

## Tulips of the Nuratau Mountains and South-Eastern Kyzylkum (Uzbekistan)

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**Abstract:** The Tien Shan and Pamir-Alay mountains in Central Asia are considered to be the primary center of origin and diversity for the genus *Tulipa* L. (Liliaceae). The Nuratau mountains, the peripheral north-western branch of the Pamir-Alay mountain system, and the neighboring area of South-Eastern Kyzylkum desert are the unique regions of the Central Asia. There are seven registered species of the genus *Tulipa*. Based on the field studies and examination of herbarium specimens a synopsis of these species in the Nuratau mountains and South-Eastern Kyzylkum desert areas is provided, including an identification key, distribution map and assessment of the current status of local populations.

**Zusammenfassung:** Die Tien Shan und Pamir-Alay-Gebirge in Zentralasien gelten als die primären Entstehungs- und Diversifikationszentren der Gattung *Tulipa* L. (Liliaceae). Das Nuratau-Gebirge, die peripheren nordwestlichen Bereiche des Pamir-Alay-Gebirges und die benachbarten Gebiete der südöstlichen Kyzylkum-Wüste stellen einzigartige Gebiete in Zentralasien dar. Sieben *Tulipa*-Arten kommen in diesem Gebiet vor. Basierend auf Freiland- und Herbarstudien wird eine Synopsis dieser Arten im Nuratau-Gebirge und der südöstlichen Kyzylkum-Wüste inklusive Bestimmungsschlüssel, Verbreitungskarte und Beschreibung der lokalen Populationen präsentiert.

**Key words:** taxonomy, ecology, biogeography, local population, threatened species.

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### Introduction

*Tulipa* L. is one of the largest genera of family *Liliaceae*. It is widespread in Southern Europe, North Africa, Middle East and Central Asia. According to the modern data, based on the measurement of nuclear DNA, it comprises 112 species (ZONNEVELD 2009). In Central Asian countries of the former USSR, i.e. Kazakhstan, Kyrgyzstan, Tadjikistan, Turkmenistan and Uzbekistan, 63 species of wild tulips are found (VVEDENSKY & KOVALEVSKAYA 1971). These grow in various landscapes, from plain deserts to mountain highlands. The Tien Shan and Pamir-Alay mountains in Central Asia are considered to be the primary center of origin and diversity for the genus *Tulipa* (BOTSCHANTZEVA 1962).

In the Republic of Uzbekistan there are 26 registered tulip species, including 4 endemic species (TOJIBAEV & KADYROV 2010). They are unevenly distributed within different biogeographic regions of Uzbekistan. The maximum diversity of tu-

lip species is concentrated in the mountain parts of Uzbekistan (20 species). For each of main mountain ranges of Western Tien Shan and Pamir-Alay in average 7-8 tulip species are recorded. Wild tulips are the most impressive of all diversity of flora of Uzbekistan. In the last decades, as a result of intensive anthropogenic impact, the range and population numbers of many tulip species have considerably declined. The current Red Data Book of Uzbekistan (2009) includes 18 species of *Tulipa*, 20 species are protected in national parks and nature reserves. But none of the Central Asian tulips have been included in the IUCN Red List of Threatened Species (2011).

The Nuratau mountains are the only unique region of the mountainous Central Asia. It is a very interesting area based on tulip species composition. The Nuratau mountains are the peripheral north-western branch of the Pamir-Alay mountain system. These are semiarid middle-altitude mountain ridges, located on the right bank of the Zeravshan River. On south-east, the Nuratau mountains are separated from the Turkestan range

by Sanzar River Valley and run northwest 250 km into the Kyzylkum desert. The Nuratau mountains consist of two parallel branches. The north branch is the major range named Nuratau. The highest peak is 2196 m a.s.l. In central part of Nuratau range, there is the Nuratau nature reserve (177,52 km<sup>2</sup>).

North of Nuratau, on the south-eastern edges of the Kyzylkum desert, there are some small outlier ridges: Pistalitau, Balyklytau, Uchkulach and Egarbelistag. They are 11 to 40 km long and 453 to 654 m high above sea level. The southern branch of the Nuratau mountains includes Aktau, Karatau, Karakchatau and Khobduntau ridges (maximum altitude is 1993 m a.s.l.).

The mean annual precipitation in the western part of the Nuratau mountains is 283 mm (Nuratau weather station, WMO code 38565) and 392 mm in the eastern part (Djizak weather station, WMO code 38579). The mean annual temperature in this area is +14°C.

This area is almost 14.000 km<sup>2</sup> and is situated on the boundaries of two large floristic provinces: Turan and Turkestan (or Central Asian mountain province). The flora of the Nuratau mountains consists of over 1200 vascular plant species (including seven tulip species) and is distinguished by considerable endemism. There are three tulip species, typical for deserts, growing on piedmont plains, on the edge of the Nuratau mountains and Kyzylkum desert. On foothills and mountain slopes there are four tulip species, typical for Turkestan province.

## Materials and methods

Our field researches were conducted in 2002-2012 on the Nuratau mountains and South-Eastern Kyzylkum desert. We have defined the area and number of tulip populations, registered their coordinates, altitude, exposition, characteristics of the terrain, soil and vegetation. We have defined the coordinates of all herbarium specimens of tulips, collected in the Nuratau mountains area and stored in TASH. All data are loaded into the GIS with ArcGIS computer program, and have created the distribution map.

The results of our researches are used for planning of development of the national system of protected areas and for compiling the cadastre of endemic and rare plants for Djizak and Navoi Regions (TOJIBAEV, BESHKO 2007).

The checklist, identification key, distribution map (Fig. 8) and information about species of the genus *Tulipa* on the Nuratau mountains and South-Eastern Kyzylkum are presented below.

## Checklist of species of the genus *Tulipa* L. on the Nuratau mountains and South-Eastern Kyzylkum desert (according to data of ZONNEVELD 2009)

**I. Subgenus *Tulipa*.** Basionym: sect. *Leiostemones* BOISSER, Fl. Orientalis 5, p. 192 (1882). Homotypic synonym: sect. *Tulipa* MARAIS, in DAVIS, P. H., (Ed.): Flora of Turkey and the East Aegean Islands 8, p. 306 (1984). Type species: *T. gesneriana* L. (1753).

**1. Section *Kolpakowskianae*** (HALL) VAN RAAMSDONK, stat. nov. Basionym: subsect. *Kolpakowskianae* HALL, The genus

*Tulipa*, p. 134 (1940). Type species: *T. kolpakowskiana* REGEL (1877).

*Tulipa lehmanniana* MERCKLIN, Mere. Acad. Pet. Say. Err. 7:513 (1854).

*Tulipa korolkowii* REGEL Act. Hort. Petrop. iii. II. (1875) 295.

**2. Section *Tulipanum*** DE REBOUL, Giorn. Bot. Ital. 2:60 (1847). Homotypic synonyms: sect. *Eriobulbi* BAKER, J. Linn. Soc.

14:276 (1874), subsect. *Oculus-solis* HALL, The genus *Tulipa*, p. 104 (1940). Type species: *T. oculus-solis* ST. AMANS (1804)

*Tulipa affinis* BOTSCHANTZ. in Not. Syst. Herb. Inst. Bot. Acad. Sci. Uzbekistan. xvi. 6 (1961).

*Tulipa micheliana* HOOG Gard. Chron. 1902, I. 350.

**II. Subgenus *Eriostemones*** (BOISSER) VAN RAAMSDONK, stat. nov. Basionym: "section" *Eriostemones* BOISSER Fl. Orientalis 5:196 (1882). Type: *T. sylvestris* L., Sp. Pl., p. 305 (1753).

**4. Section *Biflores*** (HALL) VAN RAAMSDONK, stat. nov. Basionym: subsect. HALL, The genus *Tulipa*, p. 122 (1940). Type species: *T. biflora* PALL. (1876).

*Tulipa turkestanica* REGEL Act. Hort. Petrop. iii. II. (1875) 296.

*Tulipa buhseana* BOISS. Diagn. Pl. Orient. ser. 2, 4: 98. 1859

*Tulipa sogdiana* MERCKLIN in Mem. Sav. Etr. Petersb. vii. (1851) 514.

## Distribution, ecology and status of tulip's species on the Nuratau mountains and South-Eastern Kyzylkum desert

### 1. *Tulipa lehmanniana* MERCKLIN

The species was described in 1854 by Russian botanist K.E. MERCKLIN on specimens collected between Bukhara and Kermine. It is widespread on the territory of Turan floristic province: in Kyzylkum and Karakum deserts, on the piedmont plains of Western Tien Shan and Pamir-Alay, in Ferghana Valley, Kopet-Dag, Badkhyz, Iran, Pakistan, Northern Afghanistan, Northern Muiyunkums and south-western part of Betpakdala desert. Grows in sandy and clay deserts, on piedmonts, in stony-skeleton slopes and gypsaceous rocks on outlier mountains. It is one of the most beautiful species of Central Asian wild tulips, distinguished by fineness and bright various colors of flowers. The flowering occurs in March -April.

This species is rare on the Nuratau mountains and is rather common in South-Eastern Kyzylkum desert. On the Nuratau mountains, it grows mainly in western part of Nuratau, Aktau and Karatau ridges. Solitary specimens or small populations occur sporadically. They grow in ephemeroide-sagebrush communities (*Artemisia diffusa*, *Carex pachystylis*, *Poa bulbosa*) with *Ferula foetida* and *Iris songarica*, on sands and sandy-loam grey soils, on piedmont plains and deserts (260-400 m a.s.l.). But on the southern slopes of Karatau range, populations of *Tulipa lehmanniana* ascend foothills (500 m a.s.l.). In the South-Eastern Kyzylkum, there are local populations, occupy 30-40 hectares, with numbers of 5-7 generative specimens per 1 m<sup>2</sup> (Fig. 1). So rich flowering of Lehmann's tulip will be observed in years with favorable weather conditions. On average, in dry and medium years, the numbers of generative specimens in local populations do not exceed of 5-7 per 100 m<sup>2</sup>.

**Key to the species of the genus *Tulipa* L. on the Nuratau mountains and South-Eastern Kyzylkum desert**

1. The flowers are single or multiple (2-8), white with yellow centre, small (2,5-3 cm long), stellar or narrow-campaniform. The leaves are narrow-lanceolate or linear 2
  - The flowers are large, single, bright colored (red, orange or yellow), cup-shaped or wide-campaniform 4
2. The stamen filaments are glabrous. The bulb skins are not prolonged, rigid, coriaceous, wooly all over inside surface *Tulipa sogdiana* MERCKLIN
  - The stamen filaments are haired or with a hair ring around base. Bulb skins are little prolonged, coriaceous, wooly at top inside 3
3. The leaves are very spread, usually considerably shorter than flower. A plant of deserts *Tulipa buhseana* BOISS.
  - The flower is yellow, sometimes orange, red or variegated, yellow-red. The leaves are narrow, considerably shorter than flower. The bulb skins are very prolonged (reach the soil surface), wooly all over inside surface. The underground part is nearly equal to the over ground part. A plant of deserts *Tulipa turkestanica* REGEL
4. Flower yellow, sometimes orange, red or variegated, yellow-red. Leaves narrow, considerable shorter than flower. Bulb skins very prolonged (reach the soil surface), wooly at all over inside surface. Underground part is nearly equal to over ground part. Plant of deserts *Tulipa lehmanniana* MERCKLIN
  - The flower is yellow, sometimes orange, red or variegated, yellow-red. The leaves are narrow, considerably shorter than flower. The bulb skins are very prolonged (reach the soil surface), wooly all over inside surface. The underground part is nearly equal to the over ground part. A plant of deserts 5
5. The stem is glabrous. The tepals are obtuse. The black spot in the flower's centre is small, immarginate. The leaves are curled. The stamen filaments are black in the lower part and red at the top part. The bulb skins are very prolonged, rigid, coriaceous, dark-brown, wooly at top inside *Tulipa korolkowii* REGEL
  - The stem is short densely haired. The tepals are pointed. The black spot in the flower's centre is light-yellow edged. The bulb skins are little prolonged and covered by pressed hairs all over inside surface 6
6. The leaves are curled, with violet spots and stripes. The dark spot in flower's centre is narrow, elongated, reach  $\frac{1}{3}$ - $\frac{1}{2}$  of the size of tepals *Tulipa micheltiana* HOOG
  - The leaves are without violet stripes, slightly undulated. The dark spot in flower's centre is truncated or emarginated, reach  $\frac{1}{4}$ - $\frac{1}{5}$  of the size of tepals *Tulipa affinis* BOTSCHANTZ.

*Tulipa lehmanniana* is included in the Red Data Book of Uzbekistan (1984, 1998, 2006, 2009). For this species, the main threat is overgrazing of desert pastures. According to the IUCN Red List Categories and Criteria (ver. 3.1), the current status of this species meets the NT category (Near Threatened). In Uzbekistan, there are no protected areas within its natural habitat.

## 2. *Tulipa korolkowii* REGEL

The species was described in 1875 by Edward L. REGEL. The natural distribution area of *Tulipa korolkowii* is North-Western, Western and South Pamir-Alay, South-Western Tien Shan. Due to its dwarf habitus, elegant cup-shaped bright red flowers and two-colored stamen filaments (black in the lower part and red in the top) it differs from other species (Fig. 2). Plants growing on dry stony southern slopes are 7-10 cm long, on northern slopes up to 20-25 cm. Flowering in March – May, depending on altitude.

Within all distribution area, *Tulipa korolkowii* is rather rare. Solitary specimens or small populations occur sporadically. But this tulip is widespread on all ridges of the Nuratau mountains and South-Eastern Kyzylkum desert. It grows on foothills, on lower and middle belt of mountains (from 400-500 to 2000-2200 m a.s.l.), on dry stony and rubbly slopes, on watershed ridges, among petrophytic, sagebrush-ephemeral vegetation and xerophilous shrubs. Depending on landscape and year weather

conditions, number of generative specimens in local populations vary from 5-6 to 70-80 per 100 m<sup>2</sup>.

*Tulipa korolkowii* is included in the Red Data Book of Uzbekistan (1984, 1998, 2006, 2009). For this species, the main threat is overgrazing, picking of flowers and recreation. According to the IUCN Red List Categories and Criteria (ver. 3.1), the current status of this species meet the NT category (Near Threatened). In Uzbekistan, this species is protected in Nuratau, Zaamin, Kitab, Gissar and Surkhan nature reserves.

## 3. *Tulipa affinis* BOTSCHANTZ

The species was described in 1961 by well-known expert in Central Asian tulips, Z.P. BOTSCHANTZEVA on specimens from northern slopes of Turkestan ridge. It is the sub-endemic species of the Nuratau and Kuhistan districts of Turkestan floristic province. The natural distribution area of *Tulipa affinis* is the Nuratau mountains, Malguzar and Turkestan ridges in North-Western Pamir-Alay (Uzbekistan, Kyrgyzstan and Tajikistan). It grows on the lower and middle belt of mountains, on stony and fine soil slopes, on rocks and canyons, among shrubs and juniper forests. Flowering in April – May. *Tulipa affinis* is one of the most beautiful wild tulips of Uzbekistan, distinguished by large red flowers (Fig. 3). Some specimens are 50 cm long, the tepals up to 11 cm, the lower leaf to 29-30 cm long and 8-10 cm wide.



Fig. 1: Large population of *Tulipa lehmanniana* in South-Eastern Kyzylkum (photo by N.Yu. BESHKO).

This species is widespread on all ridges of the Nuratau mountains, from eastern to western extreme end. It grows as solitary specimens, small groups or large populations (up to several hundred plants), at 800-900 m a.s.l. to 1800-2000 m a.s.l., among forb-tall grass, sagebrush-herbaceous communities, semishrubs and shrubs, particularly on relatively humid northern and western slopes. The largest populations registered on the Nuratau ridge, where *Tulipa affinis* occurs quite often (Fig. 4). The number of generative specimens in local populations vary from 4-5 to 70-80, 100 or more per 100 m<sup>2</sup>. In some areas on the watershed of Nuratau, blooming tulips makes the landscape bright red, there are up to 4-5 generative specimens per 1 m<sup>2</sup>.

According to our observations, at present, the lower edge of natural distribution area of *Tulipa affinis* is at 800-900 m a.s.l. Whereas TASH stores herbarium specimen collected in 1934 by V.P. BOTSCHANTZEV in ephemeroïd-sagebrush community on the plain between Pitalitau and Nuratau ridges (350-400 m a.s.l.); collected in 1937 by E.M. DEMURINA in piedmont plain of Karakchatau ridge (750-800 m a.s.l.). Another specimen was collected in 1938 by I.I. GRANITOV in western extreme end of

Karatau ridge, among sparse shrubs of *Amygdalus spinosissima* on stony slopes of Kokcha outlier mountain (450-480 m a.s.l.). In last decades, as a result of intensive anthropogenic impact, the natural distribution area and populations of *Tulipa affinis* have considerably declined. This species is included in the Red Data Book of Uzbekistan (1984, 1998, 2006, 2009). For this species, the main threat is overgrazing, picking of flowers and recreation. According to the IUCN Red List Categories and Criteria (ver. 3.1), the current status of this species meets the VU category (Vulnerable), B2b (ii, iii, iv). In Uzbekistan, it is protected in Nuratau and Zaamin nature reserves and Zaamin national park.

#### 4. *Tulipa micheliana* Hoog

The species was described in 1902 by Thomas HOOG on specimens collected in 1900 by German botanist Paul SINTENIS near Ashkhabad. It is widespread in North-Western Pamir-Alay and Kopet-Dag, in Uzbekistan, Tajikistan, Turkmenistan and Iran. In Uzbekistan, this tulip occurs on the Nuratau mountains, on Zaravshan, Gissar and Kugitang ridges. It grows on stony-

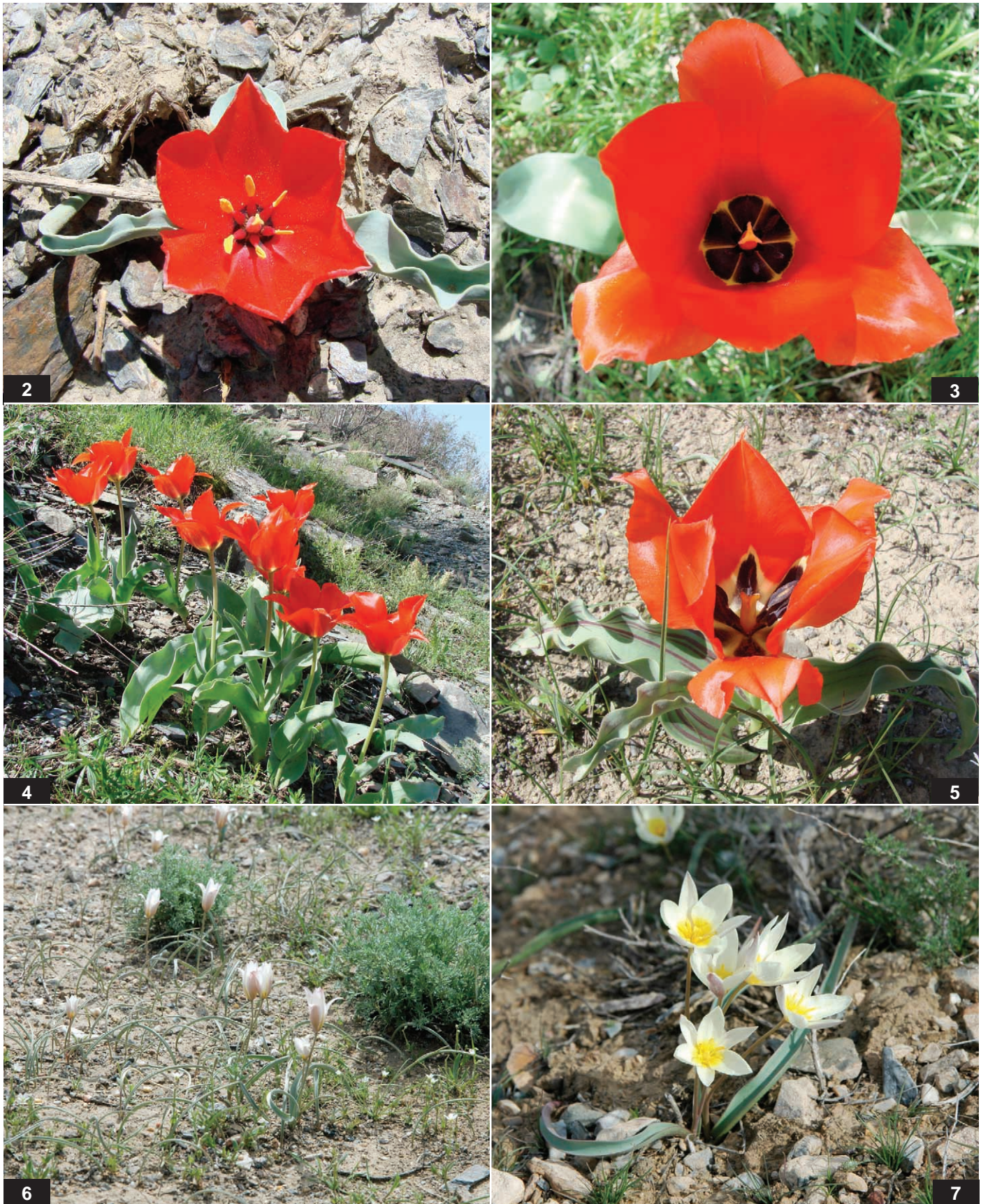


Fig. 2-7: *Tulipa* species. 2: *Tulipa korolkowii* differs by two-colored stamin filaments; 3: flower of *Tulipa affinis* BOTSCHANTZ; 4: *Tulipa affinis* on Nuratau range; 5: *Tulipa micheliana* HOOG; 6: Population of *Tulipa sogdiana* BUNGE in South-Western Kyzylkum; 7: *Tulipa buhseana* BOISS. in South-Eastern Kyzylkum (photos 2-5 by N.Yu. Beshko, 6-7 by K.Sh. Tojibaev).

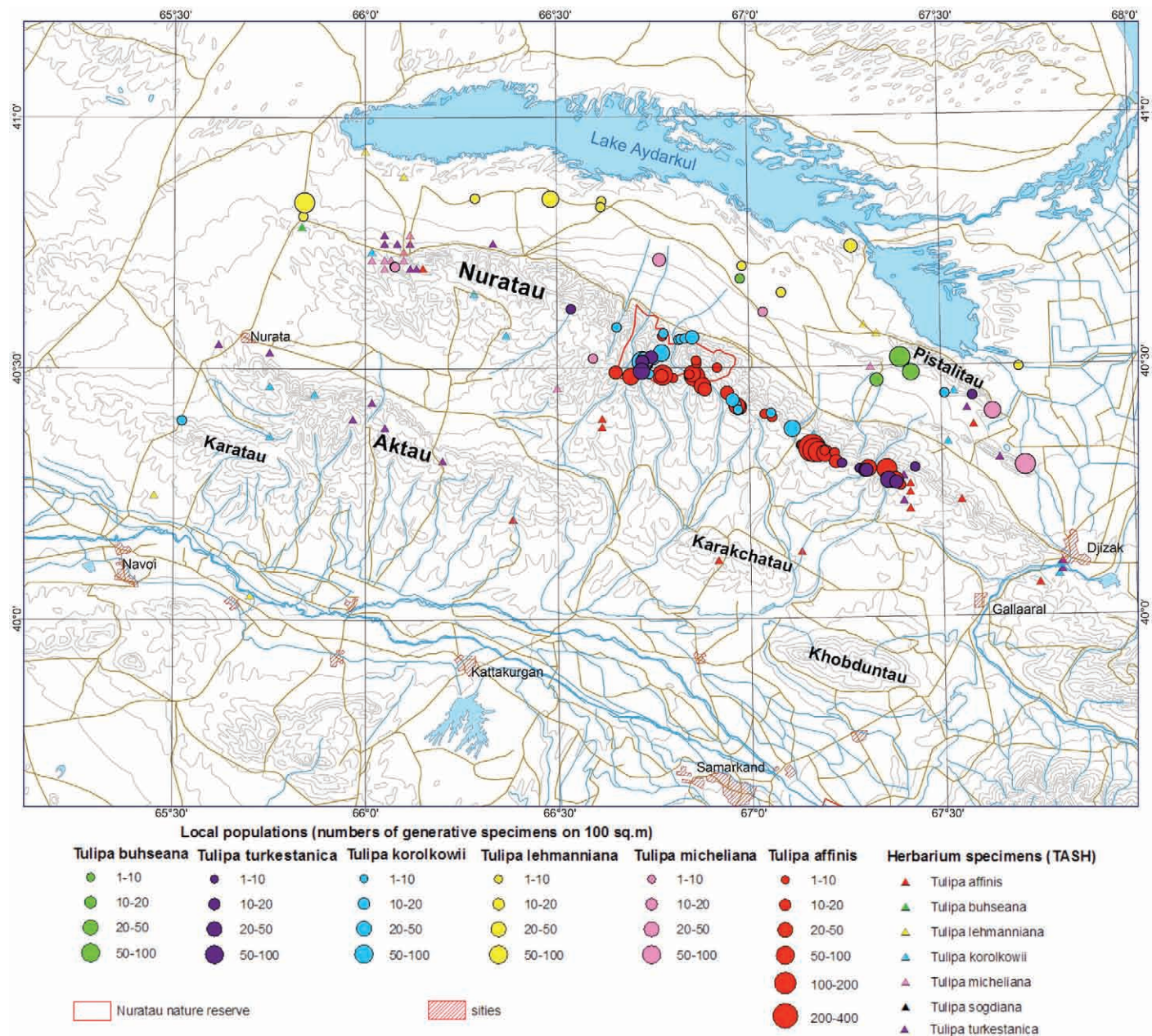


Fig. 8: Distribution map of species of *Tulipa* L. genera on Nuratau mountains and South-Eastern Kyzylkum.

skeleton and clay slopes of foothills and low mountains. It is distinguished by leaves with violet stripes (Fig. 5). The flowering occurs in March – April.

This species is quite rare on the Nuratau mountains and outlier ridges of South-Eastern Kyzylkum desert. Solitary specimens or small populations occur sporadically. They grow in ephemeroïd-sagebrush communities (*Artemisia sogdiana*, *Carex pachystylis*, *Poa bulbosa*) on piedmont plains and foothills of Nuratau, among spiny almond shrubs (*Amygdalus spinosissima*) on stony slopes of Pistalitau and Nuratau ridges (300-700 m a.s.l.). But there is known one location of *Tulipa micheliana* on middle mountain belt of the Nuratau ridge (Ustuksay, 1600

m a.s.l.), among forb-tall grass steppe. On the Pistalitau ridge, there are local populations of 20-22 up to 55-56 generative specimens per 100 m<sup>2</sup>. On piedmont plains of Nuratau, the number of generative specimens in local populations do not exceed 5-7 per 100 m<sup>2</sup>.

*Tulipa micheliana* is included in the Red Data Book of Uzbekistan (1998, 2006, 2009). For this species, the main threat is overgrazing, picking of flowers and recreation. In Uzbekistan, this species is protected in Nuratau and Surkhan nature reserves. According to the IUCN Red List Categories and Criteria (ver. 3.1), the current status of this species meet the NT category (Near Threatened).

### 5. *Tulipa sogdiana* BUNGE

The species was described in 1854 by A.A. BUNGE on specimens collected near Bukhara. This tulip is endemic of Turan floristic province. It is widespread on the territory of the Kyzylkum and Karakum deserts, in Karshi steppe, piedmont plains of Southern Pamir-Alay, in Iran and Afghanistan. It grows in sandy, stony and clay deserts. The flowering occurs in March – April.

This species is rare on the piedmont plains in western end of the Nuratau mountains, it occurs sporadically as solitary specimens or small groups. But it is common tulip of South-Western Kyzylkum desert, where large local populations are registered with numbers of 5-7 generative specimens per 1 m<sup>2</sup> (TOJIBAEV, BESHKO, 2007) (Fig. 6).

*Tulipa sogdiana* was included in previous editions of the Red Data Book of Uzbekistan (1984, 1998, 2006). At present, according to the progressive status of populations and for lack of threats of disappearance, this species was excluded from the Red Data Book (2009).

### 6. *Tulipa turkestanica* REGEL

Initially in 1873 Edward L. REGEL described this tulip as *Tulipa sylvestris* var. *turkestanica*, but in 1875 he separated it as a species. It is widespread in Pamir-Alay (Gissar, Zeravshan, Turkestan, Nuratau, Pisticalitau mountain ridges) and Western Tien Shan (Mogoltau, Ugam, Karatau and Talas Alatau ridges), in Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan. The flowering occurs in March – June, depending on altitude.

This is most common tulip species of the Nuratau mountains. There it grows almost all over the foothills and mountain slopes, on stony-skeleton and clay soils, in ephemeroïd-sagebrush communities, mountain steppes, among semishrubs and thorn cushion plant formations. It occurs as solitary specimens, small groups or large populations (up to several hundred plants). *Tulipa turkestanica* was included in previous editions of the Red Data Book of Uzbekistan (1984, 1998). At present, according to the progressive status of populations and for lack of threats of disappearance, this species was excluded from the Red Data Book (2006, 2009).

### 7. *Tulipa buhseana* Boiss.

The species was described in 1859 by Swiss botanist Pierre Edmond BOISSIER on specimens collected by F.A. BUHSE in Iran. The distribution area of *Tulipa buhseana* covers a wide range of sandy, clay and stony deserts of Central Asia between the Aral sea, the Balkhash-Alakol basin, Kopet-Dag, Badkhyz, Iran and Gungaria. In Uzbekistan, it usually occurs on the outlier mountains of the Kyzylkum desert on fine breakstone and stone slopes and on piedmont plains of Nuratau and Pisticalitau ridges in scletonless soil among ephemeroïd-sagebrush vegetation (Fig. 7). It blooms in late March – April.

On piedmont plains north of the Nuratau ridge, populations of *T. buhseana* occur sporadically. On the southern piedmont plains of the Pisticalitau ridge, we registered large local populations, which occupy 10-20 hectares. In years with favorable weather conditions, number of generative specimens reach 5-7 per 1 m<sup>2</sup>. On average, in dry and medium years, solitary flowering specimens are observed. It is a common tulip species of South-Western Kyzylkum Desert, where numerous and large local populations are registered (TOJIBAEV, BESHKO, 2007).

*Tulipa buhseana* was included in the previous editions of the Red Data Book of Uzbekistan (1998, 2006). At present, according to progressive status of populations and for lack of threats of disappearance, this species was excluded from the Red Data Book (2009).

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