

New records of *Uromyces erythronii* (*Pucciniales*) from Ukraine

Yuri Ya. TYKHONENKO¹, Nadiya N. SYTSCHAK², Alexander A. KAGALO², Oleksandr O. ORLOV³

¹M.G. Kholodny Institute of Botany, National Academy of Sciences of Ukraine
2, Tereshchenkivska Str., Kyiv 01004, Ukraine
yu.ya.tykhonenko@gmail.com

²Institute of Ecology of the Carpathians, National Academy of Sciences of Ukraine
4, Kozelnytska Str., Lviv 79026, Ukraine
sytschak@ukr.net
kagalo@mail.lviv.ua

³G.M. Vysotsky Polisskiy Branch of URIFFM
2, Neskorenykh Str., Dovzhyk village, Zhytomyr District, Zhytomyr Region 10004, Ukraine
orlov.botany@gmail.com

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Abstract. Specimens of the rust fungus *Uromyces erythronii* were recorded on *Erythronium dens-canis*, a rare species listed in the Red Data Book of Ukraine, in April 2016 near Chemeryntsi village (Lviv Region, Ukraine) and in May 2016 near Zaluzhne village (Zhytomyr Region, Ukraine). An investigation of the *Erythronium* specimens deposited in the herbaria of vascular plants of Lviv Natural History Museum (*LWS*) and M.G. Kholodny Institute of Botany (*KW*) revealed four more samples of this fungus. A list of all localities in which *U. erythronii* was recorded in Ukraine is provided. The article is illustrated by micrographs obtained by scanning electron microscopy.

Keywords: *Erythronium dens-canis*, rust fungi, distribution, morphology

Introduction

The genus *Erythronium* L. comprises about 30 species of spring-flowering perennial plants distributed in temperate regions of the Northern Hemisphere. It was established that the genus is probably sister to *Amana* Honda and that *Tulipa* L. is sister to the clade of *Erythronium* and *Amana* (Clennett et al., 2012). Within *Erythronium*, there are three strongly supported geographically distinct clades occurring in Eurasia, western North America, and eastern North America (Allen et al., 2003; Clennett et al., 2012). Its centre of diversity lies in Oregon and northern California (Allen et al., 2003). The geographic distribution of the only European species *E. dens-canis* L. is highly disjunct. There are several fragmented areas, clearly separated from one another: north-eastern Portugal, northern

Spain and the Pyrenees, the Massif Central and the western Alps, northern Italy, Hungary and the Balkans to northern Greece (Kleih, 2010). Isolated populations north of the Alps are located in the Czech Republic, Slovakia (Fischer et al., 2008), and Ukraine (Chervona knyha..., 2009).

Uromyces erythronii (DC.) Pass. parasitizes Eurasian species of *Erythronium*. In Japan and China it was also recorded on representatives of *Amana* (Hiratsuka et al., 1992; Teng, 1996), which is in concordance with the modern status of *Amana* as a genus separate from *Tulipa* and closely related to *Erythronium*. It should be noted that rusts of the genus *Uromyces* (Link) Unger do not occur on plants of the genus *Tulipa*. The earlier mentions of this fungus in Ukraine (Zerova et al., 1971; Tykhonenko, 1999) are based on the only collection from Transcarpathian Region, which, unfortunately, has been lost.

The aim of this publication is to report new records of *U. erythronii* made in Ukraine in 2016 as well as those identified from the previously collected herbarium specimens of its host plant.

Materials and Methods

Specimens collected in the field were labelled and dried for further treatment. Aeciospores and teliospores mounted in water and/or lactic acid were investigated by light microscopy under Primo Star microscope and AxioVision 4.7 software, used as well for measurements of microstructures. For scanning electron microscopy samples were coated with an ultrathin coating of gold by ion beam sputtering unit JFC-1100. Images were obtained by scanning electron microscope JEOL JSM-6060 LA. Analysis of general distribution is based on the data from many bibliographic sources, and databases available through the Internet.

The specimens are deposited in the Mycological Herbarium of M.G. Kholodny Institute of Botany, National Academy of Sciences of Ukraine (*KW*) and in the herbarium of the Institute of Ecology of the Carpathians, National Academy of Sciences of Ukraine (*LWKS*).

Results and Discussion

The rust fungus *Uromyces erythronii* was recorded on *Erythronium dens-canis*, a rare species listed in the Red Data Book of Ukraine. Specimens were collected in April 2016 near Chemeryntsi village (Lviv Region, Ukraine) and in May 2016 near Zaluzhne village (Zhytomyr Region, Ukraine). Subsequent investigation of the *Erythronium* specimens stored in the herbaria of vascular plants of Lviv Natural History Museum (*LWS*) and M.G. Kholodny Institute of Botany (*KW*) revealed four more samples of this fungus. The synonymic names, description of spermogonial, aecial and telial stages, and data on distribution in Ukraine of this species are provided below. Original illustrations are followed by information on its morphology, general distribution and phenology.

Uromyces erythronii (DC.) Pass., *Comm. Soc. crittog. Ital.* 2(fasc. 3): 452 (1867). – *Aecidium erythronii* DC., in Lamarck & de Candolle, *Fl. franç.*, Edn 3 (Paris) 2: 246 (1805). – *Caecoma cynophron* Schldtl., *Linnaea* 1: 242 (1826). – *Caecoma erythroniatum* Link, in Willdenow, *Sp. pl.*, Edn 4 6(2): 42 (1825). – *Coeomurus erythronii* (DC.) Kuntze [as '*Caecomurus*'], *Revis. gen. pl.* (Leipzig) 3(2): 450 (1898). – *Uredo erythronii* DC., in

de Candolle & Lamarck, *Fl. franç.*, Edn 3 (Paris) 5/6: 67 (1815).

Spermogonia on both sides of leaves, honey-coloured, solitary or mixed with the aecia, more or less conical. Aecia mostly hypophyllous, although they may appear on the petioles, in oblong or orbicular groups on yellow spots, generally quite conspicuous, peridium 0.3–0.4 mm in diameter, at first covered by the epidermis but later cup-shaped with coarsely incised and outwardly turned margin (Figure, *a*). Peridial cells are of variable shape, generally pentagonal, rhomboid or almost square, outer wall almost smooth, inner is covered with warts. Aeciospores globose, polygonal or ellipsoidal, 20–30 × 15–24 μm, densely and finely verruculose (Figure, *b*, *c*), with a yellow-orange content. Telia on both sides of leaves in groups, rounded or elongated, 0.3–1 mm long, pulverulant (Figure, *d*), chocolate-brown. Teliospores globoid or ovoid, 22–42 × 15–25 μm, with prominent apical papilla, wall is ornamented with longitudinally, sometimes bifurcated, ridges which are transversely connected by short, thin and almost parallel striae (Figure, *e*, *f*), pedicel is short and hyaline.

0, I, III – on *Erythronium* and *Amana* species.

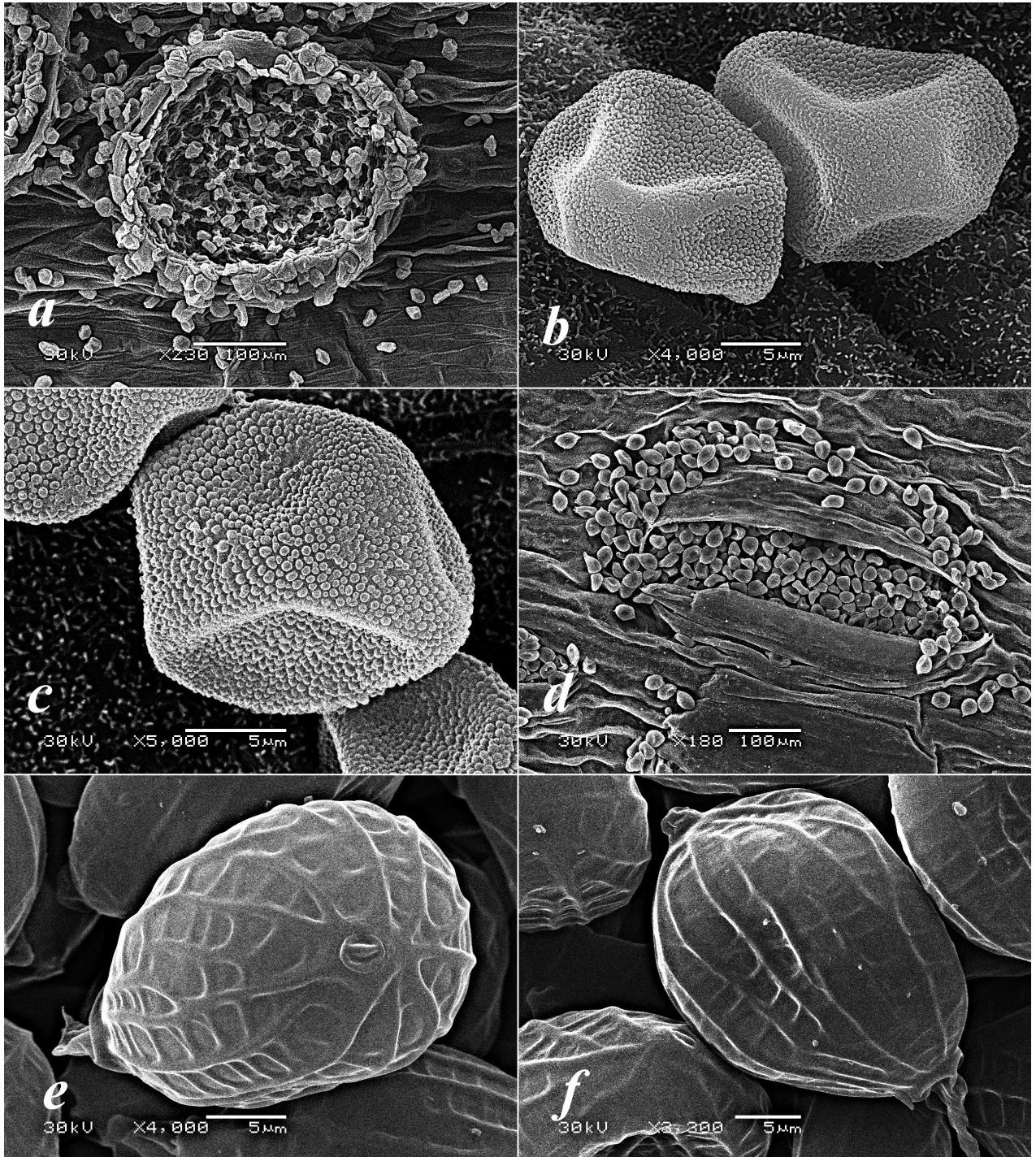
Distribution in Ukraine*:

On *Erythronium dens-canis*

0, I – Lviv Region, Peremyshlyany District, Chemeryntsi village, Golyj Kinets hamlet, Mokre wood, forest of *Fagus sylvatica* L. and *Carpinus betulus* L., 49° 40' N, 24° 44' E, 24.04.1935, leg. F. Foty-niuk (*LWS* 21164, *LWKS-B* 1192, *KW-M* 70319); *ibid.*, 08.04.2016, leg. A. Kagalo and N. Sytschak (*LWS* 31781, *LWKS-B* 1191, *KW-M* 70320). Transcarpathian Region, near Svaliava, 48° 33' N, 22° 59' E, 04.1925, leg. A. Margitai (*KW* 122870); Tiachiv District, Velyka Uholka village, near road to the tract Aldomyrove, forest of *Fagus sylvatica*, 48° 15' N, 23° 40' E, 22.04.1975, leg. L. Tassenkevych (*LWS* 21149, *KW-M* 70321).

III – Zhytomyr Region, Romaniv District, 2 km to the west of Zaluzhne village, forest of *Quercus robur* L. and *Carpinus betulus*, 50° 14' N, 27° 56' E, 12.05.2016, leg. O. Orlov (*KW-M* 70322). Lviv Region, Peremyshlyany District, Chemeryntsi village, Golyj Kinets hamlet, Mokre wood, forest of *Fagus sylvatica*

* In spring of the current year aecial stage of *U. erythronii* was collected in a new locality: Transcarpathian Region, Rakhiv District, 4.6 km to the east of Luh village, Carpathian Biosphere Reserve, Kuziy massif, hornbeam-sessile-oak-beech forest on the eastern slope of Tempa Mt., 47° 57' N, 24° 07' E, 06.04.2017, leg. N. Sytschak and A. Kagalo.



Uromyces erythronii on *Erythronium dens-canis*: a – aecium; b, c – aeciospores; d – telium; e, f – teliospores. Scale bars: a, d – 100 µm; b, c, e, f – 5 µm

and *C. betulus*, 49° 40' N, 24° 44' E, 09.05.1934, leg. F. Fotyniuk (LWS 21143, KW-M 70323).

General distribution. Europe: Austria, Bulgaria, Croatia, Czech Republic, France, Hungary, Italy, Montenegro, Romania, Slovakia, Slovenia, Spain, Switzerland, Ukraine. Asia: China, Georgia, Japan, Korea, Russian Federation (Southern Siberia). Dogtooth violets are widely cultivated in public and private gardens beyond the natural ranges of *Erythronium* species; therefore, *U. erythronii* has been also recorded in Belgium (Vanderweyen, Fraiture, 2008), Germany (Kruse et al., 2013), and the UK (Wilson, Henderson, 1966; Henderson, 2000).

Uromyces erythronii is absent from North America despite of presence of about 20 indigenous species of *Erythronium*. The only rust recorded on representatives of *Erythronium* in this continent is *U. heterodermus* Syd. & P. Syd. distributed in the western USA and Canada, which is quite different from *U. erythronii* by its morphology: it lacks aecia in its life cycle, and its teliospores are striately verrucose above and almost smooth below (Arthur, 1934). It implies that *U. erythronii* probably originated after the divergence of Eurasian and eastern North American clades of *Erythronium* but before the split of Eurasian species.

Uromyces erythronii is a typical spring species strictly dependant on phenology of its host plant. According to the special study (Fukuda, Nakamura, 1987), teliospores germinate in the soil and basidiospores infect the tightly rolled leaves at the early period of the growing season. Aecia appear about one week after the leaf emergence. Telia are produced by stomatal infection of aeciospores when aerial shoots began to yellow and after they have completely decayed, teliospores disperse to the ground. The growth period of both host and parasite lasts only for about a month. All four Ukrainian specimens of *U. erythronii* with aecial stage were collected in April and both with telia – in the first half of May.

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V.P. Hayova

Тихоненко Ю.Я.¹, Сичак Н.М.², Кагало О.О.², Орлов О.О.³ **Нові знахідки *Uromyces erythronii* (*Pucciniales*) з України.** Укр. бот. журн., 2017, 74(2): 184–188.

¹Інститут ботаніки ім. М.Г. Холодного НАН України
вул. Терещенківська, 2, Київ 01004, Україна

²Інститут екології Карпат НАН України
вул. Козельницька, 4, Львів 79026, Україна

³Поліський філіал УкрНДІЛГА ім. Г.М. Висоцького
вул. Нескорених, 2, с. Довжик, Житомирський р-н,
Житомирська обл. 10004, Україна

У квітні 2016 р. поблизу с. Чемеринці (Львівська обл.), а у травні 2016 р. поблизу с. Залужне (Житомирська обл.) були зібрані зразки гриба *Uromyces erythronii* на *Erythronium dens-canis* – рідкісній рослині, внесеній до Червоної книги України. У результаті дослідження зразків *Erythronium*, які зберігаються у гербаріях судинних рослин Львівського природознавчого музею (*LWS*) та Інституту ботаніки ім. М.Г. Холодного (*КИ*), було виявлено ще чотири випадки розвитку цього гриба. У статті наведено список усіх локалітетів, в яких *U. erythronii* був зареєстрований в Україні. Робота ілюстрована мікрофотографіями, отриманими за допомогою сканувального електронного мікроскопа.

Ключові слова: *Erythronium dens-canis*, іржасті гриби, поширення, морфологія

Тихоненко Ю.Я.¹, Сычак Н.Н.², Кагало А.А.², Орлов А.А.³ **Новые находки *Uromyces erythronii* (*Pucciniales*) из Украины.** Укр. бот. журн., 2017, 74(2): 184–188.

¹Інститут ботаніки ім. Н.Г. Холодного НАН України
ул. Терещенковская, 2, Киев 01004, Украина

²Інститут екології Карпат НАН України
ул. Козельницькая, 4, Львов 79026, Украина

³Полесский филиал УкрНИИЛХА им. Г.Н. Высоцкого
ул. Нескореных, 2, с. Довжик, Житомирский р-н,
Житомирская обл. 10004, Украина

В апреле 2016 г. в окрестностях с. Чемеринцы (Львовская обл.), а в мае 2016 г. в окрестностях с. Залужное (Житомирская обл.) были собраны образцы гриба *Uromyces erythronii* на *Erythronium dens-canis* – редком растении, занесенном в Красную книгу Украины. В результате исследования образцов *Erythronium*, хранящихся в гербариях сосудистых растений Львовского природоведческого музея (*LWS*) и Института ботаники им. Н.Г. Холодного (*КИ*), было выявлено еще четыре случая развития этого гриба. В статье приведен список всех локалитетов, в которых *U. erythronii* был зарегистрирован в Украине. Работа иллюстрирована микрофотографиями, полученными с помощью сканирующего электронного микроскопа.

Ключевые слова: *Erythronium dens-canis*, ржавчинные грибы, распространение, морфология