

Tulipa luanica (Liliaceae), a new species from southern Kosovo

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Tulipa luanica (Liliaceae) is illustrated and described as a new species. It was discovered on limestone substrate on Mt. Pashtriku (in the district of Prizren) in southern Kosovo near the border with Albania. It is compared with *Tulipa australis*, *T. gesneriana*, *T. kosovarica*, *T. serbica* (prevalent in Kosovo), and *T. albanica* (widespread in Albania). The chromosome formula is $2n = 2x = 24$ (2 metacentric, 2 submetacentric and 8 subtelocentric).

According to the world checklist for *Tulipa* (WCSP 2014), 514 taxa have been named and 90 of these are accepted there as species. According to Botschantzeva (1982), tulips occur naturally in southern Europe, North Africa, the Middle East, the Caucasus, and central Asia including China. Tulips are popular spring-flowering garden plants; millions of bulbs are sold annually and over 5000 cultivars are registered (Van Scheepen 1996). They are widely used as ornamentals and were brought to Europe via Iran and Turkey (Matin 1998).

The primary genetic diversity centre of tulips is in the Pamir Alai and Tian Shan mountains in central Asia (Hoog 1973). Taxonomy and species relationships have mainly been based on morphological characters, geographical distribution, cytogenetics, and biochemical markers, such as esterase isozyme polymorphisms (Van Raamsdonk *et al.* 1997, Van Raamsdonk & Vries 1995). Classification based on nuclear genome size divides the genus *Tulipa* into four subgenera:

Tulipa, *Eriostemon*, *Chusianae* (and *Orithya*) (Zonneveld 2009: 231). The subgenera *Tulipa*, *Eriostemon* and *Orithya* are evidently well separated from each other (Turkas *et al.* 2013). The section *Chusianae* should be excluded from subgenus *Tulipa* and accepted at subgeneric rank (Christenhusz *et al.* 2013).

Most tulip species are diploids with chromosome number $2n = 24$ (Sheidai *et al.* 2002, Zonneveld 2009). Described in the present paper *Tulipa luanica* as well as *T. australis*, *T. gesneriana*, *T. kosovarica* and *T. serbica* of subgenus *Tulipa* have glabrous filaments and the perianth is not abruptly narrowed near the base (Tutin *et al.* 2010: 28)

According to Millaku (2013: 76–77), Shuka *et al.* (2010: 17–18) and Shuka *et al.* (2012: 1), *Tulipa* in Kosovo has four or five species: *T. australis* (which according to some botanists should be treated as a subspecies of the tetraploid *T. sylvestris*), *T. serbica*, a species first discovered on Mt. Rogozna and the hill Beli Laz, both



Fig. 1. *Tulipa luanica*. — **A:** Habitat. — **B:** Habit. — **C:** Bulb. — **D:** Flower with stamen. — **H:** Stamen. — **E:** Capsule and seeds (enlarged). — **F:** Sepaloid perigone with stamens. — **G:** Outer perigone segments. — **I:** Perigone segments suffused by violet pollen.

localities on the eastern and western sides of the Ibar river (Tatić & Krivošej 1999: 159–160), *T. gesneriana*, *T. scardica*, which is distributed in the Vardar valley in Macedonia and Krivenik in southern Kosovo, with an outlying locality to the west, and *T. kosovarica* which is found in three localities in the serpentine area of Mirusha, Gurič and Llapushnik.

Kosovo, being part of the Balkan Peninsula, and with a surface area of 10 908 km², has approximately 2800–3000 plant species, of which about 370 are endemic to the Balkans (Millaku 2013: 1, 262). Šar Mts. and the Albanian Alps are Kosovo's botanically richest mountain ranges, with many rare and endemic plant species. Serpentine areas are also rich in endemic and relict plant species, including three *Tulipa* species endemic to the Republic of Kosovo.

A comparison of the species described here with *T. serbica* and *T. schrenkii* is based on literature and the herbarium material deposited in Prishtina (herb. Department of Biology, Faculty of Mathematics and Natural Sciences, University of Prishtina). Populations of *T. kosovarica*,

T. albanica, *T. gesneriana* and *T. australis* were also studied in their natural habitats. All the measurements are based on living material. Sixty living plants of each species were examined. Chromosome counts were made on somatic metaphases using the squash technique. Root tips were obtained from eight plants grown from bulbs collected from the type locality. Samples were treated with 0.05% colchicine solution for 5 hours, then fixed in 1/3 acetic-acid/ethanol for at least 24–48 hours. The root tips were hydrolyzed in 1 N HCl for 12 minutes in 60 °C, and stained with acetic carmine. Characterization of karyotype, determination of centromere position and chromosome type based in several metaphase plates all follow the nomenclature of Levan *et al.* (1964).

***Tulipa luanica* Millaku, sp. nova (Figs. 1 and 2)**

HOLOTYPE: Kosovo. Prizren district, Pashtriku mountain, on limestone substrate, 1000–1080 m a.s.l., 20 May 2013 Millaku & Elezaj 2501 (Herbarium of the Faculty of Natural

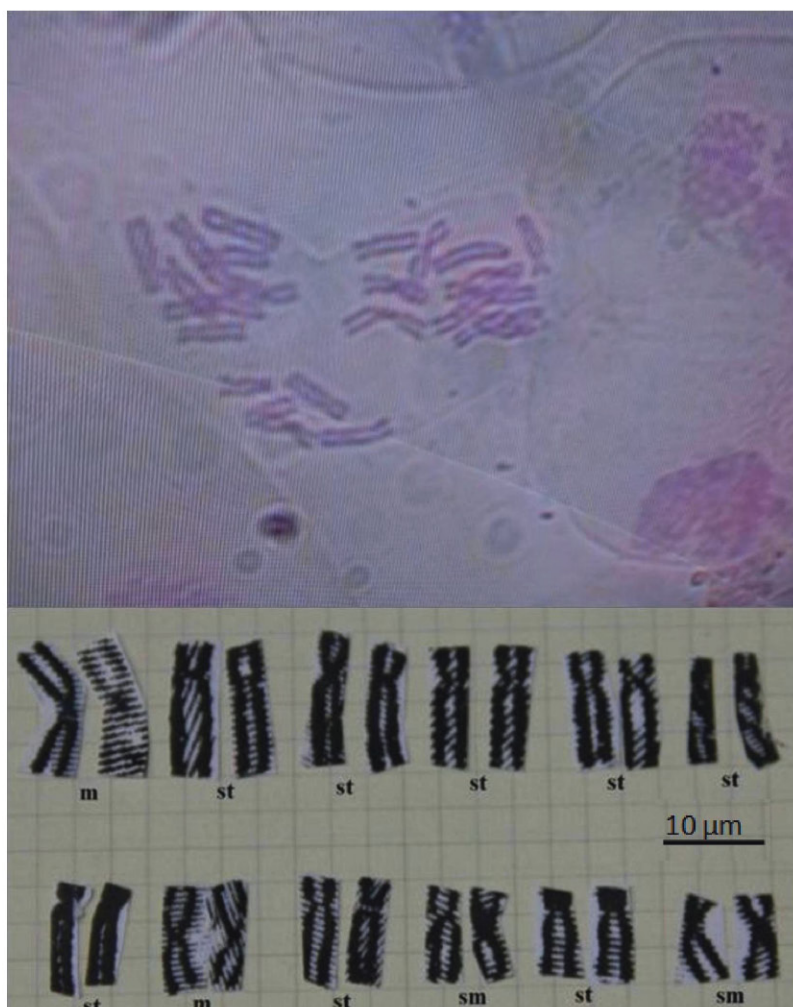


Fig. 2. *Tulipa luanica*. Metaphase plate ($2n = 24$) and corresponding karyogram.

Sciences, University of Prishtina). — PARATYPES: Kosovo. Prizren district, Pashtriku mountain, E-facing limestone slopes on the right side of the river Drini i Bardhë; Kuzhnini village, in forestry and open vegetation, 1056–1100 m, X. 7459214, Y. 4679009, 24 May 2013; same locality, 20 May 2014, *LJS 11842* (Herbarium of the Institute of Biology ZRC SAZU, Ljubljana, Slovenia), and *Millaku 01201* (priv. herb. Millaku).

Perennial herb. Bulb $3\text{--}4 \times 1.5\text{--}2.0$ cm, ovoid, not stoloniferous; tunics blackish-brown, chartaceous; inner surface densely covered with straight, $2.5\text{--}3.5$ mm long, silky, adpressed, unicellular, basifixed hairs. Stem erect, $17\text{--}55$ cm (excluding subterranean portion), glabrous, glaucous to greyish-green. Leaves $3\text{--}4(-5)$, lower ones alternate, glaucous to greyish-green, not exceeding flower. Lowermost leaves (at ground

level) $14\text{--}19 \times 2.0\text{--}5.1$ cm, caniculate, weakly undulate, linear-lanceolate-apiculate. Upper stem leaves $8\text{--}12 \times 0.6\text{--}1.5$ cm, smaller and closer, acuminate, linear. Flowers solitary, erect, rarely curved, campanulate, glabrous, in five colour nuances: pink, dark pink, persian pink, rose, persian rose. Perigone segment slightly unequal; outer segments elliptical to obovate, $4.2\text{--}6.6 \times 2.1\text{--}3.8$ cm, obtuse- or rounded-apiculate; inner segments elliptic-oblancheolate to obovate-spathulate, $3.8\text{--}6.5 \times 2.0\text{--}3.1$ cm, obtuse to subacute with white to creamy base occupying lower quarter. White or creamy base sometimes suffused by violet to dark violet colour of perigone segments. Filaments $9\text{--}14(-16)$ mm, white, glabrous; anthers $10\text{--}15$ mm, violet to

dark violet, oblong to elliptical, smaller, equaling or longer than filaments; pollen (and thus anthers) violet to dark violet. Ovary subsessile, 10–20(–22) mm long (as long as or longer than filaments at anthesis), yellow-green; stigmas 3, recurved-decurrent, white or creamy, papillose. Capsule 35–50 × 20–28 mm, ellipsoid, apiculate, shortly stipitate, with distinct transverse veins throughout, pale brown. Seeds 5–10 × 3–7 mm flat, triangular-deltoid, golden rod at maturity. Flowering from late April to late May; capsules dehiscing mid-July to end of August.

The chromosomes are large (5.25–12 μm), two pairs are metacentric (I and VIII), two pairs submetacentric (X and XII), and the remaining eight pairs are subtelocentric (II, III, IV, V, VI, VII, IX and XI) (Fig. 2). According to Shuka *et al.* (2010), the chromosome number of *T. albanica* is $2n = 24$, two of the chromosome pairs being are metacentric, three submetacentric and seven subtelocentric. *Tulipa luanica* has the same chromosome number and two metacentric chromosomes, but it differs from *T. albanica* by having two pairs of submetacentric and eight pairs of subtelocentric chromosomes.

Tulipa luanica differs from *T. gesneriana*, *T. albanica*, *T. kosovarica* and *T. serbica* in several characters (see Appendix). While *T. australis*, *T. gesneriana*, *T. kosovarica*, and *T. serbica* in Kosovo grow only on serpentine, *T. luanica* appears to grow exclusively on limestone. It is known from a single locality on Mt. Pashtriku in southern Kosovo, located on the western side of the river Drini i Bardhë, near the border with Albania. According to Shuka *et al.* (2012: 8), *T. gesneriana* occurs on both sides of the Vardar watershed with an outlying locality to the west of Bistra. Shuka *et al.* (2010: 3) wrote that *T. albanica* grows in clearings of *Quercus pubescens* woodland and *Buxus sempervirens* scrubs. *Tulipa kosovarica* is found only on the serpentine substrate in three locations in Kosovo. According to Tatić and Krivošej (1999: 159–160), Pavlović (1962: 8), and Prodanović *et al.* (2008: 332), *T. serbica* grows on Mt. Rogozna, 900 m a.s.l., on serpentine substrate.

Tulipa luanica shares its habitat with *Fraxinus ornus*, *Quercus pubescens*, *Ostrya carpinifolia*, *Senecio scopoli*, *Linaria dalmatica*, *Centaurea kosaninii*, *Delphinium fissum*, *Acanthus hungari-*

cus, *Centaurea atropurpurea*, *Helleborus multifidus*, *Eryngium palmatum*, *Hesperis matronalis*, *Erysimum pectinatum*, *Viola tricolor*, *Cephalaria pastricensis*, *Asphodelus albus* and *Asphodeline lutea*.

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Appendix. Comparison of morphological characters in *Tulipa albanica*, *T. kosovarica*, *T. gesneriana*, *T. serbica* and *T. luanica*. Data for other species than *T. luanica* taken from Shuka *et al.* (2012).

Characters	<i>T. albanica</i>	<i>T. kosovarica</i>	<i>T. gesneriana</i>	<i>T. serbica</i>	<i>T. luanica</i>
Leaf number	3–5	(2–)3–4(–5)	3–5	3–5	3–4(–5)
Lowermost leaf	canaliculate, strongly undulate	broadly canaliculate, weakly undulate	broadly canaliculate, weakly undulate	canaliculate, weakly undulate	canaliculate, weakly undulate
Lowermost leaves (cm)	10–25 × 1.0–3.5	10–22 × 1.5–3.0	10–20 × 1.5–2.5	10–30 × 1.5–3.0	14–29 × 2.1–5.1
Leaf margin	ciliolate in basal 1/3	ciliolate in basal 2/3	ciliolate in basal 1/3 or 2/3	ciliolate throughout	ciliolate throughout
Upper leaves (cm)	3–11 × 0.5–1.0	5–12 × 0.5–0.8	4–12 × 0.5–1.2	3–6 × 0.6–0.8	6.5–11.5 × 0.5–1.5
Colour of perigone segments	yellow or scarlet to dark reddish-maroon	cerise-magenta	scarlet to burgundy red	white or pale pink	pink, dark pink, persian pink, rose, persian rose
Base of perigone segment colour	yellow, without black blotch	white or whitish without black blotch, sometimes masked by shades of maroon and purple	yellow or creamy with a blackish-purple blotch	edged white at margin pale pink or whitish to pale green, without black blotch	white, creamy, sometime suffused by violet or dark violet
Outer perigone segments (cm)	4.0–7.3 × 2.3–3.6	3.5–5.0(–6.0) × 1.5–2.3	3.5–4.5 × 1.3–2.1	2–5 × 1.2–1.8	4.2–6.6 × 2.1–3.8
Inner perigone segments (cm)	3.5–7.0 × 2.0–4.2	3.0–4.7 × 1–2 cm	3–5 × 1.5–2.5	2.5–4.5 × 1.2–2.0	3.8–6.5 × 2.0–3.
Filament colour and length (mm)	golden-yellow, 7–14(–17)	white, 10–13	blackish-purple in upper half, yellow in basal half, 6–9(–11)	white or whitish, 6–7(–9)	white, rarely creamy 9–14(–16)
Anther colour and length (mm)	burgundy-red to blackish-maroon, 7–13	blackish-maroon, 8–12	blackish-maroon, 7–9	maroon to dull purple, 6–9	violet to dark violet 10–15
Pollen colour at dehiscence	dark violet-purple, very rarely yellow	purplish-maroon, very rarely yellow	greenish-yellow, very rarely blackish-maroon	yellow, very rarely purplish-maroon	violet to dark violet
Ovary length at anthesis (mm)	12–23	15–22	20–22	9–15	10–20(–22)
Stigma colour	rose-pink, yellow or pale green	creamy to pale green	pale yellow	creamy to pale green	white, creamy
Capsule size (mm)	30–35 × 15–20	30–35 × 15–22	34–44 mm long	20–30 × 15–20	35–50 × 20–28
Seed size (mm)	5.5–6.5 × 4.5–6.0	7–8 × ca. 6 mm	ca. 5 × 4 mm	immature	5–10 × 3–7