FUNGI ASSOCIATED WITH *TROLLIUS DSCHUNGARICUS* REGEL (*RANUNCULACEAE*) IN ILE ALATAU (KAZAKHSTAN)

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Abstract. The main topic of this article is the range of diversity of fungi associated with *Trollius dschungaricus* Regel collected in Ile Alatau region in the period of 1946-1959 years. The nature of the fungal population associated with *Trollius dschungaricus* Regel has been the subject of a limited number of investigations in recent years. Detailed studies of the mycoflora of the plant is lacking apart from reviewed reports of investigated species. This article reviews the micromycetes and analyzes their structural characteristics and diversity based on the classification and pathogenicity.

Trollius dschungaricus Regel is widely distributed perennial plant in North Tien Shan (Dzungarian moumtains, Ile and Kungei Alatau) and Western Tien Shan. It grows in the belt of coniferous and deciduous forests and in alpine meadows, up to an altitude of 3800 m above sea level (Tarasova, 2023). Native to Kazakhstan, Kirgizstan, Tadzhikistan, Uzbekistan, Xinjiang. In fact, Trollius plants are very tolerant to many diseases and are rarely affected by serious pests or diseases. However, recently there was a report of *Alternaria alternata* causing leaf blight on *Trollius chinensis* Bunge in China (Sun et al., 2023), and The Royal Horticultural Society of UK announced that Trollius species, in particular, *Trollius europaeus* L. may be susceptible to powdery mildews (The Royal Horticultural Society, 2024). Consequently, the mycoflora of *Trollius* species require clarification and special studies on a different theoretical and practical basis. The relevance of the topic is associated with a significant spread of the phenomenon under study and lies in the need to develop recommendations for improving work in this area.

The materials are taken from the database of the laboratory of mycology and algology of Institute of Botany and Phyto The classification and current names of fungi are drawn from Mycobank Database (Fungal Databases, Nomenclature & Species Banks), whereas plant names were obtained from online database Catalogue of Life.

Septoria dschungarica Domashova (1960) – on *Trollius dschungaricus* Regel, Almaty region, Ile Alatau, subalpine meadows, 30.08.1959, L.A. Kireeva. Pycnidae globular, 66-150 μ in diameter, with rounded stomata, scattered or clustered in groups, immersed, on spots of both sides of leaf, more often upper. Walls thick, paraplectenchymatic, dark brown, almost black. Stylospores unicellular, more often with 1 septum, filamentous, slightly curved, 49-83 × 1.5 μ (according to Domashova, 42-96 × 1.5-25(3) μ), colourless. Spots solitary, irregular, vague, yellowish-brown. Two species of *Septoria* are known in the literature on species of the genus *Trollius* L.: *S. trollii* Sacc. et Winter and *S. dschungarica* Domaschova (The Flora of spore plants of Kazakhstan, Vol. 5, 1970). The Kazakhstan specimen by the size of pycnidia and stylospores is more similar to the latter, differing from it only by a smaller number of septa (according to Domaschova, 2- 12, more often 6-8).

Oedocephalum clavatum A.L. Sm. – on *Trollius dschungaricus* Regel, Almaty region, Kungei Alatau, vicinity of Dzhalanash, 05.07.1954, B.K. Kalymbetov. Conidiophores with septa, straight, globularly swollen at the apex, up to 25-30 × 20-25 μ, sometimes branched at the top, with radially arranged short sterigmas bearing 1 conidium each. Conidia are unicellular, cylindrical, acuminate at the base, 14-17 × 5-6 μ, warty, colourless. The turfs of the fungus are spidery, intertwined. It is found mainly on decaying plant remains of species of the genera *Hyacinthus* Tourn., *Eremurus* M. B., *Trollius* L.

Erysiphe ranunculi Grev. *(Erysiphe communis* Gréville *f. trollii* Roumeguère) – on *Trollius dschungaricus* Regel, Almaty region, Ile Alatau, northern slope, on the way to Talgar pass, sparse spruce forests, 2300 m asl, 25.08.1946, M. N. Kuznetsova. Fungus disappearing. Cleistothecia on both sides of leaf plate, globular, scattered, 71-93 μ in diameter (according to Yachevsky, 125 μ in diameter). Adventitious bracts lobed, stained at the base, colourless towards the end, up to 300 μ long. Number of asci is 4, ellipsoidal, rounded, with a small pedicel, 46.5- 62 μ×21.7- 46.5 μ. Spores number 4-6, ellipsoidal, 18.6-21.7 × 9.3-12.4 μ. (Fig. 1).

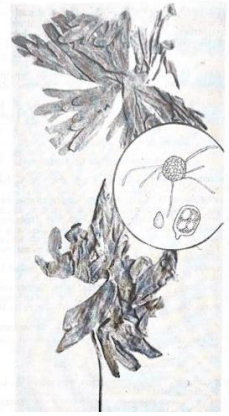

Figure 1 – *Erysiphe ranunculi Grev.* derived from The Flora of spore plants of Kazakhstan, 1973

Pseudocercosporella trollii (Sacc. & G. Winter) U. Braun *(Cercosporella trolliicola* Bond.-Mont.) – on *Trollius dschungaricus* Regel, Almaty region, Kungei Alatau, vicinity of Dzhalanash village, 05.07.1954, B. K. Kalymbetov. Conidiophores without septa, cylindrical, with teeth, 6- 21 × 1.5-2 μ (40 × 3 μ according to Vasilievsky and Karakulin), colourless, arranged in bunches, branching from stromatic mycelium tubules. Conidia with many septa (up to 12), cylindrical, needle-shaped, obovoid, bent, 70-128 × 1.5-2 μ (according to Vasilievsky and Karakulin, 70-120 × 2.5-3 μ, sometimes 150 × 3.5 μ), colourless. The sods of the fungus form a whitish or pinkish plaque on the spots on the underside of the leaf. (Fig. 2). Spots are oblong, rounded, 0.3-0.5 cm in diameter, greyish-brown, then dark brown and almost black, bounded by veins, often merging. Occurs on leaves of species of the genus *Trollius* L (Braun, 1995).

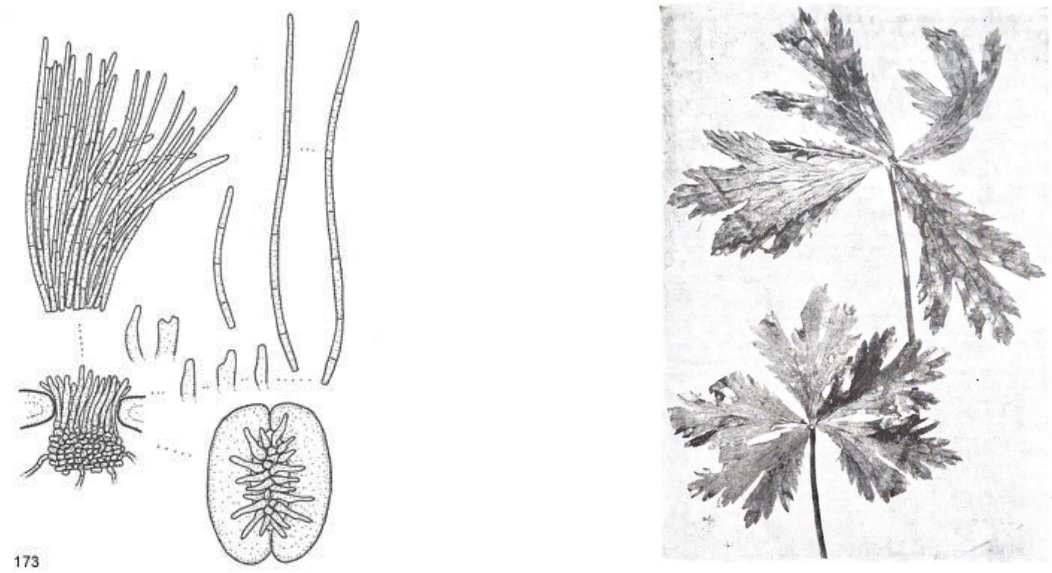

Figure 2 – *Pseudocercosporella trollii* (Sacc. & G. Winter) U. Braun derived from The Flora of spore plants of Kazakhstan Vol. 8

According to the data given, it can be seen that even considering the shortage of materials and the fact that they are collected from only Ile and Kungei Alatau regions, biodiversity of mycoflora of *Trollius dschungaricus* Regel is poor. Further details of micromycetes also confirms that by the fact that they belong to different classes: Dothideomycetes O.E. Erikss. & Winka, Pezizomycetes O.E. Erikss. & Winka, Leotiomycetes O.E. Erikss. & Winka (Table 1).

Regarding the effect of the given fungi on plant, it should be highlighted that *Septoria dschungarica* Domashova is a fungus of high pathogenicity combined with great harmfulness causing septoriosis, *Erysiphe ranunculi* Grev. is considered as the powdery mildew pathogen

which can cause significant yield reduction. *Pseudocercosporella trollii* (Sacc. & G. Winter) U. Braun has the wide host pathogenicity typical of many necrotrophic cereal parasites. Pathogenic fungi are fungi that cause disease in organisms. An unprecedented number of pathogenic fungi are emerging and causing disease in animals and plants, putting the resilience of wild and managed ecosystems in jeopardy (Gladieux et al., 2017). As for *Oedocephalum clavatum* A.L. Sm., it does not have pathogenicity, consequently is found to be saprotrophic in soil and on decaying plant remains.

Fungal name	**Class**	**Region**	**Feeding plant part**
Erysiphe ranunculi Grev.	Leotiomycetes	Ile Alatau	leaves
Oedocephalum clavatum A.L. Sm.	Pezizomycetes	Kungei Alatau	decaying plant remains
Pseudocercosporella trollii (Sacc. & G. Winter) U. Braun	Dothideomycetes	Kungei Alatau	leaves
Septoria dschungarica Domashova	Dothideomycetes	Ile Alatau	leaves

In conclusion, general descriptions of fungi associated with *T. dschungaricus* Regel are stated and special traits were specified, the insufficiency of records on *Erysiphe ranunculi* Grev. presented information is only from The Flora of spore plants of Kazakhstan. Among the four listed fungal species, three are classified as pathogenic besides *Oedocephalum clavatum* A.L. Sm. Despite limited material collection, the mycological diversity of *Trollius dschungaricus* Regel remains poor, with micromycetes spanning various classes such as Dothideomycetes, Pezizomycetes, and Leotiomycetes.

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