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Pleospora xanthoriae sp. nov. (Pleosporaceae, Pleosporales), a new lichenicolous fungus on *Xanthoria parietina* from Ukraine, with a key to the known lichenicolous species of *Dacampia* and *Pleospora*

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ABSTRACT. – The new lichenicolous fungus *Pleospora xanthoriae* is described from *Xanthoria parietina* thalli found in southern Ukraine. A key to the lichenicolous species of *Dacampia* and *Pleospora* is also provided.

KEYWORDS. – Ascomycota, Dothideomycetes, lichen parasites.

INTRODUCTION

Pleospora Rabenh. ex Ces. & De Not. is a large genus of terrestrial parasitic or saprobic fungi characterized by fissitunicate asci, anastomosing paraphysoids, muriform brown ascospores and pseudothecia of three layers: (1) a thin inner layer of thin-walled, hyaline to light brown flattened cells; (2) a relatively wide central layer of thin-walled, hyaline to light brown angular cells; (3) an outer very thin layer of dark-brown amorphous cells, which gives the brown-black colour to the ascomata (Hyde et al. 2013). Only several recently described species of *Pleospora* are lichenicolous namely, *P. tretiachii* Hafellner (= *P. aquatica* Tretiach & Nimis, see Tretiach & Nimis 1999) and *P. bernandetiae* van den Boom (van den Boom 2015). *Pleospora collematum* Zukal (Clauzade et al. 1989, Silanes et al. 2009) and *P. crozalsii* Vouaux (Clauzade et al. 1989, Roux et al. 2006) are poorly studied and rare species. Recently, *P. physciae* (Brackel) Hafellner & E. Zimm. (Brackel 2010a,b; Hafellner & Zimmerman 2012) was transferred to *Didymocyrtis* Vain. as *D. physciae* (Brackel) Hafellner (Hafellner 2015), although this was without support from molecular studies. Considering that *Pleospora* is a genus containing plant parasites, lichenicolous species of "*Pleospora* morphology" have previously sometimes been described in the lichenicolous genus *Dacampia* A. Massal. (e.g., Halıcı et al. 2009a,b; Halıcı & Hawksworth 2008, Brackel 2010a,b; Kocourcová & Knudsen 2010). Diagnostic characters for *Dacampia* s. str. are the large ascomata with the ostiolar region forming a distinct neck lined by periphysoids, the ascomata connected to distinct, brown vegetative hyphae, and an ascus apex forming a 'nasse apicale' (Crivelli 1983, Henssen 1995, Hafellner & Zimmerman 2012). The type species of the genus, *D. hookeri* (Borrer) A. Massal., was placed in Pleosporales (Ertz et al. 2015), but the placement of other *Dacampia* species has not been revised. The aim of this study is to describe a new lichenicolous species dwelling on *Xanthoria parietina* (L.) Th. Fr. that we consider to represent a member of *Pleospora* s. lat. on the basis of its morphology.

MATERIALS AND METHODS

The material was examined using standard microscope techniques. Sections for anatomical examination were cut by hand and observed in water and 10% KOH. Amyloid reactions were tested in 1%

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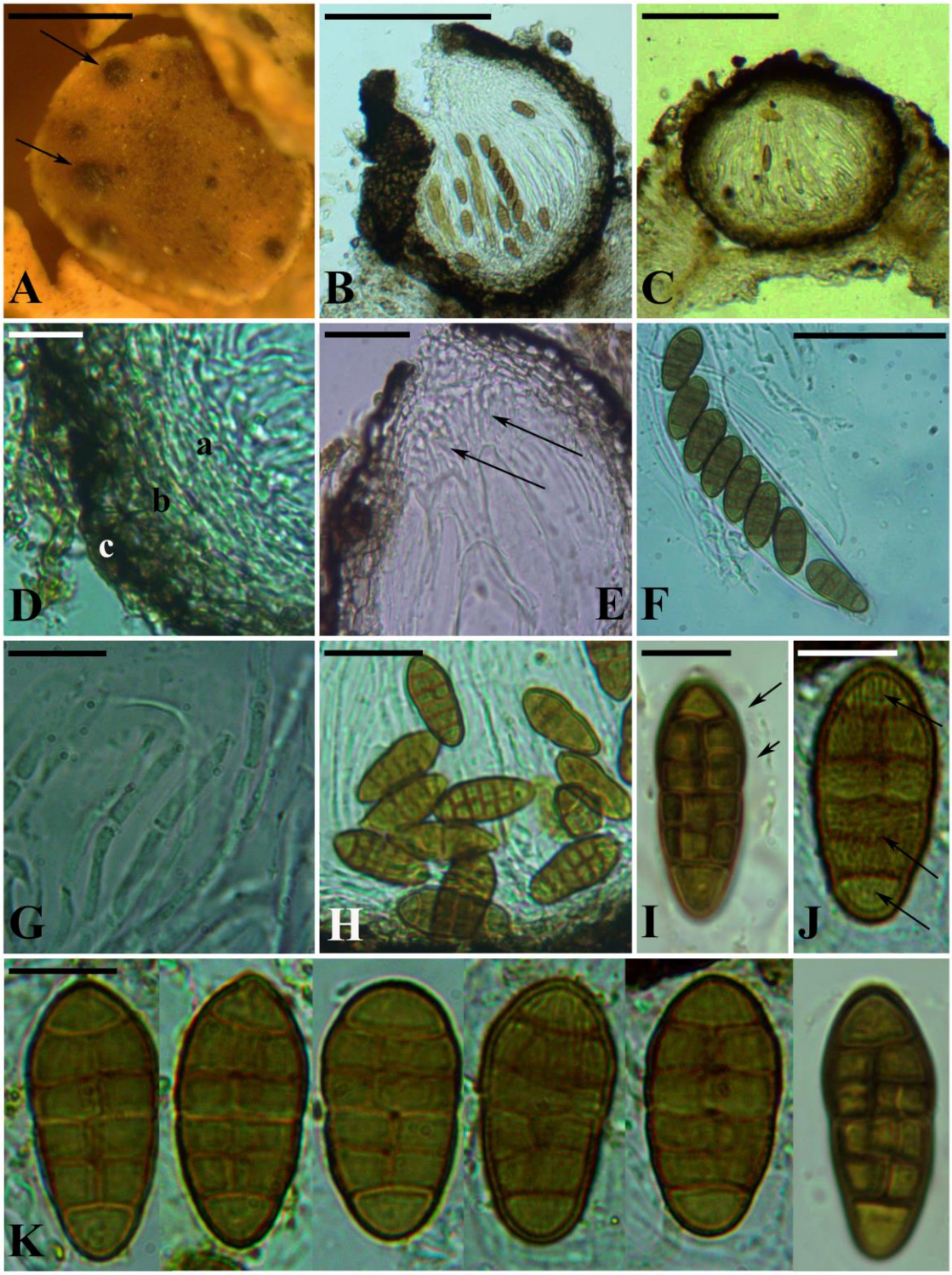

Figure 1, morphology of *Pleospora xanthoriae* (all from the holotype). A, ascomata (arrows) in the apothecia of *Xanthoria parietina*. B and C, sections of ascomata in water. D, wall of ascoma in water (a = inner, b = central, c = outer layers). E, section of the ostiolar region in young ascoma with paraphysoids (arrows). F, ascus in water. G, paraphysoids in water. H, ascospores in water. I, hyaline halo (arrows) of ascospores in iodine. J, minute sharply pointed spines (arrows) of ascospore in water. K, ascospores in water (left five) and iodine (rightmost). Scales = 1.0 mm in A; 100 μm in B & C; 50 μm in E & F; 25 μm in H; 10 μm in D, G & I-K.

Lugol's iodine with (K/I) or without (I) pre-treatment with 10% KOH. Measurements were made in water with an accuracy 0.25 μm for ascospores, asci, paraphysoids and hyphal cells; 5.0 μm for ascomatal walls; 10.0 μm for ascomata. Measurements are given as (min.–)$\bar{x}$±SD(–max.), were $\bar{x}$ is an average and SD a standard deviation. Photographs were taken with a "Levenhuk" camera on a stereomicroscope MBS-2 and microscope MICROMED-2. The specimens examined are deposited in the lichenological herbarium of Kherson State University (KHER).

THE NEW SPECIES

Pleospora xanthoriae **Khodos. & Darmostuk, sp. nov.**

MYCOBANK #816157.

FIGURE 1.

DIAGNOSIS. – Lichenicolous fungus on *Xanthoria parietina*. Ascomata perithecioid, black, subglobose, (90–)150 ± 40(–220) μm. Ascomatal wall (15–)25 ± 5(–35) μm thick, brown. Hamathecium of cellular paraphysoids, septate, simple or branched and anastomosed, (1.3–)2.3 ± 0.5(–3.3) μm, I–. Asci clavate, fissitunicate, 8–spored, (90–)110 ± 15(–130) × (18–)22 ± 3(–25) μm. Ascospores arranged irregulary biseriate to uniseriate in the ascus, ellipsoid, golden brown, muriform, with 5 transverse septa and 0–2 longitudinal septa per transverse level, slightly constricted at median septa, (20.5–)24.5 ± 1.5(–27) × (9–)11 ± 1.3(–13) μm, covered by minute sharply pointed spines.

TYPE: **UKRAINE. KHERSON REGION:** Golopristans`ky District, Black Sea Biosphere Reserve, Solonoozerna lot, N of Lake Gryazne, 46°27′33″N, 31°57′38″E, sand dunes, 29.ii.2008, on thallus and apothecia of *Xanthoria parietina* growing on plant debris, *O. Umanets 9319* (KHER!, holotype).

DESCRIPTION. – Vegetative hyphae scattered, medium brown, observed around ostiolar part, immersed in host thallus, *c*. 2–3 μm thick. Ascomata perithecioid, arising singly, with visible ostiole, without distinct neck, immersed at first to semi-immersed at maturity, black, subglobose, (90–)150 ± 40(–220) μm (*n*=15). Ascomatal wall composed of angular pseudoparenchymatous cells (textura angularis) in cross section, (15–)25 ± 5(–35) μm (*n*=15) thick, which formed three layers, a thin inner layer of thin-walled, hyaline tangentially elongated cells, (7.75–)9 ± 0.75(–10.5) × (2.0–)2.75 ± 0.5(–3.5) μm (*n*=15), a wide central layer of thin-walled, hyaline to light brown radially compressed cells, (5.5–)6 ± 0.5(–7.0) × (3.25–)3.75 ± 0.5 (–4.25) μm (*n*=20) and an outer of very thin amorphous cells, (5.25–)6.5 ± 0.5(–7.25) μm (*n*=10) wide with dark brown pigment deposited in external cellular walls. Hamathecium composed of abundant, septate, simple or branched and anastomosed cellular paraphysoids, (1.3–)2.3 ± 0.5(–3.3) μm (*n*=20), I–; ascomatal wall around ostiole in young ascomata of hyaline angular cells, *c*. 3–5 μm wide, true neck periphysoids absent. Asci clavate, fissitunicate, 8–spored, (90–)110 ± 15(–130) × (18–)22 ± 3(–25) μm (*n*=10), wall I–, plasma I+ orange. Ascospores irregularly biseriate to uniseriate in the ascus, ellipsoid, rounded to obtusely pointed at the apices, pale brown to golden brown (but old spores dark brown), muriform, with 5 transverse septa and 0–2 longitudinal septa per transverse level, 10–12 cells visible in optical field, slightly constricted at the median transverse septum, (20.5–)24.5 ± 1.5(–27) × (9–)11 ± 1.5(–13) μm, length/width (1.9–)2.3 ± 0.3(–2.9) (*n*=60); wall 1.0–1.5 μm thick with minute sharply pointed spines; hyaline halo 1.5-3.0 μm thick, finely visible in I, disappearing in overmature ascospores. Conidiomata not observed.

ECOLOGY AND DISTRIBUTION. – The new species is known only from southern Ukraine where it was found in on thalli and apothecia of *Xanthoria parietina* growing on the bark of *Populus tremula* in a small forest and on plant debris among sand dunes. It does not cause any bleaching of the thallus and apothecia.

OBSERVATIONS. – *Pleospora xanthoriae* is morphologically similar to *P. bernandetiae* which grows on *Protoparmeliopsis muralis* (Schreb.) M. Choisy, but that species has broadly ellipsoid ascospores (15–17 μm wide vs. 9–13 μm in *P. xanthoriae*), larger ascomata (400 μm wide vs. 90–220 μm in *P. xanthoriae*), and longer asci (150–200 μm long vs. 90–130 μm in *P. xanthoriae*) (van den Boom 2015). *Pleospora tretiachii* which is found on *Aspicilia supertegens* Arn. has larger ascospores (32–88 × 17–25 μm vs. 20.5–27 × 9–13 μm in *P. xanthoriae*), and ascomata larger (260–420 μm wide vs. 90–220 μm in *P.*

xanthoriae) (Tretiach & Nimis 1999). *P. collematum* and *P. crozalsii* have narrower ascospores measuring 13 × 4 µm and 16–21 × 6–7 µm respectively, and grow on different hosts (see key below; Clauzade et al. 1989). Morphologically, *P. xanthoriae* is similar to some species of *Dacampia* and *Didymocyrtis*. *Dacampia lecaniae* Kocourk. & K. Knudsen described from *Lecania fuscella* (Schaer.) A. Massal. has smooth-walled ascospores (vs. ascospore walls with minute sharply pointed spines in *P. xanthoriae*) with 7 transverse septa (vs. 9–11 septa in *P. xanthoriae*) (Kocourcová & Knudsen 2010). There are two *Dacampia* species that are lichenicolous on Teloschistaceae and thus might be confused with the new taxon. *Dacampia xanthomendozae* Etayo & Halıcı occurs on species of the genus *Xanthomendoza* S.Y. Kondr. & Kärnefelt but has longer ascospores (26.5–35.5 µm long vs. 20.5–27 µm in *P. xanthoriae*) with 7 transverse septa (vs. 9–11 transverse septa in *P. xanthoriae*) (Halıcı et al. 2009b). *Dacampia caloplacicola* Halıcı, Candan & Etayo grows on *Caloplaca crenularia* (With.) J.R. Laundon and has narrower ascospores (6–8 µm wide vs. 9–13 µm in *P. xanthoriae*), with 3 transverse septa (vs. 9–11 transverse septa in *P. xanthoriae*), and the ascospores are strongly constricted at the median septum (vs. slightly constricted at the median transverse septum in *P. xanthoriae*) (Halıcı et al. 2009b). *Pleospora xanthoriae* is morphologically similar to *Didymocyrtis physciae* which grows on *Physcia* species, but differs from the latter in its larger ascospores (20.5–27 × 9–13 µm vs. 14.5–16.5 × 6–7 µm in *D. physciae*) and different host (Brackel 2010a, Hafellner & Zimmerman 2012, Hafellner 2015).

Additional specimen examined. – **UKRAINE. KHERSON REGION:** Goloprystans`ky District, Chalbas`ka arena, Promin` village, Shelemens`ki lakes, 46°20′15″N, 32°49′07″E, small *Populus* forest, 5.xii.2015, on *Xanthoria parietina* growing on bark of *Populus tremula*, *A. Khodosovtsev 9330* (KHER!).

KEY TO KNOWN LICHENICOLOUS *DACAMPIA* AND *PLEOSPORA* SPECIES (INCL. *DIDYMOCYRTIS PHYSCIAE*)

1. Ascospores >30 µm in length **2**
    2. Asci 8–spored; lichenized; associated with *Solorina* spp. (see Henssen 1995)..... ***D. hookeri***
    2. Asci 2–6–spored; non lichenized; non associated with *Solorina* spp **3**
        3. Ascospores with conspicuous hyaline halo **4**
            4. Ascospores (32–)41–55(–88) × (17–)19–21(–25) µm; asci 4–6–spored; upper part of ascomatal cells K–; on aquatic *Aspicilia supertegens* (see Tretiach & Nimis 1999) ..... ***P. tretiachii***
            4. Ascospores (22–)26.5–38.5(–40.0) × 11.5–15(–17) µm; asci (2–)4–spored; upper part of ascomatal walls K+ purple; on *Circinaria fruticulosa* (see Halıcı et al. 2009a) ..... ***D. rubra***
        3. Ascospores without conspicuous hyaline halo **5**
            5. Asci (4–)6–spored; ascospores (26.5–)28–32(–35.5) × (10.5–)10.9–13.1(–13.5) µm; on *Xanthomendoza* spp. (see Halıcı et al. 2009b) ..... ***D. xanthomendozae***
            5. Asci 2–4–spored; ascospores (30–)34–39 × (10–)14.5–16 µm; on *Rhizocarpon obscuratum* (see Halıcı & Hawksworth 2008)..... ***D. rhizocarpicola***
1. Ascospores < 30 µm in length **6**
    6. Ascospores > 9 µm in width **7**
        7. Ascospores with up to 5 transverse septa **8**
            8. Ascomata 150–250 µm in width **9**
                9. Ascospores with 3–4 transverse septa, without hyaline halo, (23–)24.5–27 × 11–13 µm; forming necrotic spots; on *Peltigera* spp. (see Hawksworth 1986)..... ***D. rufescentis***
                9. Ascospores with 5 transverse septa, with hyaline halo, (20.5–)23.8–25.8(–27.0) × (9.0)9.5–12(–13.0) µm; not forming necrotic spots; on *Xanthoria parietina* ***P. xanthoriae***
            8. Ascomata 250–600 µm in width **10**
                10. Ascospores 22–32 × 15–17 µm; ascomata up to 400 µm in width; on *Protoparmeliopsis muralis* (see van den Boom 2015)..... ***P. bernandetiae***
                10. Ascospores 18–25 × 8–10 µm; ascomata 250–450(–600) µm in width; on *Solorina saccata* (see Bricaud & Roux 1990) ..... ***D. engeliana***
        7. Ascospores with up to 7 transverse septa **11**
            11. Asci 2–4–spored; ascospores without hyaline halo, 21–26(–31.5) × (7.0–)9.0–12.5(–14.5) µm; on *Protoparmeliopsis muralis* (see Halıcı & Hawksworth 2008)..... ***D. muralicola***
            11. Asci 8–spored; ascospores with hyaline halo..... **12**

12. Asci 70–100 × 22–24 µm; ascospores (23–)25–29(–31.5) × 11–13 µm; on *Thamnolia vermicularis* (see Zhurbenko 2012) ..... ***D. thamnoliicola*** ad int.

12. Asci 110–140 × 20–30 µm; ascospores (21–)22.8–26.5(–28) × (8–)9.5–12 µm; on *Lecania fuscella* (see Kocourková & Knudsen 2010)..... ***D. lecaniae***

6. Ascospores < 9 µm in width..... **13**

13. Ascomata 150–200 µm in width **14**

14. Ascospores 4 µm in width; on *Lempholemma compactum* (see Clauzade et al. 1989)..... ..... ***P. collematum***

14. Ascospores > 4 µm in width; not on *Lempholemma compactum*..... **15**

15. Ascospores 16–26 µm in length..... **16**

16. Ascospores 8–9 µm in width..... **17**

17. Ascomata 180–210 µm in width; ascospores usually with 5–6 transverse septa, (19–)21.5–26 × 8–9 µm; on *Peltigera rufescens* (see Bennett-Earland et al. 2006)..... ***D. peltigericola***

17. Ascomata 110–160 µm in width; ascospores usually with 5–7 transverse septa, (19.5–)21.2–24.9(–26) × (6.5–)6.8–8.3(–9) µm; on *Lecania cyrtella* (see Brackel 2010a)..... ***D. cyrtellae***

16. Ascospores 5–7 µm in width.....**18**

18. Ascospores 16–21 × 6–7 µm; on *Sticta sylvatica* (see Clauzade et al. 1989) ... . ***P. crozalsii***

18. Ascospores 21–25 × 5–6.5 µm; on *Leptogium burgessii* and *Pannaria rubiginosa* (see Halıcı & Hawksworth 2008)..... ***D. leptogiicola***

15. Ascospore 9–17 µm length **19**

19. Ascospores (9.5–)10.5–12(–12.5) × (4.5–)5.5–6.5 µm, without halo; on *Cladonia foliacea* (see Halıcı et al. 2008) ..... ***D. cladoniicola***

19. Ascospores 14.5–16.5 × 6–7 µm, with hyaline halo; on *Physcia* spp. (see Hafellner 2015)..... ***Didymocyrtis physciae***

13. Ascomata 250–600 in width..... **20**

20. Ascospores (17–)18.5–21.3(–23) × (6–)6.5–7.9(–8) µm, strongly constricted at median transverse septum; on *Caloplaca crenularia* (see Halıcı et al. 2009b) ..... ***D. caloplacicola***

20. Ascospores 18–25 × 8–10 µm, slightly constricted at median transverse septum; on *Solorina saccata* (see Bricaud & Roux 1990)..... ***D. engeliana***

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