturh. Mus. Wien 50: 531 (1940)

Type: Iran. Prov. Khorasan: [in valle fluvii Atrek inter Shirvan et Budjnurd], 25.-27.6.1937, leg. K.H. Rechinger; BP_34075, holotype.

The type specimen has a yellow thallus of tall, convex areoles and orange apothecia, c. 0.3–0.5 mm in diam. Ascospores (11.25–)13.1±1.3(–15.0) × (5.25–) 6.3±0.8(–8.0) µm in size [10]; spore length / width ratio: (1.6–)2.1±0.4(–2.9). Ascospore septa (2.25–)3.4±0.6(–4.25) µm wide [10]; septum width / spore length: (0.18–)0.25±0.03(–0.29). The specimen occurs on calcareous rock with *Caloplaca bullata* (Müll. Arg.) Zahlbr., and *Candelariella oleaginescens* Rondon.

5. ***Caloplaca gyalolechiiformis*** Szatala, Ann. Hist.-Nat. Mus. Natl. Hungarici, s.n. 7: 276 (1956)

Type: [Hungaria. Pr. pag. Nógrád, in decl. m. Várhegy, siliceicola, 17.8.1937, leg. V. Kőfaragó-Gyelnik]; BP_27571, holotype; BP_27569, 27570, isotypes.

= *Caloplaca pseudocitrina* Khodos. & Kudratov

Type: Tajikistan [Southern Tajikistan, Chormagzak pass, locality `Schizbibi`, alt. 1850 m, 1968, leg. I. Kudratov]; KW!, isotype.

Although the species superficially resembles *Caloplaca flavocitrina* (Nyl.) H. Olivier or some other species from the *Caloplaca citrina* group (sensu Vondrák et al. 2009), it is related to *C. crenulatella* (our unpublished molecular data). This is supported by its ascospore characters; in the type material, (14.5–) 17.25±1.9(–19.5) × (5.0–)6.7±1.3(–9.5) µm in size [10]; spore length / width ratio: (2.0–)2.64±0.43(–3.41). Ascospore septa (1.0–)1.68±0.46(–2.5) µm wide [10]; septum width / spore length: (0.06–)0.09±0.03(–0.15). The type material was collected from volcanic rock with accompanying *C. crenulatella*.

The description of *Caloplaca pseudocitrina* is in accordance with *C. gyalolechiiformis* (Kondratyuk et al. 2002) and its isotype in KW is obviously conspecific. Although the species is at present only known from Hungary (Szatala 1956) and Tajikistan (Kondratyuk et al. 2002), it is apparently a widely distributed species, not rare in arid regions of the Near and Middle East (our unpublished data).

6. ***Caloplaca hungarica*** H. Magn., Kungl. Vetenskaps- och Vitterhets-samhälles Handlingar, Sjätte Följden, ser. B 3: 28 (1944)

Type: [Hungaria. Com. Veszprém, in cortice ex Abiete pariete circa Juhászház, pr. pag. Szent Ivan, alt. ca 200 m s m, 1 Marc. 1917, leg. F. Fóriss, det. H. Magnusson]; BP_71731, holotype.

The holotype has deep red apothecia that are C+ purple (containing chlorinated anthraquinones) and forms small and thin thalli; individual thalli usually up to 5 mm in diam. and up to 150 µm thick. Apothecia c. 0.3–0.5(–0.7) mm in diam.; ascospores (9.5–)11.6±0.9(–12.5) × (5.5–)6.4±0.7(–7.5) µm in size [10]; spore length / width ratio: (1.5–)1.8±0.19(–2.0). Ascospore septa (3.25–)4.3±0.9 (–6.25) µm wide [10]; septum width / spore length: (0.28–)0.37±0.08(–0.53). It is a well characterized species and we have not found any other conspecific taxa.

*Caloplaca ferruginea* (Huds.) Th. Fr. differs in having apothecia 1–2 mm in diam. (Fletcher & Laundon 2009), larger thalli (often more than 1 cm in diam.) and larger ascospores, (13–)15–17 × 8–8.5(–9) µm in size with septa (5–)7–8.5 µm thick (Magnusson 1944).

7. *Caloplaca lactea* var. *subimmersa* Szatala, Ann. Hist.-Nat. Mus. Natl. Hungarici, s.n. 7: 275 (1956)

Type: Hungary. [Budakalász: in monte Monalováchegy, alt. ca 270 m, ad saxa calcarea, 25.4.1926, leg. G. Timkó]; BP_27642, holotype; BP_27643, isotype.

= ***Caloplaca lactea*** (A. Massal.) Zahlbr.

The type material is typical *Caloplaca lactea* sensu Navarro-Rosinés & Hladun (1996) possessing an endolithic inconspicuous thallus, small pale orange

apothecia (up to 0.3 mm in diam.) and ascospores (13.25–)14.8±0.75(–16.0) × (5.5–)6.9±0.8(–8.25) µm in size [10]; spore length / width ratio: (1.75–)2.2 ±0.3(–2.7). Ascospore septa (2.25–)2.8±0.3(–3.25) µm wide [10]; septum width / spore length: (0.16–)0.19±0.02(–0.23). Apothecia are sessile but low and impressed among crystals of limestone; the name *subimmersa* probably reflects this appearance.

8. *Caloplaca lactea* f. *densa* Szatala, Ann. Hist.-Nat. Mus. Natl. Hungarici, s.n. 7: 275 (1956)

Type: Hungary. [Szentes, ad murum, 1.6.1939, leg. J. Olasz]; BP_27615, holotype.

= ***Caloplaca crenulatella*** (Nyl.) H. Olivier

The holotype is conspecific with *C. crenulatella*; apothecia up to 0.5 mm in diam., pale orange with yellowish outer exciple, thallus inconspicuous consisting of small yellow areoles around apothecia, ascospores (14.0–)15.3±0.8(–16.25) × (6.0–)6.5±0.7(–8.0) µm [10], length / width ratio (2.0–)2.4±0.2(–2.7), septum (2.25–)2.7±0.25(–3.0) µm [10], septum width / spore length ratio (0.14–)0.17 ±0.03(–0.21). The type specimen grows on concrete, a typical substrate for *C. crenulatella*; accompanying species are *C. decipiens* (Arnold) Blomb. & Forssell, *C. soralifera* Vondrák & Hrouzek, and *C. teicholyta* (Ach.) J. Steiner.

9. *Caloplaca lallavei* f. *fulva* Szatala, in Verseghy, Studia bot. hung. 9: 24 (1974), nom. nud.

= ***Caloplaca erythrocarpa*** (Pers.) Zwackh

The name cannot be formally typified as it was never validly published by Szatala; it appears only in Verseghy (1974) as a nomen nudum. The material in BP consists of three envelopes; BP_27659, BP_27660 and BP_27661. All of them are conspecific with *Caloplaca erythrocarpa*; they form white thalli, up to 1 mm in diam., apothecia are deep red (strong C+ purple reaction), very low and small (up to 0.5 mm in diam.), vegetative diaspores (blastidia, etc.) are absent. Ascospores (10.75–)12.7±1.2(–14.0) × (6.0–)6.7±0.5(–7.5) µm [10], length / width ratio (1.5–)1.9±0.3(–2.3), septum thin, (2.75–)3.7±0.6(–4.75) µm [10], septum width / spore length ratio (0.25–)0.29±0.03(–0.35). The specimens grow on calcareous rock with accompanying *Caloplaca variabilis* s.l., *Candelariella aurella* (Hoffm.) Zahlbr., *Caloplaca oasis* (A. Massal.) Szatala, and *C. polycarpa* (A. Massal.) Zahlbr.

10. ***Caloplaca lojkae*** Servít & Nádv., Věstn. Král. Čes. spol. Nauk, třída mat.-přír. 1935: 20 (1936)

Lectotype, designated here: Romania. [supra lapides inundatos micaceo-schistosis in rivulo vallis "Riu sor" infra alpem Retyezát, comit. Hunyad in Transylvania, leg.

H. Lojka]; H. Lojka: Lich. Reg. Hung. Exs., 121; BP_27697 sub *Lecanora aurantiaca* f. *inalpina*.

The specimen resembles some samples of *Caloplaca percrocata* (Arnold) J. Steiner but it has much smaller ascospores and lacks a cortex; it may represent a rare, separate species. It possesses a pale grey smooth rimose thallus and brown-red apothecia, C+ slightly red. Apothecia up to 0.6 mm in diam., zeorine, with outer thalline exciple c. 80–100 µm thick and true exciple c. 40–60 µm thick. Inner part of true exciple and lower hypothecium ± paraplectenchymatous. Ascospores (10.25–)11.25±0.8(–12.5) × (5.75–)6.9±0.9(–8.75) µm [10], length / width ratio (1.3–)1.6±0.2(–1.9), septum (2.75–)3.5±0.6(–4.5) µm [10], septum width / spore length ratio (0.25–)0.31±0.06(–0.41).

Two specimens are mentioned in the protologue; "H. Lojka: Lich. Reg. Hung. Exs., 121" is the first one with a notice "Nation. Mus. Budapest". This is the one designated above as lectotype.

11. ***Caloplaca servitiana*** Szatala, in Rechinger, Denkschr. Akad. Wiss. Math. Nat. wiss. Kl. Wien 105: 51 (1943)

LECTOTYPE, DESIGNATED HERE: Greece. [Samos*:* M. Kerki, ca 800 m s. m., supra corticem]; 18.6.1932, leg. K. H. Rechinger, BP_34015 (W_9203, isolectotype!).

The specimen represents a black-fruiting, corticolous *Caloplaca* without anthraquinones. It has a dark grey thin thallus not producing any vegetative diaspores and brown-black apothecia, up to 1 mm in diam. True exciple well developed, grey when wet, 60–100 µm thick; thalline exciple (80–100 µm thick) usually hidden on lower side of apothecial margin. Some old apothecia convex with receding margins. Pigments in epihymenium and outer true exciple correspond with Sedifolia-grey (sensu Meyer & Printzen 2000). Ascospores (13.75–)14.7±0.6(–15.5) × (5.5–)6.4±0.5(–7.25) µm [10], length / width ratio (2.1–)2.3±0.2(–2.7), septum (5.5–)6.6±1.0(–8.25) µm [10], septum width / spore length ratio (0.37–)0.45±0.07(–0.55). According to the ITS sequence of fresh material conspecific with *C. servitiana* (Greece. Pindos Mts: Dasiko Khorio, *T. Spribille 16225*!, duplicate in CBFS), the species does not belong to the monophyletic *Pyrenodesmia* group of the "black-fruiting" species.

Apart from the material in BP, another syntype was found in W (9203). The specimen in W is a small thallus of *Caloplaca servitiana* which agrees morphologically with the sample in BP; it is accompanied by *Lecidella elaeochroma* (Ach.) M. Choisy and *Rinodina exigua* (Ach.) Gray.

*Caloplaca oleicola* (J. Steiner) Van den Boom & Breuss, another black-fruiting, corticolous *Caloplaca* species, is clearly distinct from *C. servitiana.* Its type specimen (Italy. *Liguria:* Rojatal, on bark of *Olea europaea*, 1907, *Brunnthaller;* WU, holotype!) has a thin white thallus and biatorine apothecia with prosoplectenchymatous true exciple and without a thalline exciple.

Pigments in outer exciple and epihymenium are anthraquinones (K+ strongly violet, K→HCl+ yellow, N+ orange, N→K+ violet-blue, N→K→HCl+ yellow, C–). Ascospores (11.0–)12.8±1.0(–14.0) × (6.5–)7.25±0.5(–8.0) µm [10], length / width ratio (1.6–)1.8±0.1(–1.9), septum (4.25–)5.2±0.7(–6.5) µm [10], septum width / spore length ratio (0.32–)0.4±0.04(–0.46). Some ascospores are of a sand-glass type (see Figs 6–8 in Navarro-Rosinés et al. 2000), with widened wall up to 1 µm. Some other details of this type specimen are present in van den Boom & Etayo (1995).

12. *Caloplaca variabilis* f. *densa* Szatala, Ann. Hist.-Nat. Mus. Natl. Hungarici, s.n. 7: 275 (1956)

Type: Hungary. [Comit. Borsod: Diósgyőr, ad saxa calcarea, leg. Fr. Hazslinszky]; BP_27988, holotype.

= ***Caloplaca variabilis*** s. lat. (the same concept was used in Verseghy 1988, 1994)

The type material belongs in the "black-fruiting" *Pyrenodesmia* group, but its exact identification is difficult, as it belongs to the *Caloplaca variabilis* complex, which has been considered heterogeneous (Muggia et al. 2008; our unpublished data).

The specimen has a grey thallus, 100–300 µm thick with Sedifolia-grey pigment (K+ violet) in the cortical tissue. Apothecia up to 1 mm in diam., in dense groups, often with angular margins. Disc brown, rarely white pruinose, true exciple dark brown (containing K+ Sedifolia-grey), 50–80 µm thick and thalline exciple 80–120 µm thick, ± white pruinose. Ascospores (11.0–)13.4±1.9(–17.75) × (6.0–)6.6±0.6(–8.0) µm [10], length / width ratio (1.5–)2.0±0.4(–3.0), septum (2.5–)2.8±0.25(–3.25) µm [10], septum width / spore length ratio (0.15–)0.21±0.03(–0.24).

13. *Caloplaca variabilis* f. *geographica* Szatala, Ann. Hist.-Nat. Mus. Natl. Hungarici, s.n. 7: 275 (1956)

Type: Hungary. [Comit. Pest. Margitliget: in monte Oszoly, alt. ca 300 m, ad saxa calcarea, 13.4.1925, leg. V. Gyelnik]; BP_27990, holotype.

= ***Caloplaca variabilis*** s. lat.

The type material represents another species from a "black-fruiting" *Pyrenodesmia* group; its exact identification is difficult for the same reason as with *Caloplaca variabilis* f. *densa*.

The specimen possesses a grey thallus, 100–250 µm tall with presence of K+ pigment Sedifolia-grey in cortical tissue. Individual thalli (c. 1 cm in diam.) are delimited by a thin black prothallus line (probably the reason for the epithet *geographica*). Apothecia low, up to 0.6 mm in diam., disc and true exciple blackish (containing K+ Sedifolia-grey), thalline exciple grey, ± white pruinose. Ascospores (11.5–)14.0±2.2(–17.0) × (5.0–)6.7±0.8(–7.75) µm [10],

length / width ratio (1.6–)2.1±0.3(–2.6), septum (2.5–)3.2±0.4(–3.5) µm [10], septum width / spore length ratio (0.2–)0.23±0.02(–0.26).

14. *Caloplaca vitellinaria* Szatala, Ann. Hist.-Nat. Mus. Natl. Hungarici, s.n. 7: 276 (1956)

Type: [Hungaria. Comit. Zala: prope pagum Szigliget, in m. Szigliget, ad muros basalticos ruinae, 20.7.1933, leg. V. Gyelnik, det. Ö. Szatala]; BP_28055, holotype.

= ***Caloplaca holocarpa*** (Hoffm.) A.E. Wade (the same concept was used in Arup 2009: 123)

Morphological characters of the type agree with *Caloplaca holocarpa*. Orange-red apothecia (0.2–0.7 mm in diam.) are densely aggregated on inconspicuous thallus; ascospores (12.5–)13.7±0.8(–15.0) × (6.5–)7.8±0.9(–9.75) µm in size [10]; spore length / width ratio: (1.5–)1.8±0.16(–2.2). Ascospore septa (4.5–)5.9±0.7(–6.75) µm wide [10]; septum width / spore length: (0.32–)0.43±0.05(–0.48). Growing on siliceous stone together with *Candelariella vitellina*; this matches the ecology of *C. holocarpa*.

Szatala (1956) described *C. vitellinaria* as a lichenicolous lichen on *Candelariella vitellina*. According to our observations, apothecia of *Caloplaca* usually grow very close to *Candelariella* squamules, but sometimes alone. Thus, it cannot be considered an obligate lichenicolous lichen, such as *Caloplaca grimmiae* (Nyl.) H. Olivier on *Candelariella*.

15. *Caloplaca vitellinoides* Verseghy, Studia bot. hung. 8: 49 (1973)

Type: Hungary. [ad rupes andesiticas toffineas pr. pag. Szentendre, comit. Pest, cca 160 m. s. m., 10.10.1925, leg. G. Timkó, det. Ö. Szatala]; BP_28057, holotype.

= ***Caloplaca crenulatella*** (Nyl.) H. Olivier

The holotype of *Caloplaca vitellinoides* is conspecific with *C. crenulatella*; apothecia (0.2–0.45 mm in diam.) pale orange with yellowish outer exciple, thallus inconspicuous, ascospores (14.25–)15.4±0.75(–16.75) × (4.75–)6.0±0.2(–7.75) µm [9], length / width ratio (1.8–)2.6±0.6(–3.5), septum (2.0–)2.5±0.7(–4.25) µm [9], septum width / spore length ratio (0.1–)0.16±0.04(–0.28).

16. *Gasparrinia granulosa* f. *flavovirens* Szatala, Ann. Hist.-Nat. Mus. Natl. Hungarici, s.n. 7: 277 (1956)

Type: Hungary. [Veszprém: in decl. montis Szent Benedekhegy, alt. ca 300 m, ad saxa calcarea, 12.8.1925, leg. V. Gyelnik]; BP_28523, holotype.

= ***Caloplaca granulosa*** (Müll. Arg.) Jatta (the same concept was used in Verseghy 1988, 1994)

The specimen is conspecific with *Caloplaca granulosa*. It possesses orbicular yellow thalli, somewhat similar to *Candelariella medians* (Nyl.) A.L. Sm., but it

contains anthraquinones. Marginal lobes are small, 0.1–0.8 mm wide; areoles in the thallus centre are entirely covered by blastidia, c. 50–300 μm in diam. In the holotype, *C. granulosa* grows together with *C. saxicola* s.l.

## Acknowledgements

Toby Spribille kindly provided his herbarium material and reviewed the manuscript. Linda in Arcadia and Shaun Pennycook made lots of valuable comments on the manuscript. Our research was supported by the Hungarian Scientific Research Fund (OTKA T47160) and the Grant Agency of the Academy of Sciences of the Czech Republic (KJB 601410701).

## Literature cited

Arup U. 2009. The *Caloplaca holocarpa* group in the Nordic countries, except Iceland. Lichenologist 41: 111–130.

van den Boom PPG, Etayo J. 1995. A new epiphytic species of the lichen genus *Caloplaca* from southwestern Europe. Mycotaxon 56: 125–132.

Fletcher A, Laundon J. 2009. *Caloplaca*. In: CW Smith et al. (eds), The lichens of Great Britain and Ireland. pp. 245–273. The British Lichen Society, London.

Kondratyuk S, Kärnefelt I, Kudratov I, Khodosovtsev A. 2002. Two new species of *Caloplaca* from Tadjikistan, Central Asia. – Nordic Journal of Botany 22(5): 633–640.

Meyer B, Printzen C. 2000. Proposal for a standardized nomenclature and characterization of insoluble lichen pigments. Lichenologist 32(6): 571–583.

Magnusson AH. 1944. Studies in the *ferruginea*-group of the genus *Caloplaca*. Kunglia Vetenskaps- och Vitterhets-samhälles Handlingar, Sjätte Följden, ser. B 3: 3–71.

Muggia L, Grube M, Tretiach M. 2008. A combined molecular and morphological approach to species delimitation in black-fruited, endolithic *Caloplaca*: high genetic and low morphological diversity. Mycological Research 112: 36–49.

Navarro-Rosinés P, Gaya E, Roux C. 2000. *Caloplaca calcitrapa* sp. nov. (*Teloschistaceae*) un nuevo liquen saxícolo-calcícola mediterráneo. Bulletin de la Société Linnéenne de Provence 51: 145–152.

Navarro-Rosinés P, Hladun NL. 1996. Les especies saxícolo-calcícolas del grupo de *Caloplaca lactea* (*Teloschistaceae*, líquenes), en las regiones mediterranea y medioeuropea. Bulletin de la Société Linnéenne de Provence 47: 139–166.

Servít M, Nádvorník J. 1936. Flechten aus der Čechoslovakei V. Karpatho-Russland. Věstn. Král. Čes. spol. Nauk, třída mat.-přír. 1935: 1–24.

Szatala Ö. 1940. Lichenes. In: KH Rechinger (ed.), Ergebnisse einer botanischen Reise nach dem Iran, 1937. Ann. Naturh. Mus. Wien 50: 521–533.

Szatala Ö. 1943. Lichenes. In: KH Rechinger (ed.), Flora Aegaea, flora der Inseln u. Halbinseln des Aegeischen Meeres. Denkschr. Akad. Wiss. Math. Nat. wiss. Kl. Wien 105(1): 16–58.

Szatala Ö. 1956. Neue Flechten. V. Ann. Hist.-Nat. Mus. Natl. Hungarici, ser. nov. 7: 271–282.

Verseghy K. 1973. *Caloplaca*-Arten in Ungarn. (Hazai *Caloplaca*-fajok). Studia bot. hung. 8: 33–64.

Verseghy K. 1974. Nachtrag II. zum "Typenverzeichnis der Flechtensammlung in der Botanischen Abteilung des Ungarischen Naturwissenschaftlichen Museums". Studia bot. hung. 9: 23–29.

Verseghy K. 1988. Magyarországi zuzmóflóra revíziójának eredményei. (Ergebnisse der Revision der Flechtenflora von Ungarn). Bot. Közlem. 74–75(1–2): 31–46 (1987–88).

Verseghy K. 1994. Magyarország zuzmóflórájának kézikönyve. (The lichen flora of Hungary). Magyar Természettudományi Múzeum, Budapest, 415 pp.

Vondrák J, Říha P, Arup U, Søchting U. 2009. The taxonomy of the *Caloplaca citrina* group (*Teloschistaceae*) in the Black Sea region; with contributions to the cryptic species concept in lichenology. Lichenologist 41: 571–604.