



Checklist of rust fungi from Ketmen ridge (southeast of Kazakhstan)

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Abstract

The Ketmen ridge has 84 species belonging to class *Urediniomycetes*. The class is represented by 11 genera from 6 families. The largest genera are *Puccinia* (48 species) and *Uromyces* (12 species). The following species are widely distributed in the territory: *Gymnosporangium fusisporum* on *Cotoneaster* spp., *Puccinia chrysanthemi* on *Artemisia* spp. and *Puccinia menthae* on *Mentha* spp. Rust fungi attack 134 species of host plants.

Key words – aecia – host plants – mycobiota – telia – uredinia

Introduction

Ketmen ridge (Ketpen, Uzynkara) is located to the east of the Zailiysky Alatau (Trans-Ili Alatau) and separated from the Central Tien-Shan by the Kegen depression. This, the most eastern ridge from the northern chains of the Tien Shan, extends in an east-west direction. The Ketmen ridge is more than 300 km long, 40–50 km wide and 3500–4200 m high. The western part of the ridge (about 160 km long) is located in Kazakhstan territory, and the eastern part in China. The highest point of the ridge, in the eastern part of the state border of Kazakhstan, is Nebesnaya peak (3638 m).

The northern slopes are gently sloping, the southern ones are steep, and the peaks not reaching the level of the snow line are flat. All the belts (from the foothill plain to the alpine belt) are represented on the northern slopes of the Ketmen. The slopes are strongly dissected by river valleys. A high-mountainous (3000–3600 m), medium-mountainous (1900–3000 m) and low-mountainous (1000–1900 m) relief is characteristic. There is no snow or glacial zone on the ridge. The main gorges of the northern slope of the Ketmen ridge are: Kalzhat, Bolshoy Dikan, Lesser Dikan, Sunkar, Dardamty, Tigermen, Aktam, Ulken Aksu, Kishi Aksu, Sumbe, Kyrgyzsai, Shoshanai, Sarybulak, Avat, Ardolaity, Ketmensai, and Temirlik.

The southern slopes are devoid of foothills and abruptly cut off to the vast Kegen-Tekes depression. The gorges of the southern slope (Shiibut, Sholak, Keimbulak, Komirshi, Shalkudysu, Kakap, Sulusai) are shorter, compared to the northern ones.

The western part of Ketmen (the mountains of Kuluktau) from Kungei Alatau and Trans-Ili Alatau is shared by the river valleys of Charyn, Chilik and the intermontane plain of Zhalanash. The main gorges of Kuluktau are: Dalaity, Uzyn-Bulak, and Shybyshy. Between the Kuluktau mountains and the main Ketmen ridge is the Kegen pass, which is 1959 m high.

The largest river is the Charyn (Shalkudysu, Kegen) with the right tributary Temirlik. On the western tip of the Karatau mountains there is a salt Tuzkol lake. The lake is 5 km long, about 1 km wide, the depth reaches 3 m. The maximum degree of salinity is 300 grams of salt per liter.

In floristic respect, the Ketmen ridge has been studied quite well. The flora of the ridge (together with the Chinese part) includes 1890 species of vascular plants, 98.5% of which are angiosperms, 80.0% are dicots and 18.5% are monocots (Sadyrova 2009). In general, the flora of the ridge is mountainous, with a large participation of boreal highland and middle meadow meadows, meadow-steppe and xerophytic desert-steppe and desert plants (Abolin 1930, Rubtsov 1953, 1955, 1956, Kamelin 1973, Abdulina 1984, Sadyrova 2009, Baizhigitov 2009).

In mycological respect, the Ketmen ridge has not been studied for a long time. A few specimens were revealed during a study of the herbarium collected in Ketmen in different years by botanists N.I. Rubtsov and E.F. Stepanova, S.A. Arystangaliev, V.P. Goloskokov, M.V. Popov, I.I. Roldugin, and V.V. Fisyun. B.K. Kalymbetov, investigating the mycobiota of the Trans-Ili Alatau, undertook short-term expeditions to the mountains of the Ketmen (the mountains of Temirlik) in 1954, 1956, 1957 and 1958. In 2004–2005, a partial examination of the northern macroslope of the Ketmen ridge was carried out by the staff of the Mycology and Algology Laboratory of the Institute of Botany and Phytointroduction. During the implementation of the project "Current state of species diversity of mycobiota and algophlora of desert lowlands of the southeast of Kazakhstan and their rational use" (2014–2017), the northern and southern macroslopes of the Ketmen ridge and its spurs (the Mountains Kuluktau, Karatau, Temirlik, Elshin Buiryk) were examined.

Materials & Methods

The study was conducted in the Ketmen ridge (southeastern regions of Kazakhstan) (Fig 1) for several years (2004, 2005, 2013–2016).



Fig 1 – Map of southeast of Kazakhstan showing the locality of Ketmen (Ketpen) ridge

Leaves of plants with typical symptoms were collected during field trips. A Canon 600E camera was used for photographing of typical leaf symptoms. Spores were stripped off the leaf surface, placed in a drop of distilled water on a microscope slide without any staining, examined

and photographed using a photomicroscope Polyvar with Nomarski interference contrast optics. Measurements of spores were made. Specimens were identified with the literature on rust fungi (Tranzshel 1939, Nevodovski 1970, Rakhimova et al. 2015).

Dried specimens are stored in the herbarium of the Institute of Botany and Phytointroduction, Almaty, Kazakhstan (AA).

The systematics of the taxa is in accordance with Kirk et al. (2001) and they are listed in alphabetical order. Species of rust fungi presented in a few literary sources are also included in the checklist.

Results

At present, the mycobiota of the Ketmen ridge has 84 species belonging to class *Urediniomycetes* (Table 1). The class is represented by 11 genera from 6 families. The largest genera are *Puccinia* (48 species) and *Uromyces* (12 species). The following species are widely distributed in the territory of the study: *Gymnosporangium fusisporum* on *Cotoneaster* spp., *Puccinia chrysanthemi* on *Artemisia* spp. and *Puccinia menthae* on *Mentha* spp. Rust fungi attack 134 species of host plants.

Table 1 Number of species of rust fungi in the families and genera in the Ketmen ridge.

Family	Genera	Species
<i>Coleosporiaceae</i>	<i>Chrysomyxa</i>	1
<i>Melampsoraceae</i>	<i>Melampsora</i>	5
<i>Phragmidiaceae</i>	<i>Phragmidium</i>	9
	<i>Trachyspora</i>	1
<i>Pucciniaceae</i>	<i>Gymnosporangium</i>	4
	<i>Pleomeris</i>	1
	<i>Puccinia</i>	48
	<i>Uromyces</i>	12
<i>Pucciniastraceae</i>	<i>Melampsoridium</i>	1
<i>Uropyxidaceae</i>	<i>Tranzschelia</i>	1
<i>Incertae sedis</i>	<i>Aecidium</i>	1
Total	11	84

Preliminary checklist of rust fungi from Ketmen ridge

Presence of aeciospores is indicated by I, urediniospores by II and teliospores by III.

Fungi

Basidiomycota Whittaker ex Moore

Urediniomycetes D. Hawksw., B. Sutton & Ainsw.

Uredinales G. Winter

Coleosporiaceae Dietel

Chrysomyxa deformans (Dietel) Jacz. (III)

On *Picea schrenkiana* Fisch. & C.A. Mey.

Southern macroslope, Komirshi gorge, 2136 m a.s.l., 43°06'51.2"N, 79°37'54.9"E, 06.07.2017, YV Rakhimova.

Melampsoraceae Dietel

Melampsora epitea Thüm. (II)

On *Salix viminalis* L.

Southern macroslope, top part of Akbet gorge, behind the Kegen pass, 1613 m a.s.l., 43°10'74.9"N, 79°13'71.9"E, 24.08.2016, LA Kyzmetova.

Melampsora euphorbiae (Ficinus & Schub.) Castagne (II, III) (Figs 2, 3)

On *Euphorbia jaxartica* Prokh.

Northern macroslope, Ulken Aksu, 2000 m a.s.l., in the spruce forest, on the slope, 30.09.2004, GA Nam.

On *Euphorbia soongarica* Boiss.

Northern macroslope, Sumbe gorge, 1475 m a.s.l., 43°15'48.4"N, 79°27'40.0"E, 16.07.2015, N Zhakhan.

On *Euphorbia* sp.

Northern macroslope, Sumbe gorge, 1475 m a.s.l., 43°15'48.4"N, 79°27'40.0"E, 16.07.2015, N Zhakhan, in the same gorge, 1477 m a.s.l., 43°16'07.1"N, 79°27'30.1"E, 16.07.2015, N Zhakhan, in the same gorge, 1449 m a.s.l., 43°16'03.2"N, 79°27'36.7"E, 16.07.2015, ZhM Takiyeva, Kyrgyzsai gorge, at the cordon of the hunting farm Gornoye, 1688 m a.s.l., 43°17'36.4"N, 79°30'46.8"E, 26.08.2016, EV Rakhimova, in the same gorge, at the forester's cordon, 1575 m a.s.l., 43°18'15.8"N, 79°30'44.4"E, 26.08.2016, EV Rakhimova, southern macroslope, Akbet gorge, behind the Kegen pass, 1621 m a.s.l., 43°10'75.7"N, 79°19'24.9"E, 24.08.2016, UK Jetigenova.



Figs 2–3 –*Melampsora euphorbiae*. 2 Urediniospores and paraphysis (arrow). – Bar = 20 μ m. 3 Uredinia on *Euphorbia* sp.

Melampsora lini (Ehrenb.) Lév. (II, III)

On *Linum heterosepalum* Regel

Southern macroslope, Talas gorge, 2106 m a.s.l., 43°08'60.5"N, 79°47'37.7"E, 26.08.2016, GA Nam.

On *Linum pallescens* Bunge

Southern macroslope, the mountains Temirlik, north-western slope, 2200 m a.s.l., 23.06.1958, BK Kalymbetov, the Saryzhaz valley, 2096 m a.s.l., 43°08'91.9"N, 79°58'25.1"E, 26.08.2016, GA Nam.

Melampsora populnea (Pers.) P. Karst. (II)

On *Populus tremula* L.

Northern macroslope, Kyrgyzsai gorge, at the cordon of the hunting farm Gornoye, 1688 m a.s.l., 43°17'36.4"N, 79°30'46.8"E, 26.08.2016, EV Rakhimova, Shoshanai gorge, floodplain, 1576 m a.s.l., 43°11'41.6"N, 79°23'66.5"E, 28.08.2016, UK Jetigenova.

On *Populus* sp.

Northern macroslope, Kyrgyzsai gorge, at the cordon of the hunting farm Gornoye, 1688 m a.s.l., 43°17'36.4"N, 79°30'46.8"E, 26.08.2016, EV Rakhimova.

***Melampsora salicina* Desm. (II)**

On *Salix* sp.

Northern macroslope, Ulkensai gorge, 1864 m a.s.l., 43°20'55.6"N, 79°56'18.5"E, 20.07.2015, UK Jetigenova, Aktam gorge, 1579 m a.s.l., 43°21'54.8"N, 79°53'33.6"E, 18.07.2015, UK Jetigenova, Avat gorge, along the river, 1673 m a.s.l., 43°19'13.0"N, 79°41'24.4"E, 17.07.2015, N Zhakhan, southern macroslope, Chakramba gorge, 2284 m a.s.l., 43°07'63.7"N, 80°07'91.2"E, 27.08.2016, AK Dzhienbekov, Komirshi gorge, 2136 m a.s.l., 43°06'51.2"N, 79°37'54.9"E, 06.07.2017, YV Rakhimova.

***Phragmidiaceae* Corda**

***Phragmidium acuminatum* (Fr.) Cooke (III)**

On *Rubus saxatilis* L.

Southern macroslope, neighborhood of Tuuk village, Baldyrgan gorge, 1997 m a.s.l., 43°04'98.7"N, 79°23'13.5"E, 27.08.2016, UK Jetigenova.

***Phragmidium devastatrix* Sorokin (III) (Figs 4, 5)**

On *Rosa* sp.

Northern macroslope, Kyrgyzsai gorge, 1425 m a.s.l., 43°18'87.2"N, 79°22'73.2"E, 11.09.2014, ZhM Takiyeva, Zhulkungei gorge, 1977 m a.s.l., 43°20'39.9"N, 80°12'52.0"E, 21.07.2015, UK Jetigenova, Sumbe gorge, 1385 m a.s.l., 43°17'00.6"N, 79°27'06.0"E, 27.08.2016, EV Rakhimova, Kishi Aksu gorge, 1396 m a.s.l., 43°20'14.8"N, 79°34'02.9"E, 28.08.2016, EV Rakhimova, southern macroslope, the mountains Karatau, 2061 m a.s.l., 43°03'75.0"N, 79°59'79.8"E, 25.08.2016, N Zhakhan.



Figs 4–5 – *Phragmidium devastatrix*. 4 Teliospores. – Bar = 30 μ m. 5 Telia on *Rosa* sp.

***Phragmidium fusiforme* J. Schröt. (*Ph. rosae-acicularis* Liro) (II, III)**

On *Rosa* sp.

Northern macroslope, Ulkensai gorge, 1617 m a.s.l., 43°21'52.4"N, 79°57'02.6"E, 19.07.2015, ZhM Takiyeva.

***Phragmidium kamtschatkae* (H.W. Anderson) Arthur & Cummins (II, III)**

On *Rosa* sp.

Northern macroslope, Aktam gorge, 1503 m a.s.l., 43°21'10.8"N, 79°44'16.4"E, 26.04.2015, GA Nam.

***Phragmidium mucronatum* (Pers.) Schldl. (*Ph. disciflorum* (Tode) James) (II, III)**

On *Rosa* sp.

Northern macroslope, Aktam gorge, 1469 m a.s.l., 43°22'42.2"N, 79°53'28.8"E, 18.07.2015, UK Jetigenova, in the same gorge, 1637 m a.s.l., 43°21'51.3"N, 79°53'32.0"E, 18.07.2015, ZhM Takiyeva, Sumbe gorge, 1475 m a.s.l., 43°15'48.4"N, 79°27'40.0"E, 16.07.2015, N Zhakhan, in the same gorge, 1449 m a.s.l., 43°16'03.2"N, 79°27'36.7"E, 16.07.2015, ZhM Takiyeva, Ulken Aksu gorge, 1426 m a.s.l., 43°20'19.3"N, 79°37'28.4"E, 24.04.2015, ZhM Takiyeva, Avat gorge, cordon, 1445 m a.s.l., 43°21'47.6"N, 79°40'52.0"E, 24.04.2015, ZhM Takiyeva.

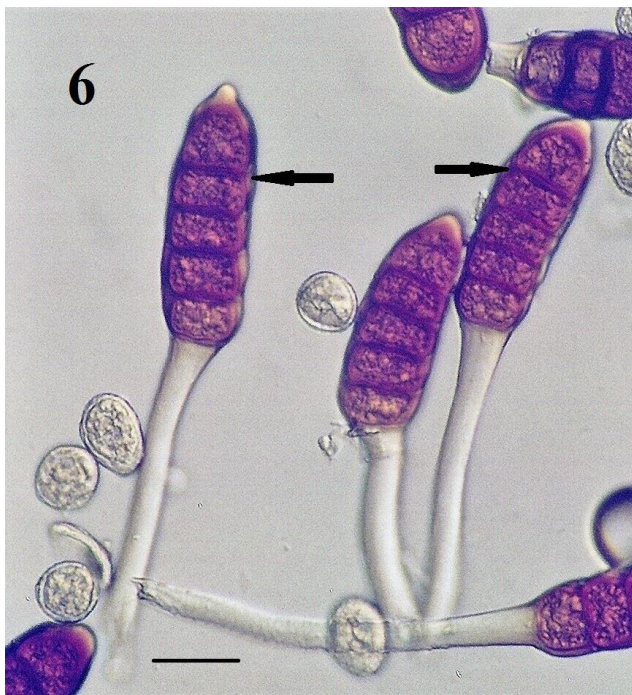
***Phragmidium potentillae* (Pers.) P. Karst. (II, III) (Figs 6, 7)**

On *Potentilla asiatica* (Th. Wolf) Juz.

Northern macroslope, Sumbe gorge, 1385 m a.s.l., 43°17'00.6", 79°27'06.0"E, 27.08.2016, EV Rakhimova, Kishi Aksu gorge, below the cordon, 1396 m a.s.l., 43°20'14.8"N, 79°34'02.9"E, 28.08.2016, EV Rakhimova, Shoshanai gorge, 1421 m a.s.l., 43°13'07.8"N, 79°21'57.7"E, 25.08.2016, EV Rakhimova; in the same gorge, floodplain, m a.s.l., 43°11'41.6"N, 79°23'66.5"E, 28.08.2016, N Zhakhan, west side, the mountains Kuluktau, Uzyn-Bulak gorge, 1817 m a.s.l., 43°07'13.2"N, 79°00'28.2"E, 24.08.2016, EV Rakhimova.

On *Potentilla multifida* L.

Southern macroslope, the mountains Elshin Byiryk, 1953 m a.s.l., 43°00'78.1"N, 79°58'68.5"E, 25.08.2016, N Zhakhan.



Figs 6–7 – *Phragmidium potentillae*. 6 Teliospores (arrows) and urediniospores. – Bar = 25 µm. 7 Uredinia on *Potentilla* sp.

On *Potentilla* sp.

Northern macroslope, Ulken Aksu gorge, 1531 m a.s.l., 43°19'36.9"N, 79°37'11.6"E, 13.09.2014, GA Nam, Sumbe gorge, 1477 m a.s.l., 43°16'07.1"N, 79°27'30.1"E, 16.07.2015, N Zhakhan, in the same gorge, 1475 m a.s.l., 43°15'48.4"N, 79°27'40.0"E, 16.07.2015, N Zhakhan, in the same gorge, 1489 m a.s.l., 43°15'44.3"N, 79°27'48.7"E, 16.07.2015, UK Jetigenova, west side, the mountains Kuluktau, Uzyn-Bulak gorge, near the fir trees, 1723 m a.s.l., 43°07'21.0"N, 79°00'44.4"E, 24.08.2016, EV Rakhimova.

***Phragmidium rosae-lacerantis* Dietel (II, III)**

On *Rosa alberti* Regel

Southern macroslope, the mountains Karatau, 2061 m a.s.l., 43°03'75.0"N, 79°59'79.8"E, 25.08.2016, LA Kyzmetova.

On *Rosa beggeriana* Schrenk

Southern macroslope, Kishi Shibut gorge, neighborhood Shalkode village, 2246 m a.s.l., 43°11'02.2"N, 79°53'35.2"E, 26.08.2016, N Zhakhan.

On *Rosa* sp.

Northern macroslope, Sumbe gorge, 1385 m a.s.l., 43°17'00.6"N, 79°27'06.0"E, 27.08.2016, EV Rakhimova, Shoshanai gorge, 1421 m a.s.l., 43°13'07.8"N, 79°21'57.7"E, 25.08.2016, EV Rakhimova, in the same gorge, floodplain, 1576 m a.s.l., 43°11'41.6"N, 79°23'66.5"E, 28.08.2016, N Zhakhan, Kishi Aksu gorge, above the cordon, 1463 m a.s.l., 43°19'38.6"N, 79°34'27.3"E, 28.08.2016, EV Rakhimova, the gorge of the left tributary of the Dardamty river, 1369 m a.s.l., 43°23'55.8"N, 80°03'26.5"E, 29.08.2016, EV Rakhimova, southern macroslope, Akbet gorge, behind the Kegen pass, 1621 m a.s.l., 43°10'75.7"N, 79°19'24.9"E, 24.08.2016, GA Nam, in the same gorge, top part, 1660 m a.s.l., 43°10'80.8"N, 79°13'54.4"E, 24.08.2016, UK Jetigenova, Talas gorge, 2106 m a.s.l., 43°08'60.5"N, 79°47'37.7"E, 26.08.2016, LA Kyzmetova, west side, the mountains Kuluktau, Uzyn-Bulak gorge, 1703 m a.s.l., 43°07'40.2"N, 79°07'28.0"E, 24.08.2016, EV Rakhimova.

Phragmidium rubi-idaei (DC.) P. Karst. (II, III)

On *Rubus idaeus* L.

Northern macroslope, Ulkensai gorge, 1617 m a.s.l., 43°21'52.4"N, 79°57'02.6"E, 19.07.2015, ZhM Takiyeva, in the same gorge, 1749 m a.s.l., 43°21'37.4"N, 79°56'45.0"E, 20.07.2015, N Zhakhan.

Phragmidium tuberculatum Jul. Müll. (II, III)

On *Rosa* sp.

West side, the mountains Kuluktau, Dalaity gorge, 1373 m a.s.l., 43°05'26.7"N, 78°53'53.1"E, 01.07.2016, EV Rakhimova, Ulkensai gorge, 1617 m a.s.l., 43°21'52.4"N, 79°57'02.6"E, 19.07.2015, ZhM Takiyeva.

Trachyspora alchemillae (Pers.) Fuckel (II, III)

On *Alchemilla* sp.

Northern macroslope, Kyrgyzsai gorge, at the cordon of the hunting farm Gornoye, 1635 m a.s.l., 43°17'40.0"N, 79°30'48.6"E, 17.07.2015, UK Jetigenova, Sumbe gorge, 1489 m a.s.l., 43°15'44.3"N, 79°27'48.7"E, 16.07.2015, UK Jetigenova, southern macroslope, Kishi Shibut gorge, neighborhood Shalkode village, 2246 m a.s.l., 43°11'02.2"N, 79°53'35.2"E, 26.08.2016, N Zhakhan, west side, the mountains Kuluktau, Uzyn-Bulak gorge, 1817 m a.s.l., 43°07'13.2"N, 79°00'28.2"E, 24.08.2016, EV Rakhimova.

Pucciniaceae Chevall.

Gymnosporangium clavariiforme (Wulfen) DC. (III)

On *Juniperus sabina* L.

West side, the mountains Kuluktau, Uzyn-Bulak gorge, 1817 m a.s.l., 43°07'13.2"N, 79°00'28.2"E, 24.08.2016, EV Rakhimova.

Gymnosporangium confusum Plowr. (I)

On *Crataegus korolkowii* L. Henry (*C. altaica* (Loudon) Lange)

Northern macroslope, Zhulkungei gorge, 1997 m a.s.l., 43°20'39.9"N, 80°12'52.0"E, 21.07.2015, N Zhakhan, Aktam gorge, 1579 m a.s.l., 43°21'54.8"N, 79°53'33.6"E, 18.07.2015, UK Jetigenova, Sumbe 1477 m a.s.l., 43°16'07.1"N, 79°27'30.1"E, 16.07.2015, N Zhakhan, Dardamty gorge, 1371 m a.s.l., 43°25'37.0"N, 80°04'23.7"E, 29.08.2016, EV Rakhimova, Kyrgyzsai gorge, 1688 m a.s.l., 43°17'36.4"N, 79°30'46.8"E, 26.08.2016, EV Rakhimova, west side, the mountains Kuluktau, Uzyn-Bulak gorge, 1817 m a.s.l., 43°07'13.2"N, 79°00'28.2"E, 24.08.2016, EV Rakhimova.

On *Crataegus* sp.

Northern macroslope, Kyrgyzsai gorge, 1635 m a.s.l., 43°17'40.0"N, 79°30'48.6"E, 17.07.2015, UK Jetigenova, Sumbe gorge, 1477 m a.s.l., 43°16'07.1"N, 79°27'30.1"E, 16.07.2015, N Zhakhan.

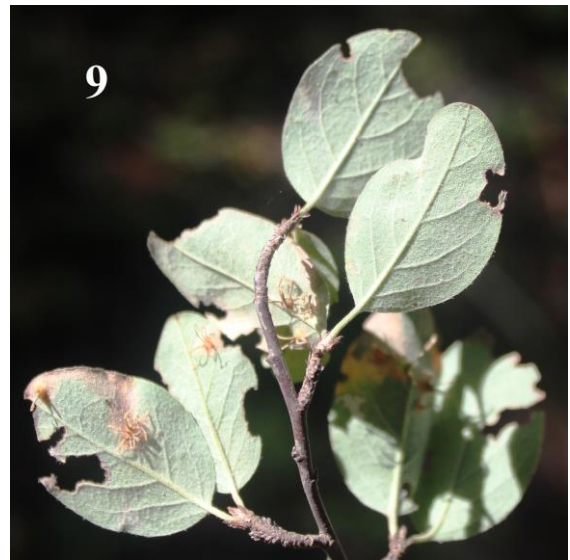
***Gymnosporangium fusisporum* E. Fisch. (I) (Figs 8, 9)**

On *Cotoneaster melanocarpus* Fisch.

Northern macroslope, Zhulkungei gorge, 1977 m a.s.l., 43°20'39.9"N, 80°12'52.0"E, 21.07.2015, UK Jetigenova, Avat gorge, 1673 m a.s.l., 43°19'13.0"N, 79°41'24.4"E, 17.07.2015, N Zhakhan, Ulkensai gorge, 2000 m a.s.l., 01.10.2004, LA Kyzmetova, in the same gorge, 1617 m a.s.l., 43°21'52.4"N, 79°57'02.6"E, 19.07.2015, ZhM Takiyeva, Aktam gorge, 1579 m a.s.l., 43°21'54.8"N, 79°53'33.6"E, 18.07.2015, UK Jetigenova, southern macroslope, Talas gorge, 2106 m a.s.l., 43°08'61.4"N, 79°47'34.3"E, 26.08.2016, LA Kyzmetova, Akbet gorge, behind the Kegen pass, 1664 m a.s.l., 43°10'81.9"N, 79°13'42.7"E, 24.08.2016, N Zhakhan, in the same gorge, 1660 m a.s.l., 43°10'80.8"N, 79°13'54.4"E, 24.08.2016, N Zhakhan, in the same gorge, at the spring, 1613 m a.s.l., 43°10'74.9"N, 79°13'71.9"E, 24.08.2016, UK Jetigenova.

On *Cotoneaster multiflorus* Bunge

Northern macroslope, Sumbe gorge, cordon, 1428 m a.s.l., 43°16'20.3"N, 79°27'25.6"E, 03.08.2014, M Ramzanova.



Figs 8–9 – *Gymnosporangium fusisporum*. 8 Aeciospores. – Bar = 25 µm. 9 Restelia on *Cotoneaster* sp.

On *Cotoneaster* sp.

Northern macroslope, Kyrgyzsai gorge, 1530 m a.s.l., 43°19'01.4"N, 79°30'06.4"E, 12.09.2014, ZhM Takiyeva, in the same gorge, at the cordon of the hunting farm Gornoye, 1688 m a.s.l., 43°17'36.4"N, 79°30'46.8"E, 26.08.2016, EV Rakhimova; Aktam gorge, 1637 m a.s.l., 43°21'51.3"N, 79°53'32.0"E, 18.07.2015, ZhM Takiyeva, in the same gorge, 1469 m a.s.l., 43°22'42.2"N, 79°53'28.8"E, 18.07.2015, UK Jetigenova, in the same gorge, 1579 m a.s.l., 43°21'54.8"N, 79°53'33.6"E, 18.07.2015, UK Jetigenova; Sumbe gorge, 1475 m a.s.l., 43°15'48.4"N, 79°27'40.0"E, 16.07.2015, N Zhakhan, in the same gorge, 1477 m a.s.l., 43°16'07.1"N, 79°27'30.1"E, 16.07.2015, N Zhakhan, in the same gorge, 1489 m a.s.l., 43°15'44.3"N, 79°27'48.7"E, 16.07.2015, UK Jetigenova, in the same gorge, 1449 m a.s.l., 43°16'03.2"N, 79°27'36.7"E, 16.07.2015, ZhM Takiyeva; Ulkensai gorge, 2000 m a.s.l., 01.10.2004, LA Kyzmetova, southern macroslope, neighborhood of Tuuk village, Baldyrgan gorge, 1997 m a.s.l., 43°04'98.7"N, 79°23'13.5"E, 27.08.2016, LA Kyzmetova, Talas gorge,

2106 m a.s.l., 43°08'61.4"N, 79°47'34.3"E, 26.08.2016, UK Jetigenova, Akbet gorge, 1660 m a.s.l., 43°10'80.8"N, 79°13'54.4"E, 24.08.2016, SB Nurashov, the mountains Karatau, 2061 m a.s.l., 43°03'75.0"N, 79°59'79.8"E, 25.08.2016, UK Jetigenova; west side, the mountains Kuluktau, Uzyn-Bulak gorge, 1703 m a.s.l., 43°07'40.2"N, 79°07'28.0"E, 24.08.2016, EV Rakhimova.

***Gymnosporangium juniperi* Link (I)**

On *Sorbus tianschanica* Rupr.

West side, the mountains Kuluktau, Dalaity gorge, 1373 m a.s.l., 43°05'26.7"N, 78°53'53.1"E, 01.07.2016, EV Rakhimova.

***Pleomeris dactylidina* (Bubák) Syd. (II, III)**

On *Dactylis glomerata* L.

Northern macroslope, Shoshanai gorge, floodplain, 1576 m a.s.l., 43°11'41.6"N, 79°23'66.5"E, 28.08.2016, UK Jetigenova; southern macroslope, Tuuk village, 1911 m a.s.l., 43°06'97.1"N, 79°16'23.5"E, 27.08.2016, UK Jetigenova, in the same place, 27.08.2016, LA Kyzmetova, Chakramba gorge, 2284 m a.s.l., 43°07'63.7"N, 80°07'91.2"E, 27.08.2016, LA Kyzmetova, neighborhood of Tuuk village, Baldyrgan gorge, 1997 m a.s.l., 43°04'98.7"N, 79°23'13.5"E, 27.08.2016, LA Kyzmetova.

***Puccinia acanthi* P. Syd. & Syd. (II, III)**

On *Onopordum acanthium* L.

Northern macroslope, Shoshanai gorge, 1685 m a.s.l., 43°11'08.6"N, 79°23'59.3"E, 11.09.2014, AK Dzhienbekov, Kyrgyzsai gorge, 1667 m a.s.l., 43°17'83.7"N, 79°30'77.5"E, 12.09.2014, UK Jetigenova, Ulken Aksu gorge, 1531 m a.s.l., 43°19'36.9"N, 79°37'11.6"E, 13.09.2014, GA Nam.

***Puccinia acetosae* (Schumach.) Körn. (I)**

On *Rumex confertus* Willd.

Southern macroslope, neighborhood of Tuuk village, Baldyrgan gorge, 1997 m a.s.l., 43°04'98.7"N, 79°23'13.5"E, 27.08.2016, UK Jetigenova.

***Puccinia acroptili* P. Syd. & Syd. (II, III)**

On *Acroptilon repens* (L.) DC.

Southern macroslope, Akbet gorge, behind the Kegen pass, 1664 m a.s.l., 43°10'81.9"N, 79°13'42.7"E, 24.08.2016, GA Nam.

***Puccinia aegopodii* (Schumach.) Link (III)**

On *Aegopodium alpestre* Ledeb.

The mountains Temirlik, 2200 m a.s.l., 22.06.1958, BK Kalymbetov, southern macroslope, Komirshi gorge, 2136 m a.s.l., 43°06'51.2"N, 79°37'54.9"E, 06.07.2017, YV Rakhimova.

***Puccinia agrostidis* Plowr. (II, III) (Figs 10, 11)**

On *Agrostis gigantea* Roth

Northern macroslope, Dardamty gorge, 1371 m a.s.l., 43°25'37.0"N, 80°04'23.7"E, 29.08.2016, YV Rakhimova, Sumbe gorge, 1385 m a.s.l., 43°17'00.6"N, 79°27'06.0"E, 27.08.2016, YV Rakhimova, southern macroslope, neighborhood of Tuuk village, Baldyrgan gorge, 1997 m a.s.l., 43°04'98.7"N, 79°23'13.5"E, 27.08.2016, GA Nam, UK Jetigenova, west side, the mountains Kuluktau, Uzyn-Bulak gorge, near the fir trees, 1723 m a.s.l., 43°07'21.0"N, 79°00'44.4"E, 24.08.2016, YV Rakhimova, in the same gorge, artificial planting of pine, birch, apricot, 1703 m a.s.l., 43°07'40.2"N, 79°07'28.0"E, 24.08.2016, YV Rakhimova, in the same gorge, 1817 m a.s.l., 43°07'13.2"N, 79°00'28.2"E, 24.08.2016, YV Rakhimova, the mountains Elshin Buiryk, 1953 m a.s.l., 43°00'78.1"N, 79°58'68.5"E, 25.08.2016, LA Kyzmetova.

***Puccinia albulensis* Magnus (*P. veronicarum* (DC) Tranzsch.) (III)**

On *Veronica* sp.

North-western slope, 2000 m a.s.l., 01.10.2004, GA Nam.

***Puccinia angelicae* (Schumach.) Fuckel (II, III)**

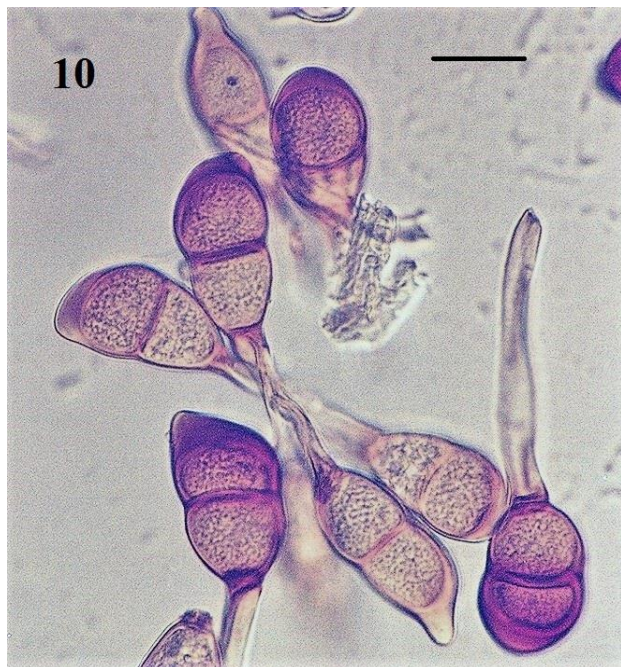
On *Seseli schrenkianum* (C.A. Mey. ex Schischk) Pimenov & Sdobnina

Northern macroslope, Ulkensai gorge, 1617 m a.s.l., 43°21'52.4"N, 79°57'02.6"E, 19.07.2015, ZhM Takiyeva.

Puccinia arenariae (Schumach.) J. Schröt. (III)

On *Cerastium davuricum* Fisch. ex Spreng.

Southern macroslope, gorge Chakramba, 2284 m a.s.l., 43°07'63.7"N, 80°07'91.2"E, 27.08.2016, LA Kyzmetova.



Figs 10–11 – *Puccinia agrostidis*. 10 Teliospores. – Bar = 20 μ m. 11 Uredinia on *Agrostis gigantea*.

Puccinia athanasiae Tranzshel & Kuprewicz., the species is absent in the database Index Fungorum (II, III) (Figs 12, 13)

On *Ajania fastigiata* (C. Winkl.) Poljakov

Northern macroslope, Ulken Aksu gorge, 2000 m a.s.l., 30.09.2004, GA Nam, Kishi Aksu gorge, cordon, 1463 m a.s.l., 43°19'38.6"N, 79°34'27.3"E, 28.08.2016, YV Rakhimova, in the same gorge, 1396 m a.s.l., 43°20'14.8"N, 79°34'02.9"E, 28.08.2016, YV Rakhimova, Shoshanai gorge, 1421 m a.s.l., 43°13'07.8"N, 79°21'57.7"E, 25.08.2016, YV Rakhimova, Kyrgyzsai gorge, at the cordon of the hunting farm Gornoye, 1688 m a.s.l., 43°17'36.4"N, 79°30'46.8"E, 26.08.2016, YV Rakhimova, Talas gorge, 2106 m a.s.l., 43°08'61.4"N, 79°47'34.3"E, 26.08.2016, GA Nam, southern macroslope, Akbet gorge, behind the Kegen pass, 1660 m a.s.l., 43°10'80.8"N, 79°13'54.4"E, 24.08.2016, LA Kyzmetova, in the same gorge, 1664 m a.s.l., 43°10'81.9"N, 79°13'42.7"E, 24.08.2016, GA Nam, Kishi Shibut gorge, neighborhood Shalkode village, 2246 m a.s.l., 43°11'02.2"N, 79°53'35.2"E, 26.08.2016, LA Kyzmetova, the mountains Karatau, neighborhood Tuzkol village, 2020 m a.s.l., 43°02'22.6"N, 79°59'89.5"E, 25.08.2016, UK Jetigenova, in the same gorge, 2061 m a.s.l., 43°03'75.0"N, 79°59'79.8"E, 25.08.2016, UK Jetigenova, west side, the mountains Kuluktau, Uzyn-Bulak gorge, 1703 m a.s.l., 43°07'40.2"N, 79°07'28.0"E, 24.08.2016, YV Rakhimova.

On *Pyrethrum fruticosum* Biehler (Tranzshel 1939).

Puccinia brachypodii G.H. Otth (*P. arrhenatheri* (Kleb.) Eriksson.) (I)

On *Berberis* sp.

Northern macroslope, Aktam gorge, 1503 m a.s.l., 43°21'10.8"N, 79°44'16.4"E, 26.04.2015, GA Nam.

Puccinia calcitrapae DC. (*P. cirsi* Lasch.) (II, III) (Figs 14, 15)

On *Alfredia acantholepis* Kar. & Kir.

Northern macroslope, Shoshanai gorge, floodplain, 1576 m a.s.l., 43°11'41.6"N, 79°23'66.5"E, 28.08.2016, UK Jetigenova, southern macroslope, the mountains Karatau, neighborhood



Figs 12–13 – *Puccinia athanasiae*. 12 Teliospore. – Bar = 25 µm. 13 Telia on *Ajania fastigiata*.

Tuzkol village, 2020 m a.s.l., 43°02'22.6"N, 79°59'89.5"E, 25.08.2016, N Zhakhan.

On *Alfredia nivea* Kar. & Kir.

Northern macroslope, Sumbe gorge, 1507 m a.s.l., 43°15'32.9"N, 79°27'57.0"E, 16.07.2015, YY Kurmantayeva, southern macroslope, Chakramba gorge, 2284 m a.s.l., 43°07'63.7"N, 80°07'91.2"E, 27.08.2016, N Zhakhan, Akbet gorge, behind the Kegen pass, 1621 m a.s.l., 43°10'75.7"N, 79°19'24.9"E, 24.08.2016, UK Jetigenova.

On *Centaurea squarrosa* Willd.

Southern macroslope, floodplain of Temirlik river, 1038 m a.s.l., 43°18'03.9"N, 79°11'70.7"E, 28.08.2016, N Zhakhan.

On *Cirsium incanum* (S.G. Gmel.) Fisch.

Northern macroslope, Shoshanai gorge, floodplain, 1576 m a.s.l., 43°11'41.6"N, 79°23'66.5"E, 28.08.2016, AK Dzhienbkov, west side, the mountains Kuluktau, Uzyn-Bulak gorge, 1817 m a.s.l., 43°07'13.2"N, 79°00'28.2"E, 24.08.2016, YV Rakhimova.

On *Cirsium vulgare* (Savi) Ten.

Northern macroslope, Aktam gorge, 1579 m a.s.l., 43°21'54.8"N, 79°53'33.6"E, 18.07.2015, UK Jetigenova, Ulkensis gorge, 2000 m a.s.l., 01.10.2004, LA Kyzmetova, Kyrgyzsai gorge, at the cordon of the hunting farm Gornoye, 1688 m a.s.l., 43°17'36.4"N, 79°30'46.8"E, 26.08.2016, YV Rakhimova, in the same gorge, 1635 m a.s.l., 43°17'40.0"N, 79°30'48.6"E, 17.07.2015, UK Jetigenova, Kishi Aksu gorge, cordon, 1463 m a.s.l., 43°19'38.6"N, 79°34'27.3"E, 28.08.2016, YV Rakhimova, Shoshanai gorge, floodplain, 1576 m a.s.l., 43°11'41.6"N, 79°23'66.5"E, 28.08.2016, AK Dzhienbkov, Sumbe gorge, 1385 m a.s.l., 43°17'00.6"N, 79°27'06.0"E, 27.08.2016, YV Rakhimova, the gorge of the left tributary of the Dardamty river, 1369 m a.s.l., 43°23'55.8"N, 80°03'26.5"E, 29.08.2016, YV Rakhimova, west side, the mountains Kuluktau, Uzyn-Bulak gorge, 1723 m a.s.l., 43°07'21.0"N, 79°00'44.4"E, 24.08.2016, YV Rakhimova.

Puccinia cesatii J. Schröt. (II)

On *Botriochloa ischaemum* (L.) Keng.

Northern macroslope, Kishi Aksu gorge, 1463 m a.s.l., 43°19'38.6"N, 79°34'27.3"E, 28.08.2016, YV Rakhimova.

***Puccinia chrysanthemi* Roze (*P. absinthii* DC.) (II, III) (Figs 16–19)**

On *Artemisia absinthium* L.



Figs 14–15 – *Puccinia calcitrapae*. 14 Urediniospores. – Bar = 25 µm. 15 Uredinia on *Cirsium vulgare*.

Northern macroslope, Sumbe gorge, 1449 m a.s.l., 43°16'03.2"N, 79°27'36.7"E, 16.07.2015, ZhM Takiyeva, Ulkensai gorge, 2000 m a.s.l., 01.04.2004, BZh Yessengulova, in the same gorge, 1795 m a.s.l., 43°21'18.1"N, 79°56'34.0"E, 20.07.2015, YY Kurmantayeva, Shoshanai gorge, 1421 m a.s.l., 43°13'07.8"N, 79°21'57.7"E, 25.08.2016, YV Rakhimova, in the same gorge, floodplain, 1576 m a.s.l., 43°11'41.6"N, 79°23'66.5"E, 28.08.2016, AK Dzhienbkov.

On *Artemisia arenaria* DC.

Northern macroslope, Ulken Aksu gorge, 2000 m a.s.l., 30.09.2004, GA Nam.

On *Artemisia dracuncululus* L.

Northern macroslope, Zhulkungei gorge, 1841 m a.s.l., 43°21'34.5"N, 80°12'34.2"E, 21.07.2015, ZhM Takiyeva, Sumbe gorge, 1475 m a.s.l., 43°15'48.4"N, 79°27'40.0"E, 16.07.2015, N Zhakhan, Shoshanai gorge, 1421 m a.s.l., 43°13'07.8"N, 79°21'57.7"E, 25.08.2016, YV Rakhimova, in the same gorge, floodplain, 1576 m a.s.l., 43°11'41.6"N, 79°23'66.5"E, 28.08.2016, AK Dzhienbkov, southern macroslope, neighborhood of Tuuk village, Baldyrgan gorge, 2078 m a.s.l., 43°05'09.2"N, 79°24'03.0"E, 27.08.2016, UK Jetigenova, in the same gorge, 1997 m a.s.l., 43°04'98.7"N, 79°23'13.5"E, 27.08.2016, LA Kyzmetova, Chakramba gorge, 2284 m a.s.l., 43°07'63.7"N, 80°07'91.2"E, 27.08.2016, LA Kyzmetova, in the same gorge, 2116 m a.s.l., 43°05'99.3"N, 80°03'72.8"E, 27.08.2016, N Zhakhan, Akbet gorge, behind the Kegen pass, at the spring, 1613 m a.s.l., 43°10'74.9"N, 79°13'71.9"E, 24.08.2016, SB Nurashov.

On *Artemisia frigida* Willd.

Northern macroslope, the gorge of the left tributary of the Dardamty river, 1369 m a.s.l., 43°23'55.8"N, 80°03'26.5"E, 29.08.2016, YV Rakhimova, Sumbe gorge, 1385 m a.s.l., 43°17'00.6"N, 79°27'06.0"E, 27.08.2016, YV Rakhimova, west side, the mountains Kuluktau, Uzyn-Bulak gorge, 1703 m a.s.l., 43°07'40.2"N, 79°07'28.0"E, 24.08.2016, YV Rakhimova.

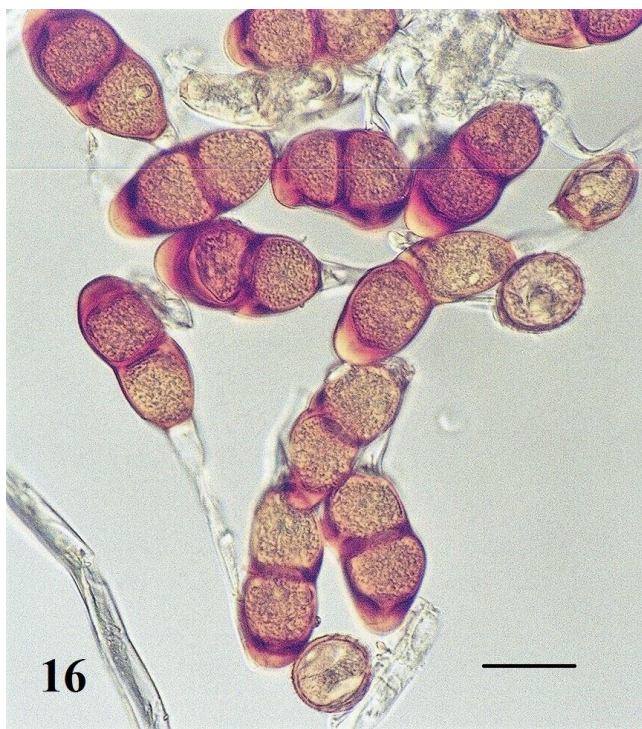
On *Artemisia integrifolia* L.

Northern macroslope, Aktam gorge, 1637 m a.s.l., 43°21'51.3"N, 79°53'32.0"E, 18.07.2015, ZhM Takiyeva.

On *Artemisia macrocephala* Jacq. ex Besser

Southern macroslope, Chakramba gorge, 2284 m a.s.l., 43°07'63.7"N, 80°07'91.2"E, 27.08.2016, GA Nam, Kishi Shibut gorge, neighborhood Shalkode village, 2246 m a.s.l.,

43°11'02.2"N, 79°53'35.2"E, 26.08.2016, UK Jetigenova, behind the Kegen pass, Akbet gorge, at the spring, 1613 m a.s.l., 43°10'74.9"N, 79°13'71.9"E, 24.08.2016, N Zhakhan, in the same gorge, 1660 m a.s.l., 43°10'80.8"N, 79°13'54.4"E, 24.08.2016, GA Nam, the mountains Karatau, 2061 m a.s.l., 43°03'75.0"N, 79°59'79.8"E, 25.08.2016, SB Nurashov, neighborhood Tuzkol village, 2020 m a.s.l., 43°02'22.6"N, 79°59'89.5"E, 25.08.2016, GA Nam, west side, the mountains Kuluktau, Uzyn-Bulak gorge, 1723 m a.s.l., 43°07'21.0"N, 79°00'44.4"E, 24.08.2016, YV Rakhimova, in the same gorge, 1817 m a.s.l., 43°07'13.2"N, 79°00'28.2"E, 24.08.2016, YV Rakhimova.



Figs 16–19 – *Puccinia chrysanthemi*. 16 Teliospores. – Bar = 25 μ m. 17 Telia on *Artemisia sublessingiana*. 18 Telia on *Artemisia absinthium*. 19 Telia on *Artemisia macrocephala*.

On *Artemisia santolinifolia* Turcz. ex Besser

Northern macroslope, Ulken Sai gorge, 2000 m a.s.l., 01.10.2004, LA Kyzmetova, the gorge of the left tributary of the Dardamty river, 1369 m a.s.l., 43°23'55.8"N, 80°03'26.5"E, 29.08.2016, YV Rakhimova, Sumbe gorge, 1385 m a.s.l., 43°17'00.6"N, 79°27'06.0"E, 27.08.2016, YV Rakhimova, southern macroslope, gorge Kishi Shibut, neighborhood Shalkode village, 2246 m a.s.l., 43°11'02.2"N, 79°53'35.2"E, 26.08.2016, SB Nurashov, the mountains Elshin Buiryk,

1953 m a.s.l., 43°00'78.1"N, 79°58'68.5"E, 25.08.2016, UK Jetigenova, west side, the mountains Kuluktau, Uzyn-Bulak gorge, 1817 m a.s.l., 43°07'13.2"N, 79°00'28.2"E, 24.08.2016, YV Rakhimova, in the same gorge, 1703 m a.s.l., 43°07'40.2"N, 79°07'28.0"E, 24.08.2016, YV Rakhimova.

On *Artemisia sublessingiana* Krasch. ex Poljakov

Northern macroslope, Dardamty gorge, 1371 m a.s.l., 43°25'37.0"N, 80°04'23.7"E, 29.08.2016, YV Rakhimova, Kishi Aksu gorge, 1463 m a.s.l., 43°19'38.6"N, 79°34'27.3"E, 28.08.2016, YV Rakhimova, Sumbe gorge, 1385 m a.s.l., 43°17'00.6"N, 79°27'06.0"E, 27.08.2016, YV Rakhimova, southern macroslope, the mountains Karatau, neighborhood Tuzkol village, 2020 m a.s.l., 43°02'22.6"N, 79°59'89.5"E, 25.08.2016, LA Kyzmetova, the mountains Elshin Buiryk, 1953 m a.s.l., 43°00'78.1"N, 79°58'68.5"E, 25.08.2016, SB Nurashov.

On *Artemisia vulgaris* L.

Northern macroslope, Zhulkungei gorge, 1977 m a.s.l., 43°20'39.9"N, 80°12'52.0"E, 21.07.2015, UK Jetigenova, Ulkensäi gorge, 1617 m a.s.l., 43°21'52.4"N, 79°57'02.6"E, 19.07.2015, ZhM Takiyeva.

On *Artemisia* sp.

Northern macroslope, Aktam gorge, 1488 m a.s.l., 43°22'35.6"N, 79°53'27.1"E, 18.07.2015, N Zhakhan; Shoshanai gorge, 1421 m a.s.l., 43°13'07.8"N, 79°21'57.7"E, 25.08.2016, YV Rakhimova, southern macroslope, behind the Kegen pass, Akbet gorge, 1664 m a.s.l., 43°10'81.9"N, 79°13'42.7"E, 24.08.2016, SB Nurashov, the mountains Karatau, neighborhood Tuzkol village, 2020 m a.s.l., 43°02'22.6"N, 79°59'89.5"E, 25.08.2016, SB Nurashov.

Puccinia coronata Corda (II, III)

On *Alopecurus pratensis* L.

Southern macroslope, behind the Kegen pass, Akbet gorge, at the spring, 1613 m a.s.l., 43°10'74.9"N, 79°13'71.9"E, 24.08.2016, LA Kyzmetova.

On *Calamagrostis epigeios* (L.) Roth

Northern macroslope, Sumbe gorge, 1385 m a.s.l., 43°17'00.6"N, 79°27'06.0"E, 27.08.2016, YV Rakhimova.

Puccinia dioicae Magnus (*P. silvatica* J. Schröt.) (I)

On *Taraxacum kok-saghyz* L.E. Rodin

Northern macroslope, Tekes village, 13.07.1934, B Shishkin.

On *Taraxacum officinale* F.H. Wigg.

Southern macroslope, the mountains Temirlik, 2200 m a.s.l., 22.06.1958, BK Kalymbetov, 01.10.2004, LA Kyzmetova.

Puccinia echinopsis DC. (II, III)

On *Echinops chantavicus* Trautv.

Northern macroslope, Temirlik gorge, 28.09.1954, PP Polyakov.

Puccinia elymi Westend. (II, III)

On *Elymus dahuricus* Turcz. ex Griseb.

Southern macroslope, Chakramba gorge, 2284 m a.s.l., 43°07'63.7"N, 80°07'91.2"E, 27.08.2016, UK Jetigenova.

On *Elymus mutabilis* (Drobow) Tzvelev

Southern macroslope, neighborhood of Tuuk village, Baldyrgan gorge, 1997 m a.s.l., 43°04'98.7"N, 79°23'13.5"E, 27.08.2016, LA Kyzmetova, Chakramba gorge, 2284 m a.s.l., 43°07'63.7"N, 80°07'91.2"E, 27.08.2016, LA Kyzmetova.

On *Elymus sibiricus* L.

Southern macroslope, Chakramba gorge, 2284 m a.s.l., 43°07'63.7"N, 80°07'91.2"E, 27.08.2016, UK Jetigenova.

On *Elymus tianschanigenus* Czerep.

West side, the mountains Kuluktau, Uzyn-Bulak gorge, 1723 m a.s.l., 43°07'21.0"N, 79°00'44.4"E, 24.08.2016, YV Rakhimova.

Puccinia festucae Plowr. (I)

On *Lonicera alberti* Regel

Southern macroslope, Komirshi gorge, 2136 m a.s.l., 43°06'51.2"N, 79°37'54.9"E, 06.07.2017, YV Rakhimova.

On *Lonicera stenantha* Pojark.

Southern macroslope, Komirshi gorge, 2136 m a.s.l., 43°06'51.2"N, 79°37'54.9"E, 06.07.2017, YV Rakhimova.

Puccinia gentianae (F. Strauss) Link (II, III)

On *Gentiana kaufmanniana* Regel & Schmalh.

Southern macroslope, Talas gorge, 2106 m a.s.l., 43°08'61.4"N, 79°47'34.3"E, 26.08.2016, N Zhakhan, in the same gorge, 2106 m a.s.l., 43°08'60.5"N, 79°47'37.7"E, 26.08.2016, LA Kyzmetova, Chakramba gorge, 2116 m a.s.l., 43°05'99.3"N, 80°03'72.8"E, 27.08.2016, LA Kyzmetova.

On *Gentiana kirilowii* Turcz.

Southern macroslope, the mountains Elshin Buiryk, 1953 m a.s.l., 43°00'78.1"N, 79°58'68.5"E, 25.08.2016, SB Nurashov.

Puccinia graminis Pers. (I, II, III)

On *Agropyron cristatum* (L.) Gaertn.

Northern macroslope, Kishi Aksu gorge, 1463 m a.s.l., 43°19'38.6"N, 79°34'27.3"E, 28.08.2016, YV Rakhimova.

On *Agropyron pectinatum* (M. Bieb.) P. Beauv. (*A. pectiniforme* Roem.)

Northern macroslope, Ulken Sai gorge, 1000 m a.s.l., 02.10.2004, LA Kyzmetova.

On *Agrostis gigantea* Roth

Northern macroslope, Ulkensai gorge, 2000 m a.s.l., 01.10.2004, GA Nam, southern macroslope, neighborhood Shalkode village, Kishi Shibut gorge, 2246 m a.s.l., 43°11'02.2"N, 79°53'35.2"E, 26.08.2016, SB Nurashov.

On *Berberis iliensis* Popov

Northern macroslope, Ulken Aksu gorge, floodplain, 2000 m a.s.l., 30.09.2004, GA Nam.

On *Berberis sphaerocarpa* Kar. & Kir.

West side, the mountains Kuluktau, Dalaity gorge, 1373 m a.s.l., 43°05'26.7"N, 78°53'53.1"E, 01.07.2016, YV Rakhimova, northern macroslope, Sumbe gorge, 1477 m a.s.l., 43°16'07.1"N, 79°27'30.1"E, 16.07.2015, N Zhakhan.

Puccinia hieracii (Röhl.) H. Mart. (*P. taraxaci* Plowr.) (II)

On *Cichorium intybus* L.

Northern macroslope, Shoshanai gorge, floodplain, 1576 m a.s.l., 43°11'41.6"N, 79°23'66.5"E, 28.08.2016, LA Kyzmetova, southern macroslope, behind the Kegen pass, Akbet gorge, 1621 m a.s.l., 43°10'75.7"N, 79°19'24.9"E, 24.08.2016, UK Jetigenova.

On *Hieracium* sp.

Northern macroslope, Kyrgyzsai gorge, at the cordon of the hunting farm Gornoye, 1688 m a.s.l., 43°17'36.4"N, 79°30'46.8"E, 26.08.2016, YV Rakhimova, Tuuk village, 1911 m a.s.l., 43°06'97.1"N, 79°16'23.5"E, 27.08.2016, AK Dzhienbkov, Ulkensai gorge, 1864 m a.s.l., 43°20'55.6"N, 79°56'18.5"E, 20.07.2015, UK Jetigenova.

On *Taraxacum officinale* F.H. Wigg.

Northern macroslope, Ulken Aksu gorge, floodplain, 2000 m a.s.l., 30.09.2004, GA Nam.

On *Taraxacum* sp.

Northern macroslope, Kyrgyzsai gorge, 1635 m a.s.l., 43°17'40.0"N, 79°30'48.6"E, 17.07.2015, UK Jetigenova, in the same gorge, at the cordon of the hunting farm Gornoye, 1688 m a.s.l., 43°17'36.4"N, 79°30'46.8"E, 26.08.2016, YV Rakhimova, Shoshanai gorge, 1421 m a.s.l., 43°13'07.8"N, 79°21'57.7"E, 25.08.2016, YV Rakhimova, southern macroslope, the mountains Elshin Buiryk, 1953 m a.s.l., 43°00'78.1"N, 79°58'68.5"E, 25.08.2016, UK Jetigenova.

Puccinia iridis Wallr. (II, III)

On *Iris ruthenica* Ker Gawl.

Northern macroslope, Zhulkungei gorge, 1885 m a.s.l., 43°21'13.0"N, 80°12'31.0"E, 21.07.2015, N Zhakhan, Ulkensai gorge, 1617 m a.s.l., 43°21'52.4"N, 79°57'02.6"E, 19.07.2015, ZhM Takiyeva, Kyrgyzsai gorge, at the cordon of the hunting farm Gornoye, 1688 m a.s.l., 43°17'36.4"N, 79°30'46.8"E, 26.08.2016, YV Rakhimova, southern macroslope, Talas gorge, 2106 m a.s.l., 43°08'60.5"N, 79°47'37.7"E, 26.08.2016, UK Jetigenova, neighborhood Shalkode village, Kishi Shibut gorge, 2246 m a.s.l., 43°11'02.2"N, 79°53'35.2"E, 26.08.2016, LA Kyzmetova.

On *Iris scariosa* Willd. ex Link

Northern macroslope, Dardamty gorge, 1371 m a.s.l., 43°25'37.0"N, 80°04'23.7"E, 29.08.2016, YV Rakhimova.

On *Iris sogdiana* Bunge

Northern macroslope, Dardamty gorge, 1371 m a.s.l., 43°25'37.0"N, 80°04'23.7"E, 29.08.2016, YV Rakhimova, southern macroslope, neighborhood of Tuuk village, Baldyrgan gorge, 1997 m a.s.l., 43°04'98.7"N, 79°23'13.5"E, 27.08.2016, LA Kyzmetova, behind the Kegen pass, Akbet gorge, at the spring, 1613 m a.s.l., 43°10'74.9"N, 79°13'71.9"E, 24.08.2016, UK Jetigenova, west side, the mountains Kuluktau, Uzyn-Bulak gorge, 1703 m a.s.l., 43°07'40.2"N, 79°07'28.0"E, 24.08.2016, YV Rakhimova.

On *Iris* sp.

Northern macroslope, Aktam gorge, 1469 m a.s.l., 43°22'42.2"N, 79°53'28.8"E, 18.07.2015, UK Jetigenova, Shoshanai gorge, 1576 m a.s.l., 43°11'41.6"N, 79°23'66.5"E, 28.08.2016, N Zhakhan, southern macroslope, the mountains Elshin Buiryk, 1953 m a.s.l., 43°00'78.1"N, 79°58'68.5"E, 25.08.2016, GA Nam.

Puccinia isiacae (Thüm.) G. Wint. (I)

On *Lamium album* L.

West side, the mountains Kuluktau, Dalaity gorge, 1373 m a.s.l., 43°05'26.7"N, 78°53'53.1"E, 01.07.2016, YV Rakhimova.

Puccinia koeleriicola Tranzschel (III)

On *Koeleria cristata* (L.) Pers. (*K. gracilis* Pers.)

Northern macroslope, Ulkensai gorge, 2000 m a.s.l., 01.10.2004, Ulken Aksu gorge, 2000 m a.s.l., 30.09.2004, GA Nam.

Puccinia komarovii Tranzschel ex P. Syd. & Syd. (III)

On *Impatiens parviflora* DC.

Northern macroslope, Ulken Aksu gorge, 1531 m a.s.l., 43°19'36.9"N, 79°37'11.6"E, 13.09.2014, GA Nam, Sumbe gorge, 1489 m a.s.l., 43°15'44.3"N, 79°27'48.7"E, 16.07.2015, UK Jetigenova, Aktam gorge, 1579 m a.s.l., 43°21'54.8"N, 79°53'33.6"E, 18.07.2015, UK Jetigenova, Kyrgyzsai gorge, 1635 m a.s.l., 43°17'40.0"N, 79°30'48.6"E, 17.07.2015, UK Jetigenova, in the same gorge, at the cordon of the hunting farm Gornoye, 1688 m a.s.l., 43°17'36.4"N, 79°30'46.8"E, 26.08.2016, YV Rakhimova, in the same gorge, 1575 m a.s.l., 43°18'15.8"N, 79°30'44.4"E, 26.08.2016, YV Rakhimova, the gorge of the left tributary of the Dardamty river, 1369 m a.s.l., 43°23'55.8"N, 80°03'26.5"E, 29.08.2016, YV Rakhimova, Shoshanai gorge, floodplain, 1576 m a.s.l., 43°11'41.6"N, 79°23'66.5"E, 28.08.2016, UK Jetigenova, west side, the mountains Kuluktau, Uzyn-Bulak gorge, 1703 m a.s.l., 43°07'40.2"N, 79°07'28.0"E, 24.08.2016, YV Rakhimova, in the same gorge, 1817 m a.s.l., 43°07'13.2"N, 79°00'28.2"E, 24.08.2016, YV Rakhimova, in the same gorge, near the fir trees, 1723 m a.s.l., 43°07'21.0"N, 79°00'44.4"E, 24.08.2016, YV Rakhimova.

Puccinia lasiagrostis Tranzschel (II, III)

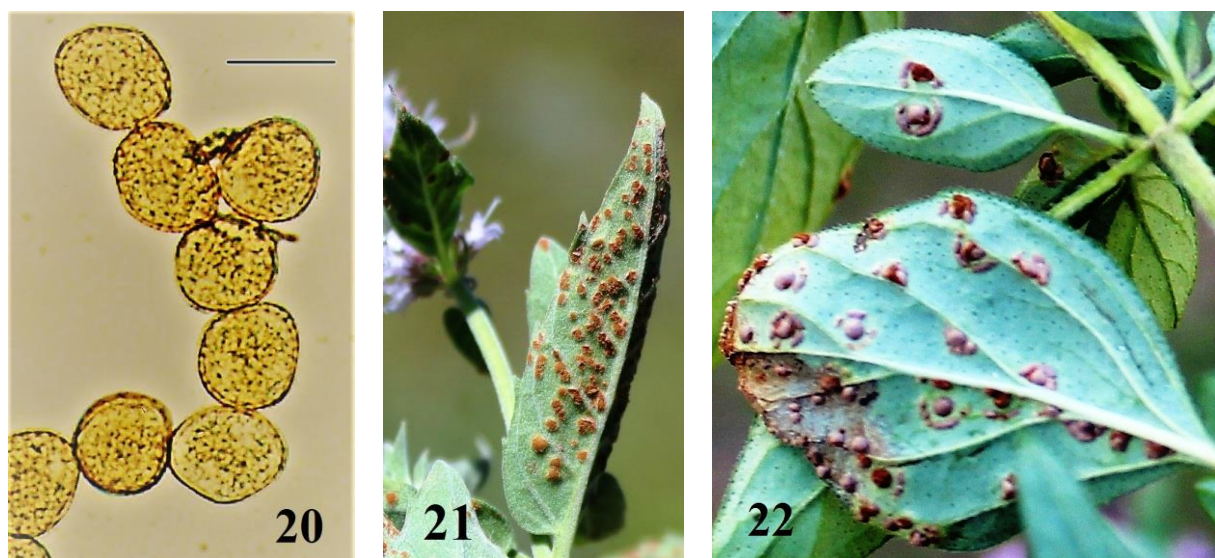
On *Achnatherum splendens* (Trin.) Nevski

Southern macroslope, the mountains Elshin Buiryk, 1953 m a.s.l., 43°00'78.1"N, 79°58'68.5"E, 25.08.2016, GA Nam.

Puccinia leveillei Mont. (II)

- On *Geranium saxatile* Kar. & Kir.
Southern macroslope, the mountains Temirlik, 2200 m a.s.l., 22.06.1958, BK Kalymbetov.
- Puccinia libanotidis*** Lindr. (II, III)
On *Seseli schrenkianum* (C.F. Mey. ex Schischk.) Pimenov & Sdobnina
Southern macroslope, Kishi Shibut gorge, neighborhood Shalkode village, 2246 m a.s.l., 43°11'02.2"N, 79°53'35.2"E, 26.08.2016, LA Kyzmetova.
- Puccinia longirostris*** Kom. (III)
On *Lonicera altmannii* Regel & Schmalh.
Northern macroslope, Ulken Aksu gorge, 2000 m a.s.l., 30.09.2004, GA Nam.
- On *Lonicera tatarica* L.
Northern macroslope, Ulkensai gorge, 2000 m a.s.l., 01.10.2004, GA Nam.
- On *Lonicera* sp.
Northern macroslope, Sumbe gorge, 1507 m a.s.l., 43°15'32.9"N, 79° 27'57.0"E, 20.07.2015, YY Kurmantayeva, in the same gorge, 1489 m a.s.l., 43°15'44.3"N, 79°27'48.7"E, 16.07.2015, UK Jetigenova, southern macroslope, the mountains Temirlik, 2606 m a.s.l., 43°01'89.1"N, 79°30'31.8"E, 04.08.2013, GA Nam.
- Puccinia magnusiana*** Körn. (III)
On *Phragmites australis* (Cav.) Trin. ex Steud.
Northern macroslope, floodplaine of Ulken Aksu river, 30.09.2004, LA Kyzmetova.
- Puccinia malvacearum*** Bertero ex Mont. (III)
On *Malva neglecta* Wallr.
Northern macroslope, Kyrgyzsai gorge, 1575 m a.s.l., 43°18'15.8"N, 79°30'44.4"E, 26.08.2016, YV Rakhimova, Shoshanai gorge, 1421 m a.s.l., 43°13'07.8"N, 79°21'57.7"E, 25.08.2016, YV Rakhimova.
- Puccinia menthae*** Pers. (III) (Figs 20–22)
On *Mentha arvensis* L.
Northern macroslope, Dardamty gorge, 1371 m a.s.l., 43°25'37.0"N, 80°04'23.7"E, 29.08.2016, YV Rakhimova.
- On *Mentha asiatica* Boriss.
Northern macroslope, Sumbe gorge, 1489 m a.s.l., 43°15'44.3"N, 79°27'48.7"E, 16.07.2015, UK Jetigenova, in the same gorge, 1449 m a.s.l., 43°16'03.2"N, 79°27'36.7"E, 16.07.2015, ZhM Takiyeva, in the same gorge, 1385 m a.s.l., 43°17'00.6"N, 79°27'06.0"E, 27.08.2016, YV Rakhimova, Zhulkungei gorge, 1977 m a.s.l., 43°20'39.9"N, 80°12'52.0"E, 21.07.2015, UK Jetigenova, Aktam gorge, 1579 m a.s.l., 43°21'54.8"N, 79°53'33.6"E, 18.07.2015, UK Jetigenova, in the same gorge, 1488 m a.s.l., 43°22'35.6"N, 79°53'27.1"E, 18.07.2015, N Zhakhan, Kishi Aksu gorge, 1396 m a.s.l., 43°20'14.8"N, 79°34'02.9"E, 28.08.2016, YV Rakhimova, Shoshanai gorge, 1421 m a.s.l., 43°13'07.8"N, 79°21'57.7"E, 25.08.2016, YV Rakhimova, Dardamty gorge, 1371 m a.s.l., 43°25'37.0"N, 80°04'23.7"E, 29.08.2016, YV Rakhimova, west side, the mountains Kuluktau, Dalaity gorge, 1373 m a.s.l., 43°05'26.7"N, 78°53'53.1"E, 01.07.2016, YV Rakhimova, Uzyn-Bulak gorge, 1723 m a.s.l., 43°07'21.0"N, 79°00'44.4"E, 24.08.2016, YV Rakhimova, floodplain of Temirlik river, 1038 m a.s.l., 43°18'03.9"N, 79°11'70.7"E, 28.08.2016, AK Dzhienbkov, southern macroslope, neighborhood of Tuuk village, Baldyrgan gorge, 1997 m a.s.l., 43°04'98.7"N, 79°23'13.5"E, 27.08.2016, N Zhakhan, behind the Kegen pass, Akbet gorge, 1621 m a.s.l., 43°10'75.7"N, 79°19'24.9"E, 24.08.2016, UK Jetigenova, in the same gorge, at the spring, 1613 m a.s.l., 43°10'74.9"N, 79°13'71.9"E, 24.08.2016, UK Jetigenova, the mountains Elshin Buiryk, 1953 m a.s.l., 43°00'78.1"N, 79°58'68.5"E, 25.08.2016, N Zhakhan.
- On *Origanum vulgare* L.
Northern macroslope, Zhulkungei gorge, 1841 m a.s.l., 43°21'34.5"N, 80°12'34.2"E, 21.07.2015, ZhM Takiyeva, Sumbe gorge, 1475 m a.s.l., 43°15'48.4"N, 79°27'40.0"E, 16.07.2015, N Zhakhan, Shoshanai gorge, floodplain, 1576 m a.s.l., 43°11'41.6"N, 79°23'66.5"E, 28.08.2016, AK Dzhienbkov, Ulkensai gorge, 2000 m a.s.l., 01.10.2004, LA

Kyzmetova, Ulken Aksu gorge, 2000 m a.s.l., 30.09.2004, LA Kyzmetova; Kyrgyzsai gorge, at the cordon of the hunting farm Gornoye, 1688 m a.s.l., 43°17'36.4"N, 79°30'46.8"E, 26.08.2016, YV Rakhimova, Kishi Aksu gorge, 1396 m a.s.l., 43°20'14.8"N, 79°34'02.9"E, 28.08.2016, YV Rakhimova, southern macroslope, neighborhood of Tuuk village, Baldyrgan gorge, 2078 m a.s.l., 43°05'09.2"N, 79°24'03.0"E, 27.08.2016, UK Jetigenova, Tuuk village, 1911 m a.s.l., 43°06'97.1"N, 79°16'23.5"E, 27.08.2016, LA Kyzmetova, west side, the mountains Kuluktau, Uzyn-Bulak gorge, 1817 m a.s.l., 43°07'13.2"N, 79°00'28.2"E, 24.08.2016, YV Rakhimova.



Figs 20–22 – *Puccinia menthae*. 20 Urediniospores. – Bar = 25 µm. 21 Uredinia on *Mentha asiatica*. 22 Uredinia on *Origanum vulgare*.

***Puccinia monticola* Kom. (I)**

On *Geranium* sp.

West side, the mountains Kuluktau, Dalaity gorge, plateau of pass, 2097 m a.s.l., 43°04'27.3"N, 78°52'21.5"E, 01.07.2016, YV Rakhimova.

***Puccinia paludosa* Plowr. (I)**

On *Pedicularis* sp.

Southern macroslope, Komirshi gorge, 2136 m a.s.l., 43°06'51.2"N, 79°37'54.9"E, 06.07.2017, YV Rakhimova.

***Puccinia phlomidis* Thüm. (I, II, III) (Figs 23, 24)**

On *Leonurus turkestanicus* V.I. Krecz. & Kuprian.

West side, the mountains Kuluktau, Dalaity gorge, 2032 m a.s.l., 43°04'56.6"N, 78°53'11.1"E, 01.07.2016, YV Rakhimova, in the same gorge, plateau of pass, 2097 m a.s.l., 43°04'27.3"N, 78°52'21.5"E, 01.07.2016, YV Rakhimova.

On *Phlomoides oreophila* (Kar. & Kir.) Adylov, Kamelin & Makhm.

Northern macroslope, Sumbe gorge, 1475 m a.s.l., 43°15'48.4"N, 79°27'40.0"E, 16.07.2015, N Zhakhan, southern macroslope, Komirshi gorge, 2136 m a.s.l., 43°06'51.2"N, 79°37'54.9"E, 06.07.2017, YV Rakhimova.

***Puccinia phragmitis* (Schumach.) Tul. (II, III)**

On *Phragmites australis* (Cav.) Trin. ex Steud.

Wwest side, Sharyn river, 474 m a.s.l., 43°31'14.1"N, 79°15'00.8"E, 27.04.2015, UK Jetigenova.

***Puccinia platypoda* Syd. & P. Syd. (III)**

On *Atraphaxis pyrifolia* Bunge

Northern macroslope, Sumbe gorge, 1475 m a.s.l., 43°15'48.4"N, 79°27'40.0"E, 16.07.2015, N Zhakhan.

Puccinia poarum Nielsen (I, II, III)

On *Poa bulbosa* L.

West side, the mountains Kuluktau, Dalaity gorge, 1373 m a.s.l., 43°05'26.7"N, 78°53'53.1"E, 01.07.2016, YV Rakhimova.

On *Poa nemoralis* L.

Northern macroslope, Ulken Aksu gorge, 2000 m a.s.l., 30.09.2004, GA Nam.

On *Poa pratensis* L.

Northern macroslope, Ulken Aksu gorge, 1531 m a.s.l., 43°19'36.9"N, 79°37'11.6"E, 13.09.2014, GA Nam, west side, the mountains Kuluktau, Uzyn-Bulak gorge, 1723 m a.s.l., 43°07'21.0"N, 79°00'44.4"E, 24.08.2016, YV Rakhimova, in the same gorge, 1703 m a.s.l., 43°07'40.2"N, 79°07'28.0"E, 24.08.2016, YV Rakhimova.

On *Poa* sp.

West side, the mountains Kuluktau, Uzyn-Bulak gorge, 1703 m a.s.l., 43°07'40.2"N, 79°07'28.0"E, 24.08.2016, YV Rakhimova.

On *Tussilago farfara* L.

Northern macroslope, Ulkensai gorge, 2000 m a.s.l., 01.10.2004, GA Nam.



Figs 23–24 – *Puccinia phlomidis*. 23 Aeciospores and peridial cells. – Bar = 25 µm. 24 Aecia on *Leonurus turkestanicus*.

Puccinia punctata Link (II, III)

On *Galium spurium* L.

Southern macroslope, neighborhood of Tuuk village, Baldyrgan gorge, 1997 m a.s.l., 43°04'98.7"N, 79°23'13.5"E, 27.08.2016, UK Jetigenova, behind the Kegen pass, Akbet gorge, 1660 m a.s.l., 43°10'80.8"N, 79°13'54.4"E, 24.08.2016, N Zhakhan.

On *Galium verum* L.

Northern macroslope, Ulkensai gorge, 2000 m a.s.l., 01.10.2004, LA Kyzmetova, southern macroslope, behind the Kegen pass, Akbet gorge, 1664 m a.s.l., 43°10'81.9"N, 79°13'42.7"E, 24.08.2016, N Zhakhan.

Puccinia pygmaea Erikss. (I, II, III)

On *Berberis sphaerocarpa* Kar. & Kir.

- Northern macroslope, Shoshanai gorge, 1685 m a.s.l., 43°11'08.6"N, 79°23'59.3"E, 11.09.2014, AK Dzhienbekov.
- On *Calamagrostis epigeios* (L.) Roth
Northern macroslope, Ulkensai gorge, 2000 m a.s.l., 01.10.2004, LA Kyzmetova.
- Puccinia recondita*** Roberge ex Desm. (I, II, III)
- On *Alopecurus pratensis* L. (*A. songaricus* (Roshev.) V. Petr.)
Northern macroslope, Ulkensai gorge, 2000 m a.s.l., 01.10.2004, GA Nam, southern macroslope, Komirshi gorge, 2136 m a.s.l., 43°06'51.2"N, 79°37'54.9"E, 06.07.2017, YV Rakhimova.
- On *Anisantha tectorum* (L.) Nevski
Southern macroslope, behind the Kegen pass, Akbet gorge, 1664 m a.s.l., 43°10'81.9"N, 79°13'42.7"E, 24.08.2016, UK Jetigenova.
- On *Bromus squarrosus* L.
Southern macroslope, behind the Kegen pass, Akbet gorge, at the spring, 1613 m a.s.l., 43°10'74.9"N, 79°13'71.9"E, 24.08.2016, UK Jetigenova, neighborhood of Tuuk village, Baldyrgan gorge, 1997 m a.s.l., 43°04'98.7"N, 79°23'13.5"E, 27.08.2016, GA Nam.
- On *Clematis songarica* Bunge
Northern macroslope, Ulken Aksu gorge, 2000 m a.s.l., 30.09.2004, GA Nam.
- On *Cynoglossum officinale* L.
West side, the mountains Kuluktau, Dalaity gorge, 1373 m a.s.l., 43°05'26.7"N, 78°53'53.1"E, 01.07.2016, YV Rakhimova.
- Puccinia rubefaciens*** Johanson (III)
- On *Galium spurium* L.
Northern macroslope, Ulkensai gorge, 1617 m a.s.l., 43°21'52.4"N, 79°57'02.6"E, 19.07.2015, ZhM Takiyeva.
- On *Galium verum* L.
Northern macroslope, Sumbe gorge, 1475 m a.s.l., 43°15'48.4"N, 79°27'40.0"E, 16.07.2015, N Zhakhan.
- Puccinia saussureae*** Thüm. (II, III)
- On *Saussurea elegans* Ledeb.
Southern macroslope, behind the Kegen pass, Akbet gorge, at the spring, 1613 m a.s.l., 43°10'74.9"N, 79°13'71.9"E, 24.08.2016, UK Jetigenova.
- Puccinia stipina*** Tranzschel (I, II, III)
- On *Dracocephalum bipinnatum* Rupr.
Southern macroslope, the mountains Temirlik, 21.09.1957, BK Kalymbetov.
- On *Stipa capillata* L.
Southern macroslope, the mountains Temirlik, 21.09.1957, BK Kalymbetov.
- Puccinia striiformis*** Wested. (II, III)
- On *Agropyron hissarica* Roshev.
06.1974–1981, SA Abiyev.
- On *Elymus tianschanigenus* Czerep.
Northern macroslope, Ulkensai gorge, 2000 m a.s.l., 01.10.2004, LA Kyzmetova.
- On *Elytrigia repens* (L.) Nevski
Ketmen foothills, 06–07.1975–1989, SA Abiyev.
- Puccinia universalis*** Arthur (III)
- On *Carex* sp.
West side, the mountains Kuluktau, Uzyn-Bulak gorge, 1723 m a.s.l., 43°07'21.0"N, 79°00'44.4"E, 24.08.2016, YV Rakhimova.
- Puccinia violae*** (Schumach.) DC. (III) (Figs 25, 26)
- On *Viola altaica* Ker Gawl.
West side, the mountains Kuluktau, Uzyn-Bulak gorge, 1723 m a.s.l., 43°07'21.0"N, 79°00'44.4"E, 24.08.2016, YV Rakhimova.

On *Viola biflora* L.

West side, the mountains Kuluktau, Uzyn-Bulak gorge, 1703 m a.s.l., 43°07'40.2"N, 79°07'28.0"E, 24.08.2016, YV Rakhimova.

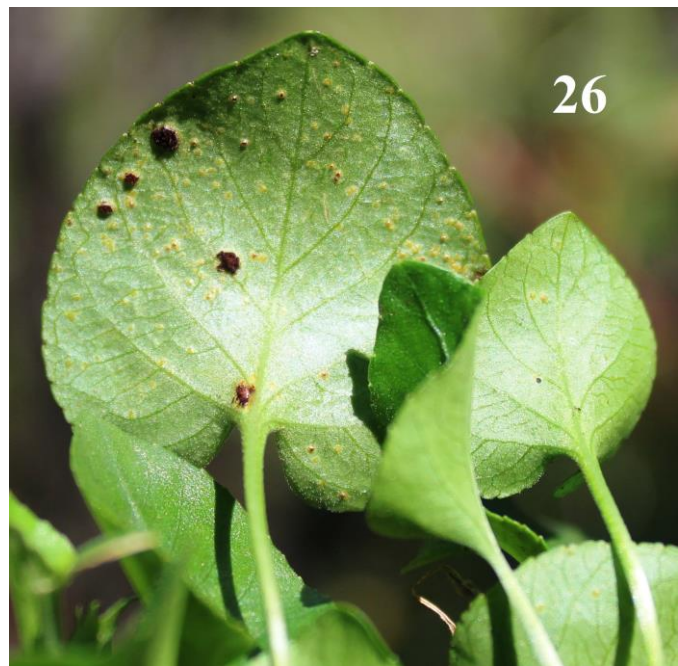
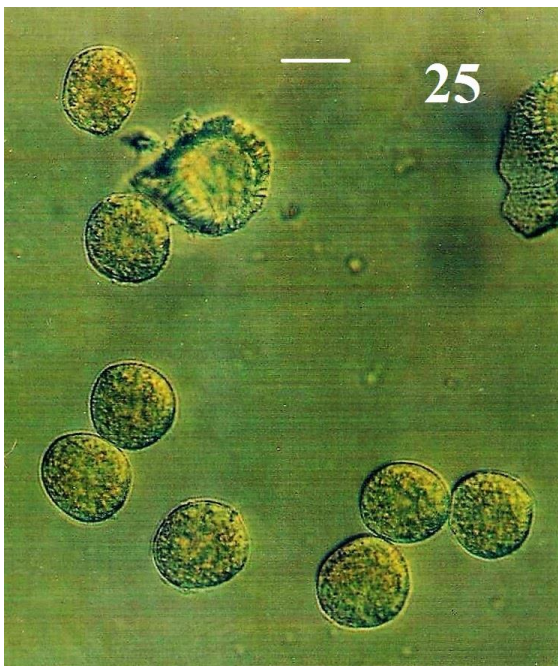
On *Viola* sp.

Northern macroslope, Zhulkungei gorge, 1885 m a.s.l., 43°21'13.0"N, 80°12'31.0"E, 21.07.2015. N Zhakhan.

Puccinia ziziphorae P. Syd. & Syd. (II, III)

On *Ziziphora clinopodioides* Lam.

Northern macroslope, gorge Zhulkungei gorge, 1841 m a.s.l., 43°21'34.5"N, 80°12'34.2"E, 21.07.2015, ZhM Takiyeva, in the same gorge, 1977 m a.s.l., 43°20'39.9"N, 80°12'52.0"E, 21.07.2015, UK Jetigenova, Sumbe gorge, 1475 m a.s.l., 43°15'48.4"N, 79°27'40.0"E, 16.07.2015, N Zhakhan, southern macroslope, Chakramba gorge, 2284 m a.s.l., 43°07'63.7"N, 80°07'91.2"E, 27.08.2016, AK Dzhiembkov, neighborhood Shalkode village, Kishi Shibut gorge, 2246 m a.s.l., 43°11'02.2"N, 79°53'35.2"E, 26.08.2016, GA Nam, behind the Kegen pass, Akbet gorge, 1660 m a.s.l., 43°10'80.8"N, 79°13'54.4"E, 24.08.2016, N Zhakhan, in the same gorge, 1664 m a.s.l., 43°10'81.9"N, 79°13'42.7"E, 24.08.2016, LA Kyzmetova, in the same gorge, 1621 m a.s.l., 43°10'75.7"N, 79°19'24.9"E, 24.08.2016, UK Jetigenova, the mountains Elshin Buiryk, 1953 m a.s.l., 43°00'78.1"N, 79°58'68.5"E, 25.08.2016, LA Kyzmetova, the mountains Karatau, neighborhood Tuzkol village, 2020 m a.s.l., 43°02'22.6"N, 79°59'89.5"E, 25.08.2016, LA Kyzmetova, west side, the mountains Kuluktau, Uzyn-Bulak gorge, 1703 m a.s.l., 43°07'40.2"N, 79°07'28.0"E, 24.08.2016, YV Rakhimova.



Figs 25–26 – *Puccinia violae*. 25 Aeciospores. – Bar = 20 μ m. 26 Uredinia and telia on *Viola altaica*.

Uromyces cytisi J. Schröt. (II, III)

On *Caragana camilli-schneideri* Kom.

Northern macroslope, Kyrgyzsai gorge, 1575 m a.s.l., 43°18'15.8"N, 79°30'44.4"E, 26.08.2016, YV Rakhimova, Kishi Aksu gorge, 1463 m a.s.l., 43°19'38.6"N, 79°34'27.3"E, 28.08.2016, YV Rakhimova, Sumbe gorge, 1385 m a.s.l., 43°17'00.6"N, 79°27'06.0"E, 27.08.2016, YV Rakhimova, the gorge of the left tributary of the Dardamty river, 1369 m a.s.l., 43°23'55.8"N, 80°03'26.5"E, 29.08.2016, YV Rakhimova.

On *Caragana pleiophylla* (Regel) Pojark.

Southern macroslope, behind the Kegen pass, Akbet gorge, 1660 m a.s.l., 43°10'80.8"N, 79°13'54.4"E, 24.08.2016, SB Nurashov, in the same gorge, 1621 m a.s.l., 43°10'75.7"N, 79°19'24.9"E, 24.08.2016, UK Jetigenova.

On *Caragana* sp.

Northern macroslope, Kishi Aksu gorge, 1396 m a.s.l., 43°20'14.8"N, 79°34'02.9"E, 28.08.2016, YV Rakhimova.

Uromyces dactylidis G.H. Otth (*Uromyces festucae* Syd.) (II, III)

On *Festuca rubra* L.

Northern macroslope, Aktam gorge, 21.06.1984, SA Abiyev); *Aconitum leucostomum* Worosch. (northern macroslope, Ulkensai gorge, 1795 m a.s.l., 43°21'18.1"N, 79°56'34.0"E, 20.07.2015, YY Kurmantayeva, Sumbe gorge, 1489 m a.s.l., 43°15'44.3"N, 79°27'48.7"E, 16.07.2015, UK Jetigenova, in the same gorge, 1477 m a.s.l., 43°16'07.1"N, 79°27'30.1"E, 16.07.2015, N Zhakhan, Kyrgyzsai gorge, 1750 m a.s.l., 43°17'28.7"N, 79°30'50.4"E, 17.07.2015, YY Kurmantayeva, in the same gorge, 1635 m a.s.l., 43°17'40.0"N, 79°30'48.6"E, 17.07.2015, UK Jetigenova, in the same gorge, 1507 m a.s.l., 43°15'32.9"N, 79°27'57.0"E, 16.07.2015, YY Kurmantayeva, west side, the mountains Kuluktau, Dalaity gorge, 1373 m a.s.l., 43°05'26.7"N, 78°53'53.1"E, 01.07.2016, YV Rakhimova, southern macroslope, neighborhood Shalkode village, Ulken Shibut gorge, 2340 m a.s.l., 43°11'22.9"N, 79°53'43.0"E, 26.08.2016, UK Jetigenova, neighborhood of Tuuk village, Baldyrgan gorge, 2078 m a.s.l., 43°05'09.2"N, 79°24'03.0"E, 27.08.2016, UK Jetigenova.

Uromyces eurotiae Tranzschel (III)

On *Krascheninnikovia ceratoides* (L.) Gueldenst.

Southern macroslope, floodplaine of Temirlik river, 1038 m a.s.l., 43°18'03.9"N, 79°11'70.7"E, 28.08.2016, UK Jetigenova, behind the Kegen pass, Akbet gorge, 1664 m a.s.l., 43°10'81.9"N, 79°13'42.7"E, 24.08.2016, LA Kyzmetova.

On *Krascheninnikovia ewersmanniana* (Stschegl. ex Losinsk.) Grubov

Northern macroslope, the gorge of the left tributary of the Dardamty river, 1369 m a.s.l., 43°23'55.8"N, 80°03'26.5"E, 29.08.2016, YV Rakhimova, southern macroslope, behind the Kegen pass, Akbet gorge, 1660 m a.s.l., 43°10'80.8"N, 79°13'54.4"E, 24.08.2016, SB Nurashov, in the same gorge, at the spring, 1613 m a.s.l., 43°10'74.9"N, 79°13'71.9"E, 24.08.2016, GA Nam.

Uromyces geranii (DC.) G.H. Otth & Wartm. (II, III) (Figs 27, 28)

On *Geranium collinum* Stephan ex Willd.

Northern macroslope, Avat gorge, 1673 m a.s.l., 43°19'13.0"N, 79°41'24.4"E, 17.07.2015, N Zhakhan, Chakramba gorge, 2284 m a.s.l., 43°07'63.7"N, 80°07'91.2"E, 27.08.2016, LA Kyzmetova, southern macroslope, behind the Kegen pass, Akbet gorge, at the spring, 1613 m a.s.l., 43°10'74.9"N, 79°13'71.9"E, 24.08.2016, UK Jetigenova.

On *Geranium sylvaticum* L.

West side, the mountains Kuluktau, Uzyn-Bulak gorge, 1723 m a.s.l., 43°07'21.0"N, 79°00'44.4"E, 24.08.2016, YV Rakhimova.

On *Geranium* sp.

Northern macroslope, Ulkensai gorge, 1617 m a.s.l., 43°21'52.4"N, 79°57'02.6"E, 19.07.2015, ZhM Takiyeva, southern macroslope, Talas gorge, 2106 m a.s.l., 43°08'60.5"N, 79°47'37.7"E, 26.08.2016, GA Nam, Chakramba gorge, 2116 m a.s.l., 43°05'99.3"N, 80°03'72.8"E, 27.08.2016, AK Dzhienbkov, Tuuk village, 1911 m a.s.l., 43°06'97.1"N, 79°16'23.5"E, 27.08.2016, N Zhakhan, neighborhood of Tuuk village, Baldyrgan gorge, 2078 m a.s.l., 43°05'09.2"N, 79°24'03.0"E, 27.08.2016, AK Dzhienbkov.

Uromyces glycyrrhizae (Rabenh.) Magnus (III)

On *Glycyrrhiza uralensis* Fisch.

Southern macroslope, behind the Kegen pass, Akbet gorge, at the spring, 1613 m a.s.l., 43°10'74.9"N, 79°13'71.9"E, 24.08.2016, LA Kyzmetova.

Uromyces graminis (Niessl.) Dietel (II, III)

On *Melica transsilvanica* Schur

Northern macroslope, Kishi Aksu gorge, 1463 m a.s.l., 43°19'38.6"N, 79°34'27.3"E, 28.08.2016, YV Rakhimova, Shoshanai gorge, floodplain, 1576 m a.s.l., 43°11'41.6"N, 79°23'66.5"E, 28.08.2016, AK Dzhienbkov, southern macroslope, behind the Kegen pass, Akbet gorge, 1660 m a.s.l., 43°10'80.8"N, 79°13'54.4"E, 24.08.2016, N Zhakhan.

Uromyces halimodendri Solkina (II, III)

On *Halimodendron halodendron* (Pall.) Voss

Northern macroslope, Ulkensai gorge, 2000 m a.s.l., 01.10.2004, LA Kyzmetova.

Uromyces pisi-sativi (Pers.) Liro (II, III)

On *Hedisarum songoricum* Bong.

Southern macroslope, behind the Kegen pass, Akbet gorge, 1664 m a.s.l., 43°10'81.9"N, 79°13'42.7"E, 24.08.2016, GA Nam, in the same gorge, 1660 m a.s.l., 43°10'80.8"N, 79°13'54.4"E, 24.08.2016, LA Kyzmetova.



Figs 27–28 – *Uromyces geranii*. 27 Teliospores. – Bar = 25 µm. 28 Telia on *Geranium collinum*.

Uromyces polygoni-avicularis (Pers.) G.H. Otth (*U. polygoni* (Pers.) Fuckel) (II, III)

On *Polygonum aviculare* L.

Northern macroslope, Sumbe gorge, 1489 m a.s.l., 43°15'44.3"N, 79°27'48.7"E, 16.07.2015, UK Jetigenova, in the same gorge, 1475 m a.s.l., 43°15'48.4"N, 79°27'40.0"E, 16.07.2015, N Zhakhan, Ulkensai gorge, 1617 m a.s.l., 43°21'52.4"N, 79°57'02.6"E, 09.07.2015, ZhM Takiyeva.

Uromyces striatus J. Schröt. (II, III)

On *Medicago falcata* L.

West side, the mountains Kuluktau, Uzyn-Bulak gorge, 1723 m a.s.l., 43°07'21.0"N, 79°00'44.4"E, 24.08.2016, YV Rakhimova, southern macroslope, behind the Kegen pass, Akbet gorge, 1621 m a.s.l., 43°10'75.7"N, 79°19'24.9"E, 24.08.2016, GA Nam, the mountains Karatau, neighborhood Tuzkol village, 2020 m a.s.l., 43°02'22.6"N, 79°59'89.5"E, 25.08.2016, GA Nam.

On *Medicago lupulina* L.

West side, the mountains Kuluktau, Uzyn-Bulak gorge, 1703 m a.s.l., 43°07'40.2"N, 79°07'28.0"E, 24.08.2016, YV Rakhimova.

Uromyces trifolii (R. Hedw.) Lév. (*U. nerviphilus* (Grognot) Hotson.) (III)

On *Amoria repens* (L.) C. Presl.

Northern macroslope, Zhulkungei gorge, 1930 m a.s.l., 43°20'56.2"N, 80°12'39.8"E, 21.07.2015, YY Kurmantayeva, Aktam gorge, 1579 m a.s.l., 43°21'54.8"N, 79°53'33.6"E, 18.07.2015, UK Jetigenova, Ulkensai gorge, 1864 m a.s.l., 43°20'55.6"N, 79°56'18.5"E,

20.07.2015, UK Jetigenova, Shoshanai gorge, floodplain, 1576 m a.s.l., 43°11'41.6"N, 79°23'66.5"E, 28.08.2016, AK Dzhienbkov.

Uromyces trifolii-repentis Liro (II, III)

On *Amoria repens* (L.) C. Presl.

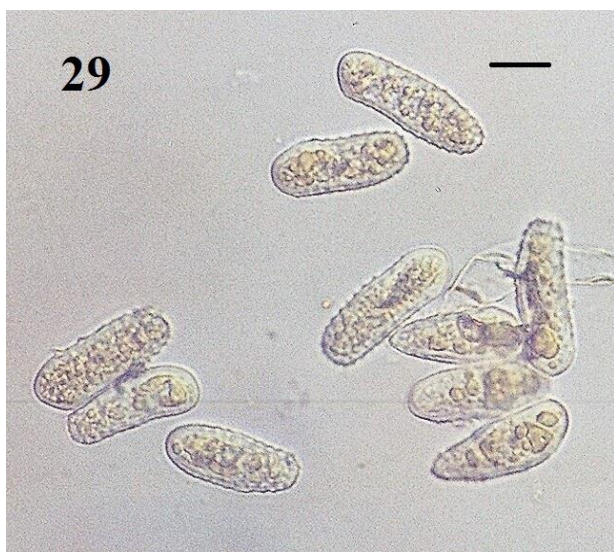
Southern macroslope, Chakramba gorge, 2116 m a.s.l., 43°05'99.3"N, 80°03'72.8"E, 27.08.2016, LA Kyzmetova.

Pucciniastraceae Gäum. ex Leppik

Melampsorium betulinum (Pers.) Kleb. (II) (Figs 29, 30)

On *Betula pendula* Roth

Northern macroslope, Kyrgyzsai gorge, at the cordon of the hunting farm Gornoye, 1688 m.a.s.l., 43°17'36.4"N, 79°30'46.8"E, 26.08.2016, YV Rakhimova, Shoshanai gorge, floodplain, 1576 m a.s.l., 43°11'41.6"N, 79°23'66.5"E, 28.08.2016, LA Kyzmetova.



Figs 29–30 – *Melampsorium betulinum*. 29 Urediniospores. – Bar = 10 µm. 30 Uredinia on *Betula pendula*.

Uropyxidaceae Cummins & Y. Hirats.

Tranzschelia anemones (Pers.) Nannf. (*T. thalictri* (Chev.) Diet.) (III)

On *Thalictrum* sp.

Northern macroslope, Ulkensai gorge, 1617 m a.s.l., 43°21'52.4"N, 79°57'02.6"E, 19.07.2015, ZhM Takiyeva.

Insertae sedis

Aecidium clematidis-songaricae Nevod. (I)

On *Clematis songarica* Bunge

Northern macroslope, Ulken Aksu gorge, 2000 m a.s.l., 30.09.2004; in the same gorge, 22.07.2005 LA Kyzmetova.

Discussion

The Trans-Ili Alatau (Kazakhstan) and Terskey Alatau (Kyrgyzstan) ridges are the closest to the Ketmen (to the west and to the south, respectively). Trans-Ili Alatau is distinguished by a high diversity of rust fungi: 235 species (Table 2), taking into account the modern limits of some species. In the territory of Terskey Alatau 123 species of rust fungi were found (Table 2).

Table 2 Number of rust species in the Ketmen, Terskei and Tranz-Ili ridges.

Genera	Number of species		
	Ketmen ridge	Terskei ridge (Domashova 1960)	Trans-Ili Alatau ridge (Kalymbetov 1969)
<i>Aecidium</i>	1	8	10
<i>Arthuriomyces</i>	-	-	1
<i>Chrysomyxa</i>	1	3	2
<i>Gymnosporangium</i>	4	4	5
<i>Hyalopsora</i>	-	-	1
<i>Melampsora</i>	5	4	7
<i>Melampsoridium</i>	1	-	1
<i>Phragmidium</i>	9	5	13
<i>Pleomeris</i>	1	1	1
<i>Puccinia</i>	48	82	144
<i>Pucciniastrum</i>	-	1	2
<i>Trachyspora</i>	1	1	1
<i>Tranzschelia</i>	1	-	2
<i>Uromyces</i>	12	14	44
<i>Xenodochus</i>	-	-	1
Total	84	123	235

This diversity is due to the fact that rust fungi tend to prefer humid habitats, and Ketmen is the most arid. Being obligate parasites, rust fungi are associated with spreading and development of nutrient plants and are found in many belts, both on herbaceous plants, and on trees and shrubs.

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