



Original Scientific Paper

Records of lichen species new for Ukraine from steppe habitats of the country

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ABSTRACT:

The lichens *Arthonia cretacea*, *Bacidia viridescens*, *Candelariella blastidiata*, *C. xanthostigmoides*, *Enchylium bachmanianum*, *Haematomma nemetzii*, *Lecania triseptata*, *Lecidea sarcogynoides*, *Ramalina europaea*, *Sarcogyne praetermissa* and *Xanthocarpia diffusa* are reported for the first time from Ukraine. *Xanthocarpia interfulgens* is confirmed from an arid Ukrainian landscape. Locations, herbarium deposits and substrates are given, together with notes on worldwide distribution of the reported taxa and morphological differences from similar species.

Keywords:

Arthonia, *Bacidia*, *Candelariella*, *Enchylium*, *Haematomma*, *Lecania*, *Lecidea*, *Ramalina*, *Sarcogyne*, *Xanthocarpia*, loess, granite, limestone, bark

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INTRODUCTION

Lichenological research on the territory of Ukraine began from the middle of the 19th century (LEVEILLE 1842). After several national inventories (KONDRATYUK *et al.* 1996, 1998; DARMOSTUK & KHODOSOVTSSEV 2017), more than 1800 lichen-forming, lichenicolous and allied fungi were registered in Ukraine. Nonetheless, unknown lichens and lichenicolous fungi are still the object of study by lichenologists. Recently, the following new lichen-forming and lichenicolous fungi were described from Ukraine: *Caloplaca emilii* Vondrák, Khodos., Cl. Roux & V. Wirth (VONDRÁK *et al.* 2013); *C. dzhankoiensis* S.Y. Kondr. (KONDRATYUK *et al.* 2013); *C. orloviana* S.Y. Kondr. (KONDRATYUK *et al.* 2020); *Pyrenodesmia microstepposa* (Frolov, Nadyeina, Khodos. & Vondrák) Hafellner & Türk (FROLOV *et al.* 2016); *Biatora radicecola* Printzen, Palice & J.P. Halda (PRINTZEN *et al.* 2016); *Lecanora orlovii* S.Y. Kondr. & L. Lőkös (KONDRATYUK *et al.* 2019); *Lecanora substerilis* Malíček & Vondrák (MALÍČEK *et al.* 2017); *Lichenochora hypanica* S.Y. Kondr. (KONDRATYUK *et al.* 2014); *Pleospora xanthoriae* Khodos. & Darmostuk (KHODOSOVTSSEV & DARMOSTUK 2016a); *Physcia*

ucrainica S.Y. Kondr., L. Lőkös & Hur (KONDRATYUK *et al.* 2015); *Trichoconis hafellneri* U. Braun, Khodos., Darmostuk & Diederich (BRAUN *et al.* 2016); *Katherinomyces cetrariae* Khodos., Gayrylenko & Klymenko and *Didymocyrtis trassii* Suija, Darmostuk & Khodos. (KHODOSOVTSSEV *et al.* 2016, 2018); *Zwackhiomyces polischukii* Darmostuk & Khodos. (KHODOSOVTSSEV & DARMOSTUK 2017); and *Roselliniella lecideae* Darmostuk, Khodos. & Naumovich (DARMOSTUK *et al.* 2018). Most of the above-mentioned new species were collected from the steppe zone.

The steppe zone of Ukraine has suitable habitats for lichens, including ones such as crystalline massifs, sand splits, old artificial forests and outcrops of Pontic limestone (KUZEMKO *et al.* 2018). The study area has various outcrops (for example, granite in the Ukrainian Crystalline Massif, sandstone, chalk and limestone in the Donetsk Ridge) in its northern part, whereas the southern part is covered by Sarmatian Miocene and Pontic Neogene limestone with Quaternary loess sediments (MARYNYCH & SHYSHENKO 2005). However, the main part of the territory has agricultural landscapes, including windbreaks and artificial forests. The climate is continental. The altitude

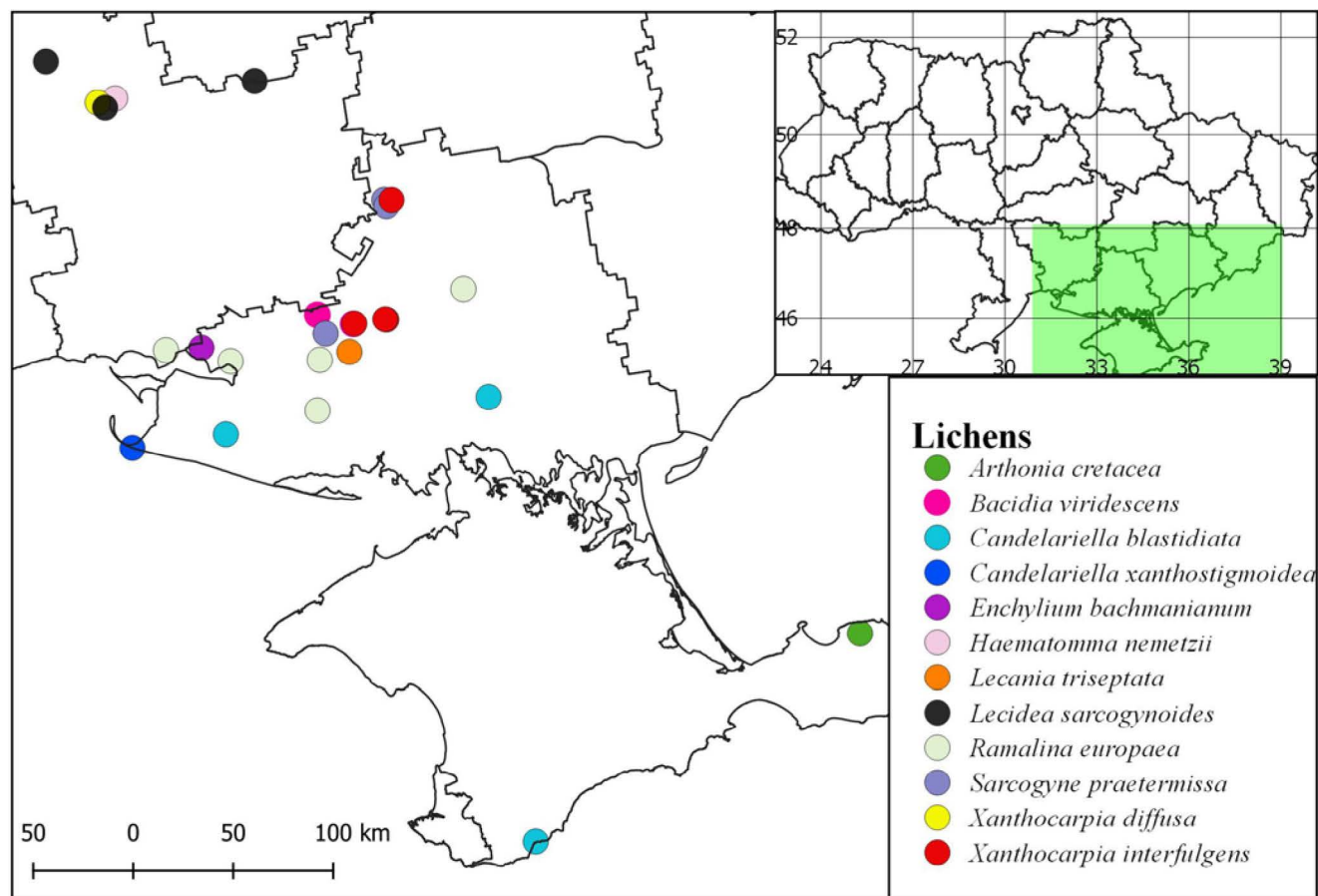


Fig. 1. Map showing locations where lichens new to Ukraine were recorded.

range in the steppe zone is from 0 to 367 m a.s.l. Annual precipitation is 400-500 mm per year. The average annual temperature is 9-10°C, the average June temperature is 23-24°C and the average January temperature is from -3 to 4°C (MARYNYCH *et al.* 1985).

The Ukrainian steppe zone has appropriate habitats and conditions for rare and noteworthy lichen species. This publication is a continuation of the list of new lichen records from the territory in question (KHODOSOVTSSEV & DARMOSTUK 2016b, 2018). Twelve lichen species new for Ukraine from these habitats are presented in the article.

MATERIAL AND METHODS

Most of the material was collected by the authors during expeditions in the steppe zone between 2017 and 2019, although some early herbarium collections made by the first author from 2001 to 2015 were also used (Fig. 1). Specimens were examined with Optica-1 and MICROMED-2 microscopes using standard microscope techniques. Microscopic examination was done in water, 10% KOH (K), and Lugol's iodine, directly (I) or after a KOH pretreatment (K/I) (SMITH *et al.* 2009). Photographs were taken with a Levenhuk C510 camera. All

examined specimens are deposited in the lichenological herbarium of Kherson State University (KHER).

RESULTS AND DISCUSSION

Eleven species [*Arthonia cretacea* Zahlbr., *Bacidia viridescens* (A. Massal.) Hellb., *Candelariella blastidiata* Yakovch., *C. xanthostigmoidea* (Müll. Arg.) R.W. Rogers, *Enchylium bachmanianum* (Fink) Otálora, P.M. Jørg. & Wedin, *Haematomma nemetzii* J. Steiner, *Lecania triseptata* (Vain.) Zahlbr., *Lecidea sarcogynoides* Körb., *Ramalina europaea* Gasparyan, Sipman & Lüicking, *Sarcogyne praetermissa* K.Knudsen & Kocourk and *Xanthocarpia diffusa* (Vondrák & Llimona) Frödén, Arup & Söchting] were not registered in the last Ukrainian checklist of lichens and lichenicolous fungi (OXNER 2010) or in recent Ukrainian lichenological papers (KONDRATYUK *et al.* 2013, 2020; KHODOSOVTSSEV & DARMOSTUK 2018), and they are new for Ukraine. Specimens of '*Caloplaca interfulgens* auct.' (KHODOSOVTSSEV 2001) were confirmed as *Xanthocarpia interfulgens* (Nyl.) Frödén, Arup & Söchting s. str. and added to the collection from arid landscapes of Ukraine. Locations, herbarium deposits and substrates are given below for each taxon, together

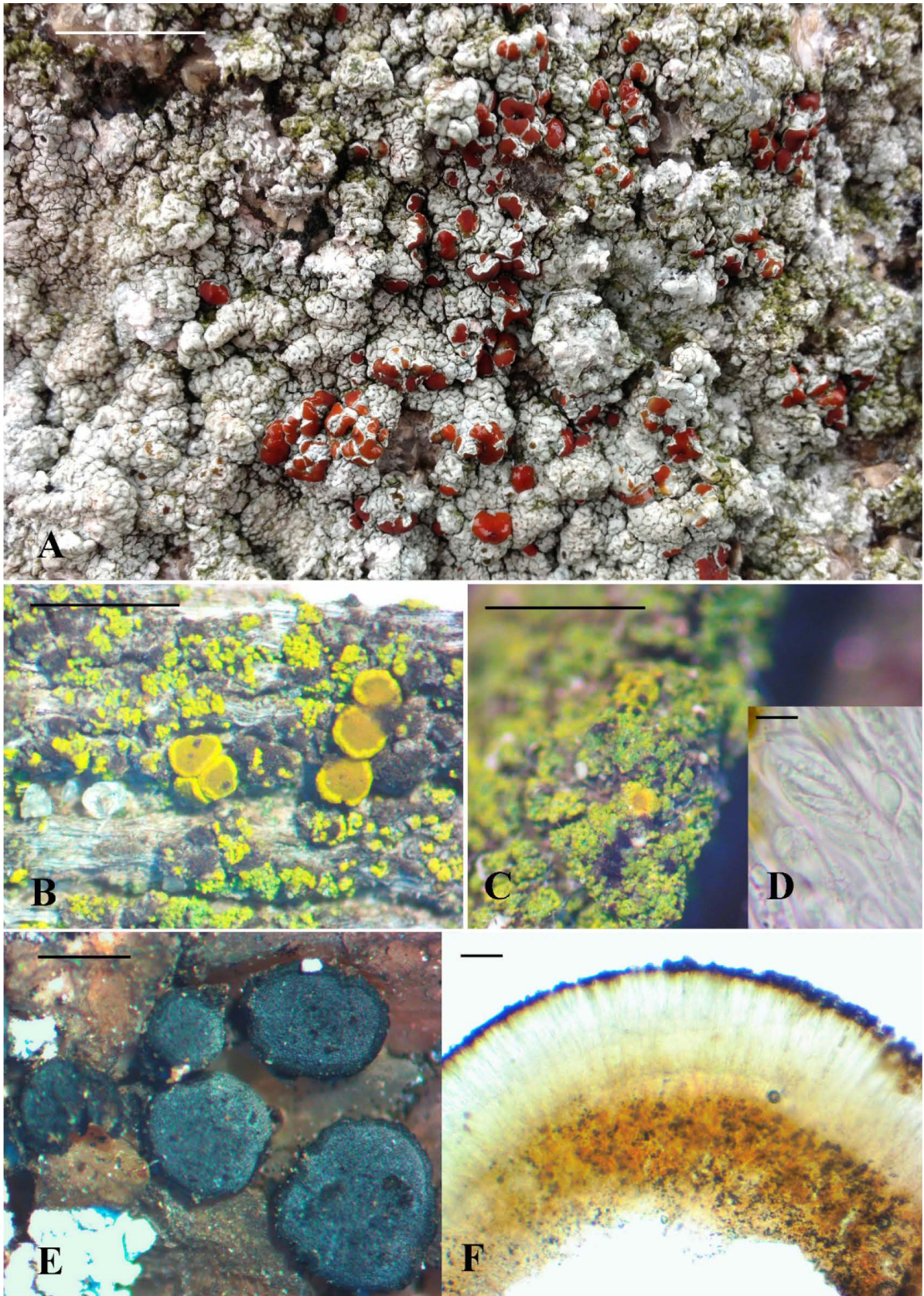


Fig. 2. A) *Haematomma nemetzii*: general habit; B, C, D) *Candelariella xanthostigmoides*: thallus and apothecia (KHER 12216) (B), general habit (KHER 12281) (C) and ascus with ascospores (D); E, F) *Lecidea sarcogynoides*: apothecia (E) and section through ascoma (F). Scale bars: A, B, C, E – 1 mm, D – 10 μ m, F – 50 μ m.

with notes on their worldwide distribution and morphological differences from similar species.

Arthonia cretacea Zahlbr.

This species was previously known from the Azorean archipelago (BERGER & PRIEMETZHOFFER 2008), Italy (NIMIS *et al.* 1994), Greece (SIPMAN & RAUS 2002) and Croatia (ZAHLEBRUCKNER 1919).

Specimen examined: Ukraine, Autonomous Republic of Crimea, Kerch Peninsula, shore of the Azov Sea, Chokrak, N 45°28'34.4", E 36°18'02.8", alt. 53 m a.s.l., on limestone, 7 May 2003, A. Khodosovtsev (KHER 4868).

Bacidia viridescens (A. Massal.) Hellb.

Bacidia viridescens is morphologically similar to the widespread *B. bagliettoana* (A. Massal. & De Not.) Jatta, but differs in having a colourless hypothecium and by the fact that it grows on shaded limestone surfaces. The examined specimens of *B. bagliettoana* (KHER 7433, 9031, 8852) from the steppe zone were collected on carbonaceous soil. It has been reported from Central Europe (DIEDERICH *et al.* 1992; PURVIS *et al.* 1992; BERGER & TÜRK 1993; VAN DEN BOOM *et al.* 1995; SCHOLZ 2000; MAYRHOFER *et al.* 2001; CZARNOTA & COPPINS 2007; SVOBODA *et al.* 2007).

Specimens examined: Ukraine, Kherson region, Beryslav district, near village of Tyagynka, «Nyzhnyodniprovsky» National Nature Park, N 46°46'02.2", E 33°01'59.9", alt. 38 m a.s.l., on shaded limestone, 31 March 2017, A. Khodosovtsev & V. Darmostuk (KHER 10916); Bilozerk district, near village of Fedorivka, N 46°48'20.8", E 32°48'32.1", alt. 13 m a.s.l., on shaded limestone, 1 April 2018, V. Darmostuk (KHER 11978).

Candelariella blastidiata Yakovchenko

This recently described species is characterised by a grey to brownish-grey squamulose thallus with marginal blastidia on the lower side of the squamules and biatorine apothecia with eight spores per ascus. Specimens of *C. blastidiata* were identified as "*Candelariella subdeflexa* (Nyl.) Lettau" in earlier papers of ours (KHODOSOVTSEV 2005; KHODOSOVTSEV & KHODOSOVTSEVA 2014). The species has been reported from the Slovak Republic, Russia and the USA (YAKOVCHENKO *et al.* 2017).

Specimens examined: Ukraine, Autonomous Republic of Crimea, Yalta, waterfall Uchan-Su, N 44°30'03.0", E 34°10'34.7", alt. 400 m, on *Acer stevenii* Pojark., 3 April 2006, A. Khodosovtsev, Yu. Khodosovtseva (KHER 7334 as *Candelariella subdeflexa*); Kherson region, Chaplynka district, Askania-Nova, park, N 46°27'7.0", E 33°52'51.3", alt. 26 m, on *Fraxinus excelsior* L., 27 August 2014, A. Khodosovtsev (KHER 8443, 8449 as *Candelariella subdeflexa*); Gola Prystan district, village of Olexiivka, N 46°17'26.9", E 32°14'08.3", 6 m alt., on *Acer negundo* L., 27 June 2017, A. Khodosovtsev & V. Darmostuk (KHER).

Candelariella xanthostigmoides (Müll. Arg.) R.W. Rogers. Fig. 2 (B, C, D)

A rare sorediate lichen, the sterile form of which can be confused with *C. efflorescens* R.C. Harris & W.R. Buck. The studied specimens from Ukraine were fertile with a few apothecia and eight-spored asci. Described from Australia, this species was recently found in North America (LENDEMER & WESTBERG 2010) and Europe, namely in Switzerland (WESTBERG & CLERC 2012) and the Czech Republic (MALÍČEK & PALICE 2013).

Specimens examined: Ukraine, Kherson region, Gola Prystan district, Black Sea Reserve, Tendrivska Kosa Island, N 46°13'54.73", E 31°39'02.37", alt. 2 m a.s.l., on *Artemisia* spp. and debris plants, 5 October 2017, A. Khodosovtsev & V. Darmostuk (KHER 12216, 12268, 12277, 12281).

Enchylium bachmanianum (Fink) Otálora, P.M. Jørg. & Wedin

This species has been reported from Europe, North America and Asia (SMITH *et al.* 2009).

Specimen examined: Ukraine, Kherson region, Bilozerk district, near village of Alexandrovka, N 46°36'23.7", E 32°15'54.3", alt. 17 m a.s.l., on loess outcrops, 14 December 2016, A. Khodosovtsev & V. Darmostuk (KHER 10919).

Haematomma nemetzii J. Steiner Fig. 2 (A)

The species is characterised by a thick grey thallus. Apothecia 0.7-2.0 mm in diameter, sessile; disc reddish (K+ purple); ascospores hyaline, 28-40 x 3-4(-5) µm, slightly curved, 1-2(-3)-septate. Thallus K+ (yellow), C-, Pd+ (yellow). It is a rare species previously known from Mediterranean Turkey, Greece, Croatia and Bulgaria (STEINER 1899; STAIGER & KALB 1995; JOHN 1996; SIPMAN & RAUS 2002; VONDRÁK 2006). There is a northeast disjunction in the distribution of the species.

Specimen examined: Ukraine, Mykolayiv region, Voznesensk district, near village of Aktove, "Buzky Gard" National Nature Park, Aktovskiy Canyon, N 47°42'48.5", E 31°27'45.8", alt. 51 m a.s.l., on vertical granite surfaces, northern exposure, 29 May 2017, A. Khodosovtsev (KHER 11683).

Lecania triseptata (Vain.) Zahlbr.

This is a lichenicolous lichen characterised by black epruinose sessile apothecia and 3-septate straight or curved ascospores measuring 14-18 x 3.5-5.5 µm (VAN DEN BOOM & KHODOSOVTSEV 2004). It was previously reported on species of the *Caloplaca polycarpoides* group, but on the Ukrainian steppe was found on species of the *Caloplaca phlogina* group. *Lecania triseptata* has been reported from a few localities in Europe and Asia (STEINER & POELT 1987; VAN DEN BOOM & KHODOSOVTSEV 2004).

Specimen examined: Ukraine, Kherson region, Oleshki district, Kozachelagerska arena, Rakiv Kutochok, N 46°38'47.3", E 33°00'34.1", alt. 42 m, on *Caloplaca phlogina* agg., on old *Populus nigra* L., 22 April 2014, A. Khodosovtsev (KHER 10658).

Lecidea sarcogynoides Körb. Fig. 2 (E, F)

This lichen grows on silicate rocks in dry regions. It is a widespread species known from Europe, Asia, Africa, Australia and New Zealand (HERTEL 2006), but not previously reported in Ukraine.

Specimen examined: Ukraine, Mykolayiv region, Voznesensk district, near village of Trykraty, "Buzky Gard" National Nature Park, Arbuzinskiy Canyon, N 47°42'24.9", E 31°25'56.9", alt. 42 m a.s.l., on granite outcrops, 20 October 2016, A. Khodosovtsev & V. Darmostuk (KHER 10597); near village of Buzki Porogy, N 47°52'44.03", E 31°06'31.62", on exposed granite boulder, alt. 45 m a.s.l., 5 July 2020, A. Khodosovtsev (KHER); Novy Bug district, near village of Rosanivka, left bank of river Beresivka, "Pryingulskiy" Regional Landscape Park, N 47°47'55.5", E 32°24'51.5", alt. 67 m a.s.l., on granite outcrops, 28 May 2017, A. Khodosovtsev & V. Darmostuk (KHER 10913, 10964).

Ramalina europaea Gasparyan, Sipman & Lücking

This recently described species is very similar to *Ramalina pollinaria* (Westr.) Ach. s. lat., but differs by having spine-like branchlets with small punctiform soralia. *Ramalina europaea* has been reported from Armenia, Austria, Finland, Russia and Sweden (GASPARYAN *et al.* 2017).

Specimen examined: Ukraine, Chernivtsi region, Kelmenets district, near village of Dnistrovka, N 48°33'20.8", E 26°55'30.6", alt. 255 m a.s.l., on *Quercus robur* L., 13 May 2018, A. Khodosovtsev & V. Darmostuk (KHER 12408); Kherson region, Bilozerka district, Alexandrovka, N 46°39'57.5", E 32°05'27.6", alt. 8 m a.s.l., on *Quercus robur*, 11 January 2018, A. Khodosovtsev & V. Darmostuk (KHER 11388, 11392, 11395); Hornostaivka district, near village of Kairy, N 46°54'57.8", E 33°43'23.6", 58 m a.s.l., on *Robinia pseudoacacia*, 17 April 1994, A. Khodosovtsev (KHER 597); Oleshki district, near village of Burkuty, N 46°23'38.6", E 32°48'35.7", alt. 13 m a.s.l., on *Fraxinus excelsior*, 27 December 2017, A. Khodosovtsev & V. Darmostuk (KHER 10914, 10915); same locality, 23 December 2014, A. Khodosovtsev (KHER 9277); near village of Sagy, N 46°36'43.1", E 32°49'26.3", alt. 11 m a.s.l., on *Robinia pseudoacacia*, 18 February 2018, A. Khodosovtsev (KHER 11398); Mykolaiv district, Ochakiv district, near village of Dniprovske, N 46°39'14.0", E 31°51'37.5", alt. 42 m a.s.l., 2 August 2018, on *Quercus robur*, A. Khodosovtsev & V. Darmostuk (KHER 12653).

Sarcogyne praetermissa K. Knudsen & Kocourk.

This species was confused with *Sarcogyne privigna* growing on limestone. The specimens of *S. praetermissa* (KHER 9039, 9384, 9903) were identified as "*Sarcogyne privigna* (Ach.) A. Massal." in earlier papers of ours (DARMOSTUK 2016). Currently *S. praetermissa* is known in the Czech Republic, Finland, Hungary, Montenegro and Sweden (KNUDSEN & KOCOURKOVÁ 2018).

Specimen examined: Ukraine, Kherson region, Belozerka district, near village of Poniativka, N 46°43'30.4", E 32°51'38.3", alt. 32 m a.s.l., on limestone, 9 August 2008, A. Khodosovtsev & L. Gavrylenko (KHER 7647, 7648); Velyka Oleksandrivka district, near village of Zaporizhia, N 47°17'38.6", E 33°13'40.5", alt. 32 m a.s.l., on limestone, 28 December 2015, V. Darmostuk (KHER 10468, 10469); near village of Mala Olexandrivka, N 47°16'04.6", E 33°14'26.9", alt. 32 m a.s.l., on limestone, 12 August 2012, V. Darmostuk (KHER 9039, 9384, 9903).

Xanthocarpia diffusa (Vondrák & Llimona) Frödén, Arup & Søchting

The lichen was found in periodically inundated places of the Mertvovod River on the canyon bottom. Although *X. diffusa* in the past was mainly found along the coasts of the Black and Mediterranean Seas, some finds belonged to inland regions of Bulgaria, Greece and Spain (VONDRÁK *et al.* 2011). Our specimen has a longer ascospore than in the type description [(11.0–) 15.3 ± 1.4 (–17.7) µm in the type vs. (14.2–) 17.7 ± 1.6 (–21.7) µm], but exhibits a typical diffuse thallus edge and a white to grey prothallus. Previously known from Bulgaria, Georgia, Greece, Russia, Spain and Turkey (VONDRÁK *et al.* 2011).

Specimen examined: Ukraine, Mykolayiv region, Voznesensk district, near village of Trykraty, "Buzky Gard" National Nature Park, Arbuzinskiy Canyon, Mertvovod River, N 47°42'24.9", E 31°25'56.9", alt. 42 m a.s.l., on granite boulder in geolittoral zone, 20 October 2016, A. Khodosovtsev & V. Darmostuk (KHER 10917, 10660).

Xanthocarpia interfulgens (Nyl.) Frödén, Arup & Søchting

After the study of NAVARRO-ROSSINES *et al.* (1996), *Caloplaca interfulgens* was a little known taxon from Algeria and Tunisia. In Europe, morphologically similar specimens were treated as *Caloplaca interfulgens* auct. (NIMIS 1993; KHODOSOVTSEV 2001). Following revision of the *Caloplaca crenulatella* group (VONDRÁK *et al.* 2011), specimens of *Caloplaca interfulgens* were found in collections from Iran and Kazakhstan, as well as in Austria, Germany, Russia and the Slovak and Czech Republics (VONDRÁK *et al.* 2013); in Turkey (VONDRÁK *et al.* 2012); and in Poland (WILK 2015). We revised the specimens from arid landscapes on limestone under the herbarium name '*Caloplaca interfulgens* auct' and

confirmed four specimens of *Xanthocarpia interfulgens* (Nyl.) Frödén, Arup & Søchting from Ukraine. Among them, one specimen (KHER 2816) was cited as '*Caloplaca interfulgens* auct' (KHODOSOVTSSEV 2001).

Specimen examined: Ukraine, Kherson region. Beryslav district, near village of Mykolaivka, right bank of the Kozak River, N 46°47'07.9", E 33°14'26.6", alt. 14 m a.s.l., on limestone, 27 October 1993, leg. A. Khodosovtsev (KHER 2816); near village of Burgunka, right bank of the Kozak River, N 46°47'13.2", E 33°14'01.2", alt. 17 m a.s.l., on limestone, 19 July 2008, leg. A. Khodosovtsev (KHER 7734); near village of Tyagynka, N 46°46'05.8", E 33°02'25.2", 8 August 2010, alt. 20 m a.s.l., on limestone, leg. A. Khodosovtsev & L. Gavrylenko (KHER 7531); village of Mala Olexandrivka, alt. 40 m a.s.l., on limestone, 28 December 2015, leg. Darmostuk (KHER 9896).

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REZIME

Botanica
 SERBICA

Novi podaci o lišajevima sa stepskih staništa Ukrajine

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Lišajevi *Arthonia cretacea*, *Bacidia viridescens*, *Candelariella blastidiata*, *C. xanthostigmoides*, *Enchylium bachmanianum*, *Haematomma nemetzi*, *Lecania triseptata*, *Lecidea sarcogynoides*, *Ramalina europaea*, *Sarcogyne praetermissa*, *Xanthocarpia diffusa* su prvi put zabeleženi u Ukrajini. Lišaj *Xanthocarpia interfulgens* je potvrđen u sušnim predelima Ukrajine. Prikazane su lokacije, herbarijumski podaci, supstrat, generalna distribucija i morfološke razlike između sličnih vrsta.

KLJUČNE REČI: *Arthonia*, *Bacidia*, *Candelariella*, *Enchylium*, *Haematomma*, *Lecania*, *Lecidea*, *Ramalina*, *Sarcogyne*, *Xanthocarpia*, les, granit, krečnjak, kora