Tropaeolum TROPAEOLACEAE

U. Eggli

Tropaeolum Linné (Spec. Pl. [ed. 1] 1: 345, 1753). **Type**: *Tropaeolum majus* Linné [lectotype, designated by Nash, North Amer. Fl. 25: 89, 1910]. – **Distr:** S Mexico, Central America, N, W and SE South America (to Patagonia), esp. along the Andes. **Etym:** Diminutive of Lat. 'tropaeum' (from Gr. 'tropaion'); mark, token, shield or memorial of victory, trophy; from the shield-like peltate leaves and the flower, which in lateral view resembles a medieval helmet.

Incl. *Acriviola* Miller (1754). **Type**: *Tropaeolum majus* Linné.

Incl. *Cardamindum* Adanson (1763). **Type**: *Tropaeolum majus* Linné.

Incl. *Magallana* Cavanilles (1798). **Type:** *Magallana porifolia* Cavanilles.

Incl. *Chymocarpus* D. Don *ex* Brewster & al. (1833). **Type:** *Tropaeolum pentaphyllum* Lamarck [type according to D. Don, Trans. Linn. Soc. London 17: 14, 1834].

Incl. *Rixaea* Morren (1845). **Type:** *Tropaeolum azureum* Bertero *ex* Colla.

Incl. *Anisocentra* Turczaninow (1863). **Type:** *Anisocentra cardiopetala* Turczaninow.

Incl. *Trophaeastrum* Sparre (1991). **Type:** *Tropaeolum patagonicum* Spegazzini.

Description as for the family.

The genus *Tropaeolum* was divided into 10 sections by Sparre & Andersson (1991), but based on the molecular phylogeny of Andersson & Andersson (2000), only 2 well-supported clades can be recognized at sectional level: Section *Chilensia* embraces 29 taxa with entire petals and often reduced nectar spurs; this section can be further subdivided into 5 subsections (Watson & Flores 2010), and Hershkovitz & al. (2006) found some evidence for hybridization amongst several of its species. Section *Tropaeolum* (here belongs *T. tuberosum*) consists of 78 taxa with ciliate petals and well-developed nectar spurs; it can be divided into 6 informal groups.

Economic Importance: The only taxon with more pronounced importance is *T. tuberosum*, cultivated throughout the Andes as food item (see below for details). A number of *Tropaeolum* species are cultivated as ornamentals in gardens (esp. *T. majus*, "Nasturtium", "Indian Cress", thought to be the ancient spontaneous hybrid *T. minus* × *T. ferreyrae*, originating in Peru and introduced to Europe in 1684 (Mabberley 2017, perhaps subsequently also crossed with *T. peltophorum*, see Sparre & Andersson 1991). Pickled flower buds of *T. majus* and some other species are sometimes used as a substitute for capers.

U. Eggli (✉)
Sukkulenten-Sammlung Zürich, Grün Stadt Zürich, Zürich, Switzerland
e-mail: Urs.Eggli@zuerich.ch

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T. tuberosum Ruiz & Pavón (Fl. Peruv. 3: 77, t. 314, 1802). **Type:** Peru (*Ruiz & Pavón* s.n. [MA, CONC, F, G, MO]). – **Lit:** Grau & al. (2003: with ills.); Hind (2010: with ills.). **Distr:** Colombia, SW Venezuela, Ecuador, Peru, Bolivia, N Peru, N Argentina; high Andes.

≡ *Chymocarpus tuberosus* (Ruiz & Pavón) Heynhold (1840) ≡ *Trophaeum tuberosum* (Ruiz & Pavón) Kuntze (1891); **incl.** *Tropaeolum suberosum* C. Mueller (1857) (*nom. inval.*, ICN Art. 61.1); **incl.** *Trophaeum denticulatum* Kuntze (1891).

T. tuberosum is usually divided into 2 subspecies following Sparre & Andersson (1991), ssp. *silvestre* for naturally occurring plants, and ssp. *tuberosum* for the cultivated material. However, Grau & al. (2003: 30) argue that the distinction is questionable since at least some wild accessions from Peru produce elongate tubers. On the other hand, chemical differences between the two subspecies are reported (see references in Grau & al. 2003).

The species is widely cultivated in the high Andes of Ecuador, Peru and Bolivia as a valuable staple food; it is known as "Mashua", "Añu" or "Isaño", and a variety of further local names are listed by Grau & al. (2003: 8–9). These authors also provide a detailed synopsis of the biology, agronomy, ethnobotany and genetic variation and breeding perspectives of the crop. The tubers have a water content of 78–94 % and a starch content of 7–10.5% (King 1987; Sperling and King 1990; Grau & al. 2003: 24); dry-matter content can be as low as 8 % (vs. 23 % and more for potatoes) (Condori & al. 2008). In Bolivia, *T. tuberosum* is mostly grown for feeding to pigs, but it is considered to be under-used for human consumption. To make the tubers palatable to humans, they must be boiled, and they are usually used as components in stews and other dishes (Grau & al. 2003: 23). Under optimal conditions, annual yields of 55–60 t/ha or more can be achieved (Grau & al. 2003: 19; Condori & al. 2008). Tuber formation needs short-day conditions, and starts when day length becomes less than 12 h (Grau & al. 2003: 22). The time from planting to harvest is 6–8 months, and material is propagated only vegetatively, although large quantities of seeds are produced (King 1987). Cultivated clones appear to be self-fertile as seed is also formed in plantings of a single clone (Grau & al. 2003: 13). Apart from its use as food item, *T. tuberosum* is also valued for medicinal and anti-aphrodisiac qualities in Andean folk medicine (see synopsis by Grau & al. 2003). Many local cultivars exist, partly with different tuber colours, and a Bolivian gene bank holds 80 different accessions (Condori & al. 2008).

T. tuberosum was probably first used medicinally, and only became an important Andean food item much later – the earliest archeological evidence of its usage dates from 650–1350 CE, and the taxon is also shown on Nazca ceramcis dated 1000 CE (Grau & al. 2003: 3, and references there cited).

T. tuberosum ssp. **silvestre** Sparre (in Harling, G. & Andersson, L. (eds.), Fl. Ecuador 2: 9, 1973). **Type:** Peru, Lima (*Asplund* 10847 [S]). – **Distr:** C Colombia, Ecuador, Bolivia (La Paz), Argentina (Jujuy, Catamarca); woodland, cloud forests, grassland, high-mountain meadows or rocky ground in the high Andes, 2400−3000(−3950) m.

Incl. *Tropaeolum buchenavianum* Hieronymus (1895); **incl.** *Tropaeolum hieronymi* Buchenau (1899) (*nom. illeg.*, ICN Art. 52.1); **incl.** *Tropaeolum septemlobatum* Heilborn (1930).

Differs from ssp. *tuberosum*: Smaller and more slender in all parts; **R**stock fusiform, tubers absent (but see discussion above).

T. tuberosum ssp. **tuberosum** – **Distr:** SW Venezuela to C Bolivia (Cochabamba, La Paz, Oruro); high Andes, cultivated only. – Figs. 1 and 2.

Incl. *Tropaeolum mucronatum* Meyen (1835) ≡ *Trophaeum mucronatum* (Meyen) Kuntze (1891); **incl.** *Tropaeolum cubio* Bukasov (1925) (*nom. inval.*, ICN Art. 36.1b).

Herbs with climbing (by twining stems and petioles) to prostrate annual stems to 2–4(−12) m, **R**stock with tubers 5–6(−15) × 3–4(−6) cm ∅, yellow or greenish with purple blotches, speckles or streaks; stems, petioles and pedicels often reddish; **L** alternate, petiole to 10 cm, lamina peltate, 4–5(−6) × 5–6(−7) cm, suborbicular,

Fig. 1 **Tropaeolum tuberosum** ssp. **tuberosum**. (Copyright: Wikimedia, by Peganum, Henfield, England)

Fig. 2 **Tropaeolum tuberosum** ssp. **tuberosum** (tuber, longitudinally cut). (Copyright: Wikimedia, Public Domain)

somewhat (3- to) 5- (to 6-) lobed, often incised to ⅓ of the length of the lamina, basally rounded to subtruncate, tip obtuse to truncate, mucronate; stipules inconspicuous, thin, early caducous; **Fl** solitary, axillary; **Ped** 150–200 mm; hypanthium red or reddish, orange or sometimes yellow; **Sep** 5 (−7 in some clones), upper free **Sep** lobes 8–10 × 4–5 mm, lanceolate to narrowly triangular, lower lobes 12–14 × 4–5 mm, lanceolate, nectary spur tubular, 18–22 × 5–6 mm ∅ at the base; **Pet** 5 (−7 in some clones), spreading, dark yellow or orange with darker veins, or sometimes pale pink to reddish, the upper shortly clawed, lamina 6–9 × 5–8 mm, suborbicular with entire or repand margins, the lower with a long claw, lamina 10–15 × 4–6 mm, elliptic to subspatulate; **Fr** dark brown to blackish when fully ripe, mericarps 4–5 mm, rugose, somewhat ribbed, ribs crenulate.

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