

Rust Fungi on Plants in Gardens and Parks of Astana and Karaganda Provinces, Kazakhstan

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ABSTRACT: A survey conducted during 2008 to identify rust fungi on trees and shrubs in gardens and parks of Astana and Karaganda provinces, Kazakhstan. As a result of this study 6 species belonging to 5 genera have been determined. Those genera are *Melampsora*, *Melampsoridium*, *Puccinia*, *Uromyces* and *Gymnosporangium*.

Key words: Rust fungi, Uredinales, tree, shrub, Kazakhstan

Astana ve Karaganda (Kazakistan) İllerinde Park ve Bahçelerdeki Bitkilerde Saptanan Pas Fungusları

ÖZET: Kazakistan'ın Astana ve Karaganda illerinde park ve bahçelerdeki ağaç ve çalılar üzerindeki pas funguslarını saptamak için 2008 yılında sürveyler yapılmıştır. Çalışma sonucunda 5 pas cinsine ait 6 tür tespit edilmiştir. Pas cinsleri *Melampsora*, *Melampsoridium*, *Puccinia*, *Uromyces* ve *Gymnosporangium* olarak belirlenmiştir.

Anahtar Kelimeler: Pas fungusları, Uredinales, ağaç, çalı, Kazakistan

INTRODUCTION

The territory of Kazakhstan occupies 2,725,000 square kilometers. It stretches from north to south for more than 1.6 thousands kilometers, from the moderate and humid forest steppe of the West Siberian Depression to the hot deserts of Middle Asia and the Tien Shan mountain ranges, and from west to east almost form three thousand km from the Volga River to the snowy tops of Altai. Naturally there is a large diversity of nature, landscapes and soils.

An average annual temperature ranges from 0.5 °C in the north to 12 °C in the south. The variation in the sum of active temperatures is wide. All the territory of Kazakhstan with regard to thermal resources is conclusive to cultivation of cereals, leguminous forage and vegetable crops, and in the southern regions of rice, cotton, sugar beet, etc. The amount of annual precipitation varies within a wide range from 120 to 600/800 mm (Anonymous, 1995).

Rust fungi (Basidiomycota, Uredinales) are among the most destructive plant diseases. The Uredinales is the largest natural group among the Basidiomycota, with about 7000 species currently placed in approximately 14 families and 160 genera (Ono and Aime, 2006). Among them, there are disease agents that severely affect field crops, vegetables, ornamentals, fruit, and forest trees (Agrios, 2005). Rust fungi are obligate parasites of

living plants although a few species are now cultured on artificial media (Cummins and Hiratsuka, 2003).

Rust fungi attack mostly leaves and stems. Rust infections usually appear as numerous rusty, orange, yellow, or even white-colored spots that rupture the epidermis (Agrios, 2005).

The identification of the parasitic fungal flora of a region is the first and most important step in controlling fungal diseases in a country. There are a few studies on rust fungi on trees and shrubs of different parts of Kazakhstan. These rust species are *Melampsora magnusiana* G. Magn. on *Populus alba* L., *M. salicina* Lev. on *Salix alba* L., *M. populina* (Pers.) Lev. on *Populus italica* Maench., *Melampsoridium betulinum* (Pers.) Kleb. on *Betula pendula* Roth., *Phragmidium rubi-idaei* (Pers.) Karst. and *Gymnoconia peckiana* (Home) Trottr. on *Rubus idaeus* L., *Ph. disciflorum* (Tode) James. on *Rosa* sp. and *Peridermium pini* (Wild) Lew. et. Kled. on *Pinus sylvestris* L. in Aksu, Ekibastuz and Pavlodar provinces (Osmanova, 2008). *Gymnosporangium juniperinum* (L.) Mart O. J. on *Malus sieversii* (Ledeb.) M. Roem. has been reported from central region of Trans Ili Alatau (Dernovskaya and Rakhimova, 2001). In addition to *Ph. devastatrix* Sorokin, *Ph. disciflorum* (Tode) James, *Ph.*

kamtschatkae (Ander.) Arth., *Ph. rosae-acicularis* Liro, *Ph. rosae-lacerantis* Diet. and *Ph. tuberculatum* J. Muller have been listed as pathogens of *Rosa* spp. of Kazakhstan (Rakhimova et al., 2005; Valiyeva et al., 2005; Tykhonenko, 2007).

The main aim of this work was to determine the species of rust fungi on trees and shrubs in gardens and parks of Astana and Karaganda provinces, Kazakhstan.

MATERIALS AND METHODS

This study was conducted in Astana and Karaganda provinces, Kazakhstan (Figure 1). The provinces have a continental climate, with exceptionally cold winters and moderately hot summers, arid and semiarid. During 2008, gardens and parks of Astana and Karaganda province were

surveyed and plant leaves (trees and shrubs) infected with rust fungi were sampled. The host specimens were prepared according to established herbarium techniques. Host plants were identified by the authors. The herbaria were examined by standard light and phase contrast microscopy. For light microscopical investigations the spores were scraped with a razor blade from the surface of leaves, mounted and stained in lactophenol containing cotton blue. The preparations were examined using an Olympus BH2 research microscope. Identification at the species level of rust fungi was carried out according to the diagnostic morphological criteria found principally in publications by Ellis and Ellis (1985), Cummins and Hiratsuka (2003) and Sadravi et al. (2007).



Figure 1. Map of study area.

RESULTS AND DISCUSSION

At the conclusion of the study, six rust species found on seven trees and shrubs genera were identified (Table 1). The host species are arranged in alphabetical order. These rust species are *Uromyces genistae-tinctoriae* (Pers.) Wint. on *Caragana arborescens* Lam., *Melampsora populnea* (Pers.) P. Karst. on *Populus alba* L. and *Puccinia coronata* Corda on *Rhamnus cathartica* L. in Astana province. *Puccinia graminis* Pers. on *Berberis karkaralensis* Korn. et Potap. and *Berberis oblonga* (Regl.) Schneid., *Melampsorium betulinum* (Pers.) Kleb. on *Betula pendula* Roth., *Gymnosporangium*

juniperi-virginianae Schw. on *Crataegus sanguinea* Pall. and *Melampsora populnea* (Pers.) P. Karst. on *Populus canescens* (Ait.) Smith were determined in Karaganda province. *M. magnusiana* previously reported on *P. alba* from Kazakhstan (Osanova, 2008) but not determined in this study. *U. genistae-tinctoriae* on *C. arborescens* in Germany, Portugal, Romania, Russia and Ukraine; *M. populnea* on *P. alba* in Algeria, Argentina, Brazil, Bulgaria, China, Denmark, England, Germany, Greece, India, Mexico, Norway, Pakistan, Russia, Uruguay and USA; *P. coronata* on *R. cathartica* in Bulgaria, China, Finland, Lithuania, Norway, Poland, Sweden,

Ukraine and USA; *M. populnea* on *P. canescens* in Bulgaria, China, Denmark and Germany; *G. juniperi-virginiana* on *Crataegus* sp. in Georgia and USA; *Melampsorium betulinum* on *B. pendula* in Australia, Bulgaria, California, Canada, China, Denmark, England, Finland, Germany, Japan, New Zealand, Norway, Poland, Romania, Switzerland and Russia were previously reported (Farr and Rossman, 2009). Rust species, mostly belonging to the genera *Melampsora*, *Melampsorium*, *Phragmidium*, *Gymnoconia*, *Gymnosporangium* and *Peridermium* on trees and shrubs have been reported from Kazakhstan (Dernovskaya and Rakhimova, 2001; Rakhimova et al., 2005; Valiyeva et al., 2005; Tykhonenko, 2007; Ospanova, 2008). The most significant studies on rusts conducted in this country

include those on *Melampsora* and *Phragmidium* on trees and shrubs (Ospanova, 2008).

Rust diseases cause serious economic damage worldwide on agricultural, forest, and ornamental plants (Cummins and Hiratsuka, 2003). Because of the presumed host-specificity of some species, they also offer a potential source of biological control organisms for noxious and invasive weeds (McCain et al. 1990; Evans 1993). Kazakhstan is a very suitable country for the occurrence of rust fungi, due to its climatic conditions and plant diversity. Finally, rust fungi of trees and shrubs should be mentioned. These records show that further study on the mycoflora of Kazakhstan is needed.

Table 1. Host and location of rust fungi determined in gardens and parks of Kazakhstan.

Host	Rust Fungi	Location
<i>Berberis karkaralensis</i> Korn. et Potap.	<i>Puccinia graminis</i> Pers	Karaganda
<i>Berberis oblonga</i> (Regl.) Schneid.	<i>Puccinia graminis</i> Pers.	Karaganda
<i>Betula pendula</i> Roth.	<i>Melampsorium betulinum</i> (Pers.) Kleb.	Karaganda
<i>Caragana arborescens</i> Lam.	<i>Uromyces genistae-tinctoriae</i> (Pers.) Wint.	Astana
<i>Crataegus sanguinea</i> Pall.	<i>Gymnosporangium juniperi-virginiana</i> Schw.	Karaganda
<i>Populus alba</i> L.	<i>Melampsora populnea</i> (Pers.) P. Karst.	Astana
<i>Populus canescens</i> (Ait.) Smith	<i>Melampsora populnea</i> (Pers.) P. Karst.	Karaganda
<i>Rhamnus cathartica</i> L.	<i>Puccinia coronata</i> Corda	Astana

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