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First records of *Uromyces glycyrrhizae* (*Pucciniales*) in Ukraine

Yuri Ya. TYKHONENKO, Liudmyla P. VAKARENKO

M.G. Kholodny Institute of Botany, National Academy of Sciences of Ukraine
2 Tereshchenkivska Str., Kyiv 01004, Ukraine
yu.ya.tykhonenko@gmail.com
larix04@ukr.net

Tykhonenko Yu. Ya., Vakarenko L.P. **First records of *Uromyces glycyrrhizae* (*Pucciniales*) in Ukraine.** Ukr. Bot. J., 2018, 75(2): 187–190.

Abstract. Epiphytotic development of a new for Ukraine rust fungus *Uromyces glycyrrhizae* was recorded in May and September 2017 on the eastern shore of Kuyalnik Estuary (Odesa Region, Ukraine) on *Glycyrrhiza glabra*, a species listed in the *Red Data Book of Ukraine*. Hitherto, the fungus was reported for Europe, northern Africa, Asia and North America. The reason why *U. glycyrrhizae* was recorded in Ukraine only recently remains unclear, but taking into account that this species in Europe is confined to its warmer part, climate change might be argued as a cause of this. The article is illustrated by original micrographs.

Keywords: rust fungi, *Glycyrrhiza glabra*, distribution, morphology

Introduction

The genus *Glycyrrhiza* L. comprises about 20 species distributed mainly in temperate Eurasia and in North Africa. Only few species are known from outside Eurasia: *G. acanthocarpa* (Lindl.) J.M. Black is native of Australia, *G. astragalina* Hook. & Arn. – of South America, and *G. lepidota* Pursh – of North America (The Plant List, 2013). In Ukraine three species of this genus occur. *Glycyrrhiza glabra* L. distributed in coastal areas of the Black and Azov seas is listed in the *Red Data Book of Ukraine* (Fedoronchuk, 2009). *Uromyces glycyrrhizae* (Rabenh.) Magnus parasitizing several species of *Glycyrrhiza* in Eurasia and North America hitherto was unknown in Ukraine.

Here we report the first for Ukraine records of this fungus and provide some data on its morphology, occurrence, and life cycle.

Materials and methods

Systemically infected plants of *G. glabra* were collected in Odesa Region, Ukraine. The specimens were studied under a dissecting microscope, labelled and dried for further treatment. Aecio- and teliospores mounted in water or lactic acid were investigated by light microscopy. Photomicrographs were taken under Primo Star microscope, Canon A300 digital camera and AxioVision 4.7 software, used as well for measurements

of microstructures. For scanning electron microscopy, samples were covered with an ultrathin coating of gold by ion beam sputtering unit JFC-1100. Images were obtained by a scanning electron microscope JEOL JSM-6060 LA.

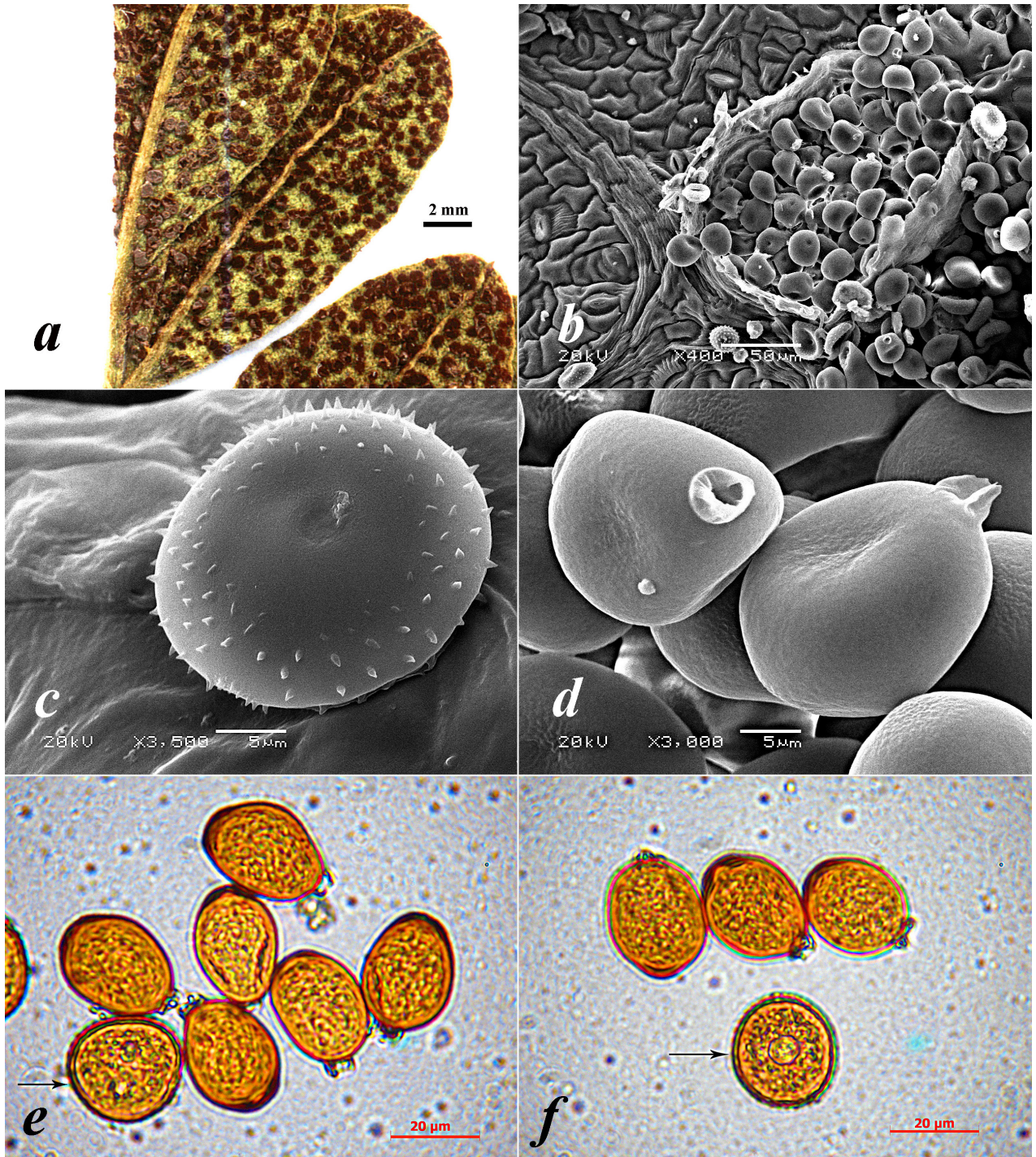
Analysis of general distribution is based on the data from literature (González Fragoso, 1925; Arthur, 1934; Tranzschel, 1939; Savulescu, 1953; Guyot, 1957; Casulli, Ippolito, 1995; Denchev, 1995; Braun, 1999; Zhuang, 2005; Savchenko et al., 2014) and databases available through the Internet, including GBIF Portal (GBIF Secretariat, 2018), USDA Fungal Database (Farr, Rossman, 2018), etc.

The specimens are deposited in the Mycological Herbarium of the M.G. Kholodny Institute of Botany, National Academy of Sciences of Ukraine (KW-M).

Results and discussion

Epiphytotic development of a new for Ukraine fungus, *Uromyces glycyrrhizae* was recorded in May and September 2017 on *Glycyrrhiza glabra*, a species listed in the *Red Data Book of Ukraine*. Infected plants were collected in a plant community dominated by *Bromus inermis* Leyss. (cover percentage is 70%), with *G. glabra* as a codominant (cover percentage is 30–50%). A diagnosis and original illustrations of the species, data on its distribution, morphology and phenology are provided below.

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Uromyces glycyrrhizae: *a* – habit of aecia on *Glycyrrhiza glabra*; *b* – scanning electron microscopy of telium; *c* – scanning electron microscopy of aeciospore; *d* – scanning electron microscopy of teliospores; *e*, *f* – light microscopy of aeciospores (indicated by arrows) and teliospores

Uromyces glycyrrhizae (Rabenh.) Magnus, *Ber. dt. bot. Ges.* 8: 383. 1890. – *Puccinia glycyrrhizae* Rabenh., *Bot. Ztg.* 8: 438. 1850. – *Dicaeoma glycyrrhizae* (Rabenh.) Kuntze, *Revis. gen. pl.* (Leipzig) 3(2): 469. 1898. – *Klebannia glycyrrhizae* (Rabenh.) Arthur, *Résult. Sci. Congr. Bot. Wien 1905*: 345. 1906.

Spermogonia mainly hypophyllous, systemic. Aecia mostly hypophyllous, uredinoid, systemic, dark cinnamon-brown (Figure, *a*). Aeciospores globose, 23–32 × 24–32 μm, flattened laterally, wall chestnut-brown, 1–2 μm thick, echinulate, with two equatorial pores, spore surface around pores free of spines (Figure, *c, e, f*). Uredinia wanting, or if present indistinguishable from the aecia. Urediniospores in localized telia, resembling aeciospores. Telia chiefly hypophyllous, either systemic or developed from localized mycelium, dark chestnut-brown (Figure, *b*). Teliospores ellipsoid, 15–22 × 23–32 μm, wall chestnut-brown, uniformly 1.5–2.5 μm thick, with a hyaline umbo over the pore, smooth, pedicel colourless, short, fragile (Figure, *d, e, f*).

Distribution in Ukraine. On *Glycyrrhiza glabra*: Odesa Region, on the eastern shore of Kuyalnik Estuary, 46°41'08" N, 30°42'55" E, 31.05.2017, L.P. Vakarenko (KW-M70925), 21.09.2017, L.P. Vakarenko (KW-M70926).

General distribution. Europe: Bulgaria, Czech Republic, Greece, Italy, Portugal, Romania, Russia, Spain, Ukraine (current report). Northern Africa: Algeria, Libya. *Asia*: Armenia, Azerbaijan, China, Georgia, Iran, Iraq, Israel, Japan, Kazakhstan, Kyrgyzstan, Mongolia, Pakistan, Russia, Tajikistan, Turkey, Turkmenistan, Uzbekistan. North America: central and western states of the USA.

In Europe only two other species of *Uromyces* cause systemic infection of legumes of the tribe *Galegeae*, and they clearly differ from *U. glycyrrhizae*. *Uromyces lapponicus* Lagerh. has aecidioid aecia and verrucose teliospores whereas *U. phacae-frigidae* (Wahlenb.) Har. produces only telia with verrucose teliospores. Both species occur in arctic regions and mountains of Eurasia and North America, so in terms of biogeography they are also quite different from *U. glycyrrhizae*.

A special study on phenology of *U. glycyrrhizae* (Luo et al., 1992) revealed that urediospores and basidiospores formed from teliospores infect the basal buds of licorice plants before winter and remain dormant there. The following spring, the infected buds produce stems with systemic infection.

Aecial and telial stages of *U. glycyrrhizae* last for the extended period. Our specimen collected in May bears aecia, whereas a specimen collected in September shows telia with only a small admixture of aeciospores.

The reason why *U. glycyrrhizae* was recorded in Ukraine only recently, remains unclear. Taking into account that this species in Europe is confined to its warmer part, climate change might be argued as a cause of this; however, our records are not the northernmost ones in Europe since the species was noted as far north as Saratov, Russia (51° N) (Tranzschel, 1939). The possibility that *U. glycyrrhizae* was merely overlooked is also rather unlikely. Natural populations of *G. glabra* in Ukraine were regularly surveyed during the last 20 years and, due to systemic character of the disease, plants infected by *U. glycyrrhizae* are quite different from the healthy ones and clearly visible; moreover, such symptoms of the parasite last for almost whole vegetation season.

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- Институт ботаники ім. М.Г. Холодного НАН України вул. Терещенківська, 2, Київ 01004, Україна
- У травні та вересні 2017 р. на східному узбережжі Куяльницького лиману (Одеська обл., Україна) на *Glycyrrhiza glabra* – рослині, включений до Червоної книги України, було відмічено епіфітотійний розвиток нового для України іржастого гриба *Uromyces glycyrrhizae*. До нашої знахідки цей вид був відомий з Європи, північної Африки, Азії та Північної Америки. Причини того, чому *U. glycyrrhizae* був відмічений в Україні лише нещодавно, залишаються нез'ясованими, але, беручи до уваги, що в Європі цей вид поширений тільки в південних регіонах, це може бути обумовлено глобальними змінами клімату. Стаття ілюстрована оригінальними мікрофотографіями.
- Ключові слова:** іржасті гриби, *Glycyrrhiza glabra*, поширення, морфологія
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- Институт ботаники им. Н.Г. Холодного НАН Украины ул. Терещенковская, 2, Киев 01004, Украина
- В мае и сентябре 2017 г. на восточном побережье Куяльницкого лимана (Одесская обл., Украина) на *Glycyrrhiza glabra* – растении, внесенном в Красную книгу Украины, было отмечено эпифитотийное развитие нового для Украины ржавчинного гриба *Uromyces glycyrrhizae*. До нашей находки этот вид был известен из Европы, северной Африки, Азии и Северной Америки. Причины того, почему *U. glycyrrhizae* был отмечен в Украине лишь недавно, остаются невыясненными, однако, принимая во внимание, что в Европе этот вид распространен только в южных регионах, это может быть обусловлено глобальными изменениями климата. Статья иллюстрирована оригинальными микрофотографиями.
- Ключевые слова:** ржавчинные грибы, *Glycyrrhiza glabra*, распространение, морфология