Ліхенологія

Lichens and lichenicolous fungi of Khortytsia Island (Ukraine)

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KHODOSOVTSEV A.YE., DARMOSTUK V.V. (2020). **Lichens and lichenicolous fungi of Khortytsia Island (Ukraine).** *Chornomors'k. bot. z.,* **16** (1): 74–80. doi: 10.32999/ksu1990553X/2020-16-1-5

80 species of lichens and 12 species of lichenicolous fungi were found on Khortytsia Island. The lichen *Verrucaria fusconigrescens* is for the first time reported for the continental part of Ukraine. Lichens *Acarospora insolata, Bacidia fuscoviridis, Caloplaca chlorina, C. soralifera, C. xerica, Dermatocarpon miniatum, Lecanora argopholis, L. orosthea, L. swartzii, Lobothallia alphoplaca, Monerolechia badia, Rhizocarpon lecanorinum, Xanthocarpia crenulatella, Xanthoparmelia loxodes* and lichenicolous fungi *Abrothallus caerulescens, Lichenostigma elongatum, Marchandiomyces corallinus, Polycoccum pulvinatum, Stigmidium xanthoparmeliarum, Zwackhiomyces lithoiceae* are reported for first time for Zaporizhzhia Region. *Melanelixia fuliginosa, Protoparmelia badia* and *Evernia mesomorpha* were erroneously reported for Khortytsia Island and therefore should be excluded from the list of species. Of the recorded lichens, two species, *Lassalia pustulata* and *Xanthoparmelia camtschadalis*, are included into the Red Data Book of Ukraine. *Verrucaria fusconigrescens* is a new host for *Zwackhiomyces lithoiceae*.

Key words: Ukrainian crystalline shield, granite, Zaporizhzhia, Dnipro river

ХОДОСОВЦЕВ О.Є., ДАРМОСТУК В.В. (2020). **Лишайники та ліхенофільні гриби острова Хортиця (Україна).** *Чорноморськ. бот. ж.* **16** (1): 74–80. doi: 10.32999/ksu1990-553X/2020-16-1-5

На острові Хортиця виявлено 80 видів лишайників та 12 видів ліхенофільних грибів. Лишайник *Verrucaria fusconigrescens* вперше наводиться для рівнинної частини України. Лишайники *Acarospora insolata, Bacidia fuscoviridis, Caloplaca chlorina, C. soralifera, C. xerica, Dermatocarpon miniatum, Lecanora argopholis, L. orosthea, L. swartzii, Lobothallia alphoplaca, Monerolechia badia, Rhizocarpon lecanorinum, Xanthocarpia crenulatella, Xanthoparmelia loxodes* та ліхенофільні гриби *Abrothallus caerulescens, Lichenostigma elongatum, Marchandiomyces corallinus, Polycoccum pulvinatum, Stigmidium xanthoparmeliarum, Zwackhiomyces lithoiceae* – виявилися новими для Запорізької області. Лишайники *Melanelixia fuliginosa, Protoparmelia badia* та *Evernia mesomorpha* некоректно наводилися для острова Хортиця, тому повинні бути виключені зі списку ліхенобіоти. Виявлені тут *Lassalia pustulata* та *Xanthoparmelia camtschadalis* занесені до Червоної книги України. Ліхенофільні гриби є типовими для лишайникових угруповань у межах Українського кристалічного щита. Для *Zwackhiomyces lithoiceae* – це перше повідомлення на *Verrucaria fusconigrescens.*

Ключові слова: Український кристалічний щит, граніти, Запоріжжя, Дніпро

ХОДОСОВЦЕВ А.Е., ДАРМОСТУК В.В. (2020). **Лишайники и лихенофильных грибы острова Хортица (Украина).** Черноморск. бот. ж. **16** (1): 74–80. doi: 10.32999/ksu1990-553X/2020-16-1-5

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Submitted 03 January 2020 Recommended by S. Kondratyuk Published 18 April 2020

На острове Хортица обнаружено 80 видов лишайников и 12 видов лихенофильных грибов. Лишайник *Verrucaria fusconigrescens* впервые приводится для равнинной части Украины. Лишайники *Acarospora insolata, Bacidia fuscoviridis, Caloplaca chlorina, C. soralifera, C. xerica, Dermatocarpon miniatum, Lecanora argopholis, L. orosthea L. swartzii Lobothallia alphoplaca, Monerolechia badia, Rhizocarpon lecanorinum, Xanthocarpia crenulatella, Xanthoparmelia loxodes* и лихенофильные грибы *Abrothallus caerulescens, Lichenostigma elongatum, Marchandiomyces corallinus, Polycoccum pulvinatum, Stigmidium xanthoparmeliarum, Zwackhiomyces lithoiceae* – оказались новыми для Запорожской области. Лишайники *Melanelixia fuliginosa, Protoparmelia badia* и *Evernia mesomorpha* некорректно приведены для острова Хортица, поэтому должны быть исключены из списка лихенобиоты. Обнаруженные здесь *Lassalia pustulata и Xanthoparmelia camtschadalis* включены в Красную книгу Украины. *Lassalia pustulata* растет на вертикальных гранитных поверхностях с редкими для степной зоны лишайниками *Lecanora orosthea* и *Rinodona confragosa*. Лихенофильные грибы являются типичными для лишайниковых группировок в пределах Украинского кристаллического щита. Для *Zwackhiomyces lithoiceae* это первое сообщение на *Verrucaria fusconigrescens*.

Ключевые слова: Украинский кристаллический щит, граниты, Запорожье, Днепр

Khortytsia Island (Zaporizhzhia) has great historical and spiritual significance for Ukraine. It is part of the Ukrainian crystalline shield and consists of Proterozoic granites which are found as outcrops on the island banks. The granite surfaces are covered by lichens. Lichens and lichenicolous fungi of the Island are poorly studied and only a few species have been recorded. For example, *Staurothele columellaris* was described as a new for science species based on A. Lazarenko collections from Khortytsia Island [OXNER, 1956]. Another noteworthy record is a rare lichen in the steppe zone of Ukraine *Scytinium gelatinosum* (= *Leptogium sinuatum*) also collected by A. Lazarenko and later published in the first volume of the second issue of 'Flora of the lichens of Ukraine" [OXNER, 1956]. Later stadies [PETROVA, 1993; VASYLENKO, 2016] have provided data on 23 lichens from the island. In this article, we present the results of our survey of lichens and lichenicolous fungi on Khortytsia Island in June 2018.

Materials and methods

Lichens and lichenicolous fungi were collected during a field trip on June 29–30, 2018 to Khortytsia Island. The species were identified at the Biodiversity and Ecological Monitoring Laboratory named after J.K. Pachosky in Kherson State University. The collected materials have been determined by the standard procedure [SMITH et al., 2009] using LOMO microscopes MBS–1 and MICROMED–2. All the examined specimens are deposited in the lichenological herbarium of Kherson State University (KHER). The nomenclature of lichens and lichenicolous fungi follows Index Fungorum [Index fungorum, 2020] and the checklist by Darmostuk and Khodosovtsev [2017]. The references are provided for the species that were not found during the authors' field studies. The new species for Zaporizhzhia Region are indicated by asterisk "*".

Result and discussion

1. An annotated list of the lichens

ACAROSPORA fuscata (Nyl.) Th.Fr. – on exposed granite surfaces.
A. insolata H. Magn. – lichenicolous on *Bellemerea cupreoatra*.
AMANDINEA punctata (Hoffm.) Coppins & Scheid. **–** on bark of *Robinia pseudoacacia, Quercus robur*.
ASPICILIA cinerea (L.) Körb. s. lat. **–** on exposed granite surfaces.
ATHALLIA pyracea (Ach.) Arup, Frödén & Søchting – on branch of *Robinia pseudoacacia*.

***BACIDIA fuscoviridis** (Anzi) Lettau **–** on shaded granite surfaces with calcareous film near water.
BELLEMEREA cupreoatra (Nyl.) Clauzade & Cl.Roux – on exposed granite surfaces.
CALOGAYA decipiens (Arnold) Arup, Frödén & Søchting – on exposed granite surfaces with calcareous film.
C. lobulata (Flörke) Arup, Frödén & Søchting – on bark of *Robinia pseudoacacia*.
***CALOPLACA chlorina** (Flot.) H.Olivier – on vertical shaded and moist granite surfaces.
C. demissa (Körb.) Arup & Grube – on vertical shaded granite surfaces.
***C. soralifera** Vondrák & Hrouzek – on granite surfaces near water.
***C. xerica** Poelt & Vezda – on exposed granite surfaces near water.
CANDELARIELLA aurella (Hoffm.) Zahlbr. – on granite surfaces with calcareous film [VASYLENKO, 2016].
C. vitellina (Ehrh.) Müll.Arg. – on exposed granite surfaces.
C. xanthostigma (Ach.) Lettau – on bark of *Robinia pseudoacacia*.
CIRCINARIA caesiocinerea (Nyl. ex Malbr.) A.Nordin, Savic & Tibell – on exposed granite surfaces.
CLADONIA fimbriata (L.) Fr. – on layers of soil in granite fissures [VASYLENKO, 2016].
***DERMATOCARPON miniatum** (L.) W.Mann – on vertical granite surfaces.
ENDOCARPON psorodeum (Nyl.) Blomb. & Forssell – on vertical granite surfaces and water tracks.
EVERNIA prunastri (L.) Ach. – on bark of *Robinia pseudoacacia* [VASYLENKO, 2016 as *Evernia mesomorpha*].
HYPOGYMNIA physodes (L.) Nyl. – on bark of *Quercus robur* [VASYLENKO, 2016].
LASALLIA pustulata (L.) Mérat – on vertical granite surfaces.
***LECANORA argopholis** (Ach.) Ach. – on exposed granite surfaces.
L. carpinea (L.) Vainio – on bark of *Robinia pseudoacacia*.
***L. orosthea** (Ach.) Ach. – on shaded granite surfaces.
L. rupicola (L.) Zahlbr. – on vertical granite surfaces [VASYLENKO, 2016].
***L. swartzii** (Ach.) Ach. – on shaded vertical granite surfaces.
LECIDEA fuscoatra (L.) Ach. – on exposed granite surfaces.
LECIDELLA elaeochroma (Ach.) M. Choisy – on bark of *Robinia pseudoacacia*.
LEPRARIA sp. – on shaded granite surfaces.
LEPRARIA membranacea (Dicks.) Lettau – on granite fissures in shaded condition.
***LOBOTHALLIA alphoplaca** (Wahlenb.) Hafellner – on exposed granite outcrops near water.
MASSJUKIELLA polycarpa (Hoffm.) S.Y. Kondr., Fedorenko, S. Stenroos, Kärnefelt, Elix, J.-S. Hur & A. Thell – on branches of *Robinia pseudoacacia*.
***MONEROLECHIA badia** (Fr.) Kal – on exposed granite surfaces and thallus of lichens.
MYRIOLECIS dispersa (Pers.) Śliwa et al. – on granite surfaces in pioneer communities [VASYLENKO, 2016].
M. hagenii (Ach.) Śliwa, Zhao Xin & Lumbsch – on bark [VASYLENKO, 2016].
PARMELIA saxatilis (L.) Ach. – on granite [VASYLENKO, 2016].
P. sulcata Taylor – on bark of *Robinia pseudoacacia* and *Quercus robur* [VASYLENKO, 2016].
PARMELINA tiliacea (Hoffm.) Hale – on shaded granite surfaces with thin layers of humus.
PHAEOPHYSCIA nigricans (Flörke) Moberg – on granite surfaces in subnitrophilous lichen communities.
P. orbicularis (Neck.) Moberg – on granite surfaces in subnitrophilous lichen communities.
PHYSCIA adscendens H. Olivier – on bark of *Robinia pseudoacacia* and *Quercus robur*.
P. caesia (Hoffm.) Hampe ex Fürnr. – on exposed granite surfaces.
P. dubia (Hoffm.) Lettau **–** on bark [VASYLENKO, 2016].
P. dimidiata (Arnold) Nyl. – on exposed granite surfaces.

Fig. 1. The granite outcrops of Khortytsia Island.

P. stellaris (L.) Nyl. – on bark [VASYLENKO, 2016].
P. tenella (Scop.) DC. – on bark of *Quercus robur* [VASYLENKO, 2016].
Ph. tribacea (Ach.) Nyl. – on rock [VASYLENKO, 2016].
PHYSCONIA distorta (With.) J.R. Laundon – on bark [VASYLENKO, 2016].
P. grisea (Lam.) Poelt – on bark [VASYLENKO, 2016].
PLACOPYRENIUM trachyticum (Hazsl.) Breuss – on vertical granite surfaces near water.
POLYSPORINA simplex (Davies) Vezda – on granite surfaces in pioneer lichen communities.
PROTOPARMELIOPSIS garovaglii Arup, Zhao Xin & Lumbsch – on exposed granite surfaces.
P. laatokkensis (Räsänen) Moberg & R.Sant. – on exposed granite surfaces.
P. muralis (Rabenh.) M.Choisy – on exposed granite surfaces.
PROTOPARMELIOPSIS sp. – on exposed granite surfaces. The specimens consist of small dispersed gray-green thalli up to 1 cm in diameter with short lobes 1-2 mm long and numerous apothecia 0,2–0,5 mm in diameter in the central parts of thalli. These specimens need further revision.
RAMALINA capitata (Ach.) Nyl. – on exposed granite surfaces in nitrophilous lichen communities.
R. polymorpha (Lilj.) Ach. – on exposed granite surfaces.
R. pollinaria (Westr.) Ach. s. lat. **–** on bark [VASYLENKO, 2016].
RHIZOCARPON distinctum Th.Fr. – on exposed granite surfaces.
R. geographicum (L.) DC. – on exposed granite surfaces [VASYLENKO, 2016].
***R. lecanorinum** Anders – on exposed granite surfaces.
RINODINA confragosa (Ach.) Körb. – on shaded vertical granite surfaces.

R. pyrina (Ach.) Arnold – on branches of *Robinia pseudoacacia.*
RUFOPLACA arenaria (Pers.) Arup, Søchting & Frödén – on exposed granite surfaces.
R. subpallida (H.Magn.) Arup, Søchting & Frödén – on granite surfaces near water.
SARCOGYNE privigna (Ach.) A.Massal. – on exposed granite surfaces.
SCOLICIOSPORUM umbrinum (Ach.) Arnold – on shaded granite surfaces.
SCYTINIUM gelatinosum (With.) Otalora, P.M. Jorg. & Wedin – on granite boulder [OXNER, 1956].
STAUROTHELE columellaris Oxner – on granite surfaces near water [OXNER, 1956].
TRAPELIA involuta (Taylor) Hertel – on shaded moist granite surfaces.
VERRUCARIA fusconigrescens Nyl. – on shaded and moist granite surfaces near water. The lichen formed brown line in geolittoral zone. It is a new species for the continental part of Ukraine. Previously it was reported from Crimea [REDCHENKO, 2002].
***XANTHOCARPIA crenulatella** (Nyl.) Frödén, Arup & Søchting – on granite surfaces with calcareous film..
***XANTHOPARMELIA camtschadalis** (Ach.) Hale (= *X. vagans* auct.) – on soil [VASYLENKO, 2016].
X. conspersa (Ehrh. ex Ach.) Hale – on exposed granite surfaces.
X. loxodes (Nyl.) O.Blanco, A.Crespo, Elix, D.Hawksw. & Lumbsch – on inclined granite surfaces.
X. pulla (Ach.) O.Blanco, A.Crespo, Elix, D.Hawksw. & Lumbsch – on exposed granite surfaces.
X. stenophylla (Ach.) – on exposed granite surfaces.
XANTHORIA parietina (L.) Th. Fr. – on bark of *Robinia pseudoacacia, Quercus robur, Salix alba* [VASYLENKO, 2016].

2. An annotated list of lichenicolous fungi

***ABROTHALLUS caerulescens** I. Kotte – on thalli of *Xanthoparmelia conspersa*. This is a common species to steppe zone of Ukraine [DARMOSTUK, KHODOSOVTSEV, 2017].
ATHELIA arachnoidea (Berk.) Jülich – on thalli of *Caloplaca demissa*. It is a widespread facultatively lichenicolous basidiomycete that can infect wide spectrum of lichens.
CERCIDOSPORA macrospora (Uloth) Hafellner & Nav.-Ros. – on thalli and apothecia of *Protoparmeliopsis muralis*. It is common species on *P. muralis* on siliceous outcrops [DARMOSTUK, 2016].
LICHENOSTIGMA cosmopolites Hafellner & Calat. – on thalli and apothecia of *Xanthoparmelia conspersa*.
***L. elongatum** Nav.-Ros. & Hafellner – on thalli of *Aspicilia cinerea* and *Protoparmeliopsis muralis*.
LICHENOTHELIA convexa Henssen – on hypothallus of *Aspicilia cinerea* and *Rhizocarpon* spp.
***MARCHANDIOMYCES corallinus** (Roberge) Diederich & D. Hawksw. – on thalli of *Lecanora rupicola*.
MUELLERELLA pygmaea (Körb.) D. Hawksw. – on thalli of *Lecidea fuscoatra*.
***POLYCOCCUM pulvinatum** (Eitner) R. Sant. – on thalli of *Physcia caesia*.
POLYSPORINA subfuscescens (Nyl.) K.Knudsen & Kocourk. – on unidentified brown squamulose thallus (probably *Acarospora* sp.).
***STIGMIDIUM xanthoparmeliarum** Hafellner – on thalli and apothecia of *Xanthoparmelia conspersa*.
***ZWACKHIOMYCES lithoiceae** (B.de Lesd.) Hafellner & V. John – on thalli of *Verrucaria fusconigrescens*. This species was recently reported as new for Ukraine [DARMOSTUK et al., 2018; DARMOSTUK, 2019] on *Verrucaria nigrescens* s.lat. *V. fusconigrescens* is a new host.

3. Discussion

In total, 80 species of lichens and 12 species of lichenicolous fungi were found in habitats of Khortytsia Island. The lichen *Verrucaria fusconigrescens* is the first time reported for the continental plain part of Ukraine. Lichens *Acarospora insolata, Bacidia fuscoviridis, Caloplaca chlorina, C. soralifera, C. xerica, Dermatocarpon miniatum, Lecanora argopholis, L. orosthea, L. swartzii, Lobothallia alphoplaca, Monerolechia badia, Rhizocarpon lecanorinum, Xanthocarpia crenulatella, Xanthoparmelia loxodes* and lichenicolous fungi *Abrothallus caerulescens, Lichenostigma elongatum, Marchandiomyces corallinus, Polycoccum pulvinatum, Stigmidium xanthoparmeliarum, Zwackhiomyces lithoiceae* are new for Zaporizhzhia Region. Lichens *Melanelixia fuliginosa, Protoparmelia badia* and *Evernia mesomorpha* [VASYLENKO, 2016] were erroneously reported for Khortytsia Island and should be excluded from the list. The diversity of the lichens and lichenicolous fungi is lower than in other lichen "hot-spot" territories of the Ukrainian crystalline massive, such as Buzky Canyon [MYHAYLYUK et al., 2011], Trykraty massive [KHODOSOVTSEV et al., 2019] and Kamyani Mohyly [KHODOSOVTSEV et al., 2013]. The diversity of lichens and lichenicolous fungi is similar to that other parts of granite outcrops in Ukrainian crystalline shield in the steppe zone, e.g. Bobrynets ravine (Kirovograd Region) [KHODOSOVTSEV et al., 2017].

The exposed granite surfaces are covered by *Acarospora fuscata, Aspicilia cinerea, Bellemerea cupreoatra, Candelariella vitellina, Circinaria caesiocinerea, Lecidea fuscoatra, Protoparmeliopsis muralis, Rufoplaca arenaria, Xanthoparmelia stenophylla, X. conspersa, X. pulla,* etc. The tops of the boulders are colonized by nitrophilous communities with dominant *Ramalina polymorpha* and *R. capitata*. *Dermatocarpon miniatum, Lassalia pustulata, Lecanora rupicola, Rhizocarpon distincum, Scoliciosporum umbrinum* grow on vertical and inclined surfaces. The deep fissures between granite rocks are inhabited by *Lecanora orosthea, L. swartzii, Rinodina confragosa*. The specific communities have formed in geolittoral zone. Here, *Caloplaca chlorina* and *Verrucaria fusconigrescens* often cover large areas on shaded granite cliffs near water surfaces. The sorediate *Bacidia fuscoviridis* is found in this zone. *Caloplaca xerica* is dominant on exposed granite boulders near water. Reported lichenicolous fungi are common in the silicolous lichen communities within Ukrainian crystalline shield. Corticolous lichens are typical for anthropogenic forest stans and parks in steppe zone of Ukraine [KHODOSOVTSEV et al., 2017]. *Lecanora carpinea, Lecidella elaeochroma, Massjukiella polycarpa, Physcia adscendens, Phaeophyscia orbicularis, Xanthoria parietina* are dominant species in such communities.

Conclusion

Eighty species of lichens and twelve species of lichenicolous fungi were found in habitats of the Khortytsia granite outcrops. The lichen *Verrucaria fusconigrescens* is for the first time reported for the continental part of Ukraine and 19 species are new for Zaporizhzhia Region. The diversity of lichens and lichenicolous fungi of Khortytsia Island is similar to that of the main parts of granite outcrops on Ukrainian crystalline shield in thrsteppe zone.

Acknowledgements

The authors are grateful to Yakiv Didukh, Ivan Moysiyenko, Olexander Rylskiy, Olexandr Lisevskiy, Sergiy Vasylenko for help during summer expedition to Khortytsia Island, Jurga Motiejūnaitė and Andrey Tsurykau for correct remarks to the paper. This study was financially supported by the project of Ministry of Science and Education of Ukraine N 0119U000105.

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