FUNGI — ГРИБЫ

First record and new host of *Uromyces helichrysi* (Pucciniales) from Uzbekistan

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Abstract. As a result of mycological research on the territory of Nuratau Nature Reserve, a new rust fungus for mycobiota of Uzbekistan — *Uromyces helichrysi* was found. This species was collected on *Helichrysum nuratavicum* (a new host for the *U. helichrysi*), an endemic plant that have been listed in Red Data Book of Uzbekistan. A brief description and photographs of *U. helichrysi* are provided.
Keywords: *Helichrysum nuratavicum*, Pucciniaceae, rust fungi, Nuratau Nature Reserve.

Первая находка и новый хозяин ржавчинного гриба *Uromyces helichrysi* из Узбекистана

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Резюме. В результате микологических исследований на территории Нуратинского природного заповедника выявлен новый для микобиоты Узбекистана ржавчинный гриб *Uromyces helichrysi*. Этот вид обнаружен на эндемичном, внесенном в Красную книгу Узбекистана растении *Helichrysum nuratavicum*, который зарегистрирован как новый хозяин для *Uromyces helichrysi*. Приводится краткое описание и фотографии выявленного вида.
Ключевые слова: *Helichrysum nuratavicum*, Pucciniaceae, растение-хозяин, ржавчинные грибы, Нуратинский государственный заповедник.

The study of rust fungi has important economical and agricultural applications. Uzbekistan has the highest diversity in rust fungi compared to other Central Asian countries. According to Ramazanova and co-authors, there are 261 rust fungi that are found on 511 host plant species belonging to 43 families (Fungal..., 1986).

It should be noted, the territory of Nuratau Nature Reserve (NNR) is one of the most representative regions in the botanical and mycological respect. NNR is located in the central part of the Nuratau Ridge that consists of two parallel 250 km mountain ranges along the right bank of the Zarafshan River. The northern slopes of the ridge are facing the Kyzylkum Desert. The flora of the Nuratau Mountains includes 1289 species of vascular plants, 34 of them are local endemics; the checklist of the flora of the NNR includes 820 species of 385 genera and 81 families (Tojibaev *et al.,* 2017).

The goal of this paper is to report the first record of *Uromyces helichrysi* for Uzbekistan and its new host, *Helichrysum nuratavicum* Krasch., one of the four species of the genus known for the flora of Uzbekistan (Conspectus..., 1993). *Helichrysum nuratavicum* is known from Jizzakh, Navoi and Samarkand regions: the Nuratau and Aktau ranges (Flora of Uzbekistan, 1962). This species is listed in the Red Data Book of Uzbekistan since 2009 (Red..., 2019).

Material and Methods

Fungal samples and the host plants were collected from Nuratau Nature Reserve (Uzbekistan) in 2019 (Fig. 1). The host specimens were prepared according to the conventional herbarium techniques. Host plants were identified using the Flora of Uzbekistan (1962). Teliospores were taken from dried host samples and placed in oil immersion (glycerin). Teliospores were seen and measured in oil immersion, using a Moticam 5 N-300M microscope at magnification up to ×400. Microphotographs of teliospores were acquired under a Moticam 5 N-300M microscope. The current name of rust species was given according to international databases "Index Fungorum" (2019), the name of host plant is given according to The Plant List (2013). All collected specimens are kept in the Tashkent Mycological herbarium (TASM) of the Institute of Botany of Academy of Sciences of the Republic of Uzbekistan.

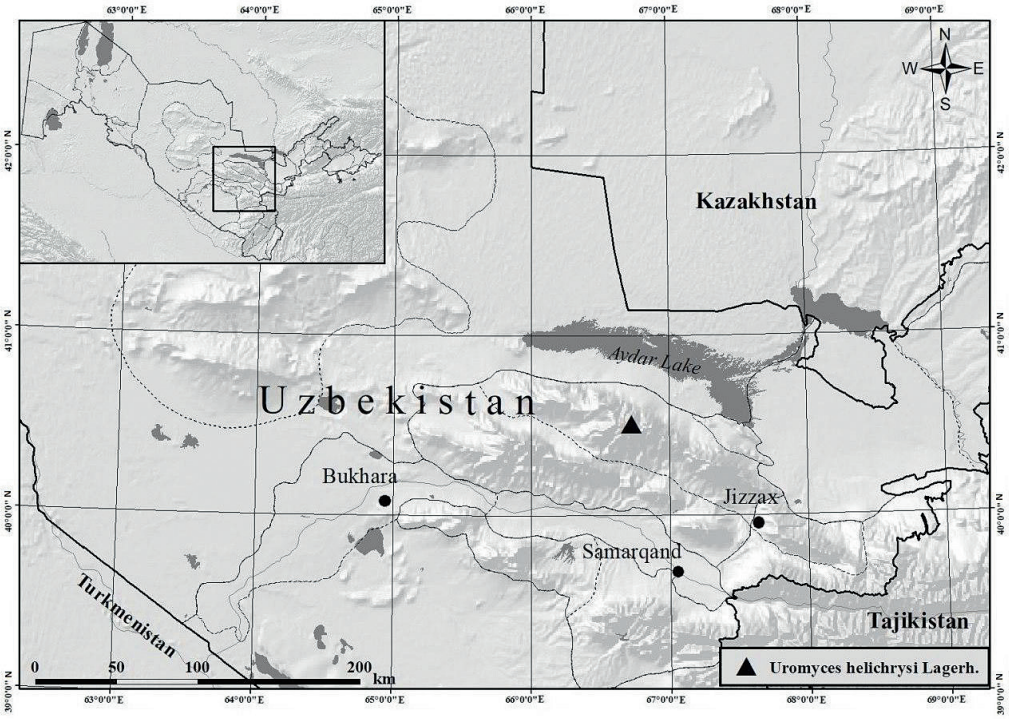

Fig. 1. Locality of *Uromyces helichrysi* in Uzbekistan.

Results

After thorough examination of *Helichrysum nuratavicum*, collected from Nuratau Nature Reserve, we found a new rust fungus species for mycobiota of Uzbekistan, *Uromyces helichrysi*. The description of the species based on the analysis of the specimen collected in the Uzbekistan is given below.

Uromyces helichrysi Lagerh., in Sydow, 1899, Uredineen: no. 159. (Plate I)

Spermogonia, aecia, uredinia and urediniospores not seen. Telia amphigenous, subepidermal, in groups, on small dark brown spots, 0.5–2 mm diam., pulverulent, ruptured epidermis conspicuous. Teliospores 1-celled, globose to ellipsoid, (20)22–(24)26 µm long, lateral wall 1.5–2 µm thick, distal wall 4–5 µm thick, yellowish to brown, smooth, germ pores not observed. Pedicels persistent or deciduous, smooth, thin-walled, hyaline, long, 30–50 × 4–5 µm (Plate I). Basidia and basidiospores not found. Also, we did not find any information about basidia and basidiospores of *U. helichrysi*.

Specimen examined: **Uzbekistan**, Nuratau Ridge, Nuratau Nature Reserve, the Hayatbashi Mt., north slope, 1800–2000 m a. s. l., 40.509806° N, 66.729614° E, 16 VI 2019, *Mustafaev, Xujanov*, IM19/028, TASM.

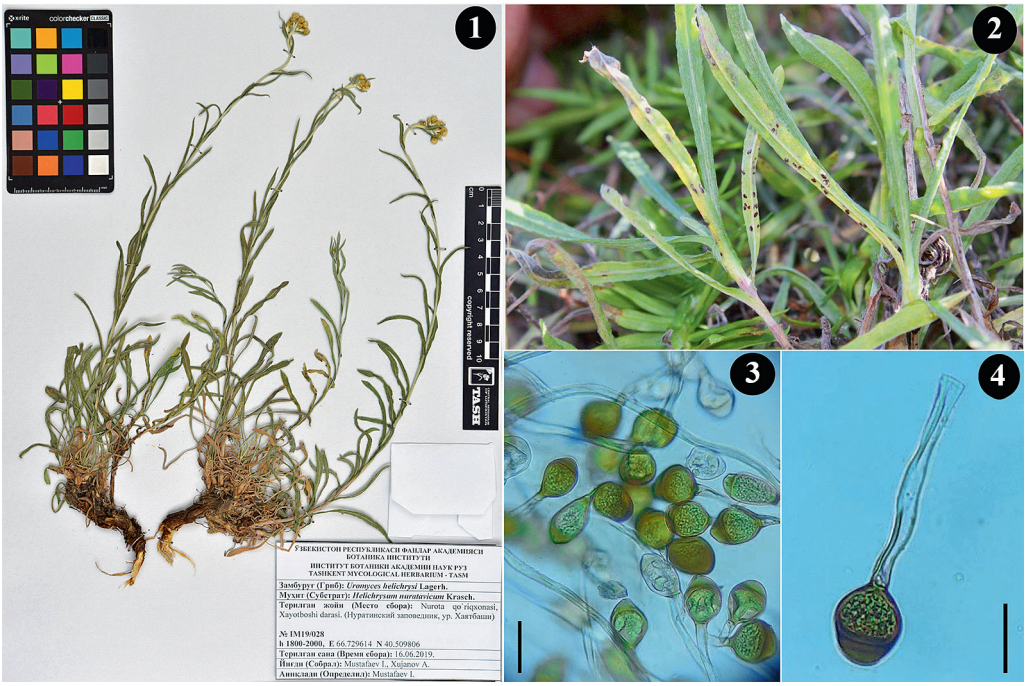

Plate I. *Uromyces helichrysi* (IM19/028, TASM).
1 — herbarium specimen of *Uromyces helichrysi* on *Helichrysum nuratavicum*;
2 — damaged leaves of *Helichrysum nuratavicum*; 3, 4 — teliospores of *Uromyces helichrysi*.
Scale bars: 3, 4 — 20 µm.

Discussion

We have identified for the first time *Uromyces helichrysi* on the territory of Uzbekistan. In addition, *Helichrysum nuratavicum* has been noted as the new host plant for this rust fungus.

One of the unique features of the rust fungi is that they have up to six functionally and morphologically different spore states in their life cycles. The situation is further complicated because they not only have many different spore states but gametophytic states and saprophytic states often grow on two unrelated groups of host plants (Hiratsuka, Hiratsuka, 1980). Interestingly, it has been noted by several scientists that *Uromyces helichrysi* also has a microcyclic life cycle and does not change host (Annaliev, 1990; Klenke, Scholler, 2015). Likewise, we did not find spermogonia, aecia, uredinia and urediniospores of this fungus.

Many rust fungi have evolved shortened life cycles in various ways, usually in response to a shortened growing season for the hosts, due to high latitude, high altitude or desert conditions (Savile, 1953). *Uromyces helichrysi* has a short development cycle, probably due to the growth of the host plants on relatively high mountain belts and a short growing season. *Uromyces helichrysi* is recorded on *Helichrysum nuratavicum* at an altitude of 1800 m a. s. l., and on *H. plicatum* DC. in Turkey at an altitude of 1300–1800 m a. s. l. It should be noted that the only record of this species on the territory of the Commonwealth of Independent States (CIS), including Central Asia was in Turkmenistan by Annaliev (1990). In 2006 *Uromyces helichrysi* was found on *Helichrysum plicatum* var. *plicatum* and *H. plicatum* var. *polyphyllum* P. H. Davis et Kupicha in Kahramanmarafl Province in Turkey and recorded as a new species for Turkey (Bahcecioglu *et al.*, 2006). It is known that *Helichrysum* Mill. species can be host of 9 species of rust fungi in addition to *Uromyces helichrysi*: *Aecidium helichrysi* Doidge, *Puccinia cornurediata* Berndt, *P. horti-kirstenboschi* Berndt et E. Uhlmann, *P. kalchbrenneriana* De Toni, *P. naufraga* Berndt, *P. pienaarii* Pole-Evans, *P. rocherpaniana* Mennicken et Oberw., *P. subindumentana* Berndt and *P. subtaufus* G. Winter (Berndt, 2009). However, no records of the species from the genera *Puccinia* Pers. and *Aecidium* Pers. from *Helichrysum* in the CIS including Central Asia are known for us.

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