Lomelosia solymica (Dipsacaceae), a new chasmophyte from the Western Taurus Mts, Turkey

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Abstract

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Lomelosia solymica, a plant of montane, sea facing cliffs of the Tahtalı Dağı in the Western Taurus Mts south of Antalya is described as a species new to science and illustrated. Its isolated taxonomic position within the genus and its peculiarities, such as the awnless calyx, are discussed. We interpret the latter character within the chasmophytic syndrome and develop the hypothesis that it facilitates dispersal by ants into narrow rock fissures.

In summer 2004, the pharmacist Robert Ulrich, Tübingen, Germany, forwarded two specimens of a low, cushion-forming chasmophyte collected in upper montane elevations of Tahtalı Dağı to the senior author with the request for identification. Scrappy, partly sterile, partly still in bud as they were, their identity could only be narrowed down to, most likely, a few genera of *Dipsacaceae,* and they could have been named only if encountered in the field before. Since this was not the case, a digital image of a specimen was sent to Özkan Eren, who studied, among others, the flora and vegetation of Tahtalı Dağı within the frame of his PhD at Akdeniz University, Antalya. He, too, never came across such a plant, but offered to re-collect it. Investing this labour appeared promising, because no matching or similar species are included in Flora of Turkey (Davis 1972). This was surprising, since Tahtalı Dağı, the ancient Solyma, which is known for its local endemics (Davis 1958, 1971, Parolly & Nordt 2001), is a very well explored mountain range (see e.g., the collections cited in Flora of Turkey). The second author succeeded in gathering the unknown, now flowering species close to Ulrich's locality at an altitude of about 1600 m in August 2004. His collection confirmed that we were dealing with an undescribed, scabiosoid *Dipsacaceae,* set apart from all others by the absence of calyx setae as well as the pygmy and compact chasmophytic habit (Fig. 1-2). The last step, again, was done by Robert Ulrich, who later in the year collected ripe fruits and added two (satellite) localities on the occasion of two field trips (in September and October), now making a full treatment possible. We describe the novelty here within the genus *Lomelosia* Raf. (= *Scabiosa* sect. *Trochocephalus* Mert. & Koch).

Lomelosia solymica Parolly, Ö. Eren & Nordt, **sp. nov.**
Holotype: Turkey, C3 Antalya, Tahtalı Dağı, SW Kemer, ascent from Beycik, 36°31' 55.6"N, 30°26'142"E, 1630 m, vertical limestone cliffs, 6.8.2004, *Eren 387/04 & Taylan* (Adnan Menderes University Herbarium, Aydın; isotypes: B, E, GAZI, HUB, herb. Parolly).

Species insignis, ab omnibus *Lomelosiis* habitu compacto pulvinato et statura minima, foliis glaberrimis hyalino-marginatis, tantum 8 bracteis involucratis, corona regulari et calycibus non setosis differt.

Fig. 1. *Lomelosia solymica* – specimen *Ulrich 4/24a* (herb. Parolly). – Scale bar = 1 cm.

Compact, pulvinate chamaephyte, forming flat cushions to 40 cm in diam. and 3-5 cm height, with numerous flowering and sterile rosettes. *Rootstock* branched, fairly stout, 0.5-1 cm in diam., densely clothed by the imbricately arranged petiolar remains of the previous years' leaves. *Stems* short, including the peduncle (10-)15-35(-45) mm long, 1-1.5 mm in diam. at the base, ascending to erect, simple, somewhat flattened and indistinctly 2-winged at the base, very densely white-pubescent with short (c. 0.1 mm) retrorse hairs (sometimes in addition with c. 0.02-0.05 mm long hairs). *Leaves* vividly green, (sub)coriaceous, most of them in the basal rosette, entire, with a distinct, occasionally somewhat undulate, 0.1-0.2 mm wide hyaline margin, mostly glabrous, exceptionally with scattered marginal setae, midvein whitish (green), very prominent especially on the lower surface; leaf bases flattened and expanded to form paler leaf sheaths, c. 2-4 mm long. *Rosette leaves* (10-)15-35(-40) × 2-6 mm, narrowly obovate to spathulate or oblanceolate, tapering into a narrow base, apex mostly acute, less often mucronulate to obtuse. *Stem leaves* similar, but smaller in size than rosette leaves, very few, often reduced to bracts. *Peduncle* 1-2 cm long, c. 0.7 mm in diam., leafless. *Capitula* solitary, in flower flattened-hemispherical, radiant, (15-)20-25(-30) mm in diam., in fruit globose, 12-17 mm in diam. *Involucral bracts* 8, in two series, distinctly (3-)5-7-veined outside, variable in shape and density of the indumentum, outer surface thinly to densely pubescent, inner surface often glabrous; outermost bracts green, mainly with paler centres and purplish margins, ovate to ovate-lanceolate, often gibbous in the middle, 4-6 × 2-3 mm, apex apiculate to obtuse; innermost bracts similar but smaller in size, gradually merging into the receptacular bracts. *Receptacular bracts* white, with purplish or green tips, scale-like, keeled, oblanceolate to narrowly ovate, 3-5 × 1.2-2 mm, herbaceous with a hyaline membranous margin clearly dilated towards the base or only with herbaceous tip and vein, apex ± rounded, hairs as in involucral bracts but thinner. *Florets* 14-20, pale mauve, lilac to pinkish, the outer strongly radiant, 11-13 mm long. *Corolla* with a narrowly infundibuliform, white-lanate tube, c. 4.5-7 mm

Fig. 2a-b. *Lomelosia solymica* in its natural habitat [Turkey, C3 Antalya, Tahtalı D.]; note the dispersed fruits in b. – Photographs by Gertrud Ulrich, 11.9.2004.

long and with (4-)5 very unequal lobes, outside loosely lanate-pubescent, inside with scattered stalked glands; lobes of the 3 lower segments elliptic, obovate to narrowly ovate, 4.5-5.5 × 3-4 mm, the 2 upper broadly obovate, 2-2.5 × 2-2.5 mm. *Stamens* 4(-5), long exerted; filaments whitish to rarely pale purplish in upper part, 6-12 mm long, flattened, winged; anthers pale pinkish

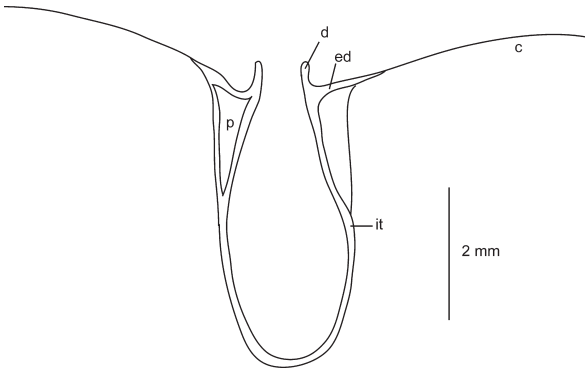

Fig. 3. *Lomelosia solymica* – half-schematic section of epicalyx. – c = corona, d = diaphragma, ed = epidiaphragma, it = involucel tube, p = pits; initial pits (= foveoles) indicated by dotted lines.

mauve, (narrowly) elliptic, c. 1.8-2 × 0.5-0.7 mm, finely but distinctly papillose. *Style* purple, 10-13 mm long, glabrous; stigma capitate. *Involucel* with a conspicuous, membranous, cup-shaped, symmetrical corona, 4 mm long and 5-7 mm in diam; corona veins 17-25, pale brown to purple, not or shortly excurrent; involucel tube broadly cylindrical, c. 3-4 × 2 mm, with 8 deep, elongate, whitish pits, each c. 1.3 mm long, densely pilose with white, spreading hairs, 2-3 mm long. *Calyx* shorter than corona, c. 2 mm long and 2 mm in diam., connate at the base, forming an irregularly 5-lobed green disc covered inside by scattered glandular hairs; calyx setae absent.

Ic. – Fig. 1-3; for further photographs (in colour) see the electronic supplement to this paper at http://www.bgbm.org/willdenowia/willd35/parolly+al.htm

Etymology. – The epithet is derived from Solyma, the ancient name of Tahtalı Dağı, or, as pars pro toto, of the whole Beydağları (Davis 1958), the massif to which Tahtalı Dağı belongs.

Distribution. – The present records of *Lomelosia solymica* are confined to Tahtalı Dağı and are from three different cliffs within the reach of a few kilometres at altitudes between 1350 and 1650 m.

Additional specimens seen. – TURKEY, C3 ANTALYA: SE-Seite des Tahtalı Dağı (SW Kemer), 1490 m, Kalkfelsen, SW-exp., 30.4. & 12.6.2004, *Ulrich 4/24* (herb. Parolly); ibid., 1490-1510 m, 11.9.2004, *Ulrich 4/24a-b* (herb. Parolly); ibid., 1560 m, Kalkfelsen, S-exp., 14.10.2004, *Ulrich 4/24c* (herb. Parolly [photograph]); ibid., 1630 m, 1.12.2004, *Eren 402/4 & Taylan* (Adnan Menderes University Herbarium).

Phenology. – *Lomelosia solymica* is a late-flowering species those anthesis starts in late July and which has plentiful flowering cushions still in mid October; fruit-set begins in September. The last fruits were collected in early December. The cushions grow luxuriantly in early summer, while still in bud, and also produce the longest leaves at that time. Later in the year, general appearance is less lush, with an increasing number of decaying and withering basal leaves.

Synecology. – *Lomelosia solymica* grows in sun-drenched, vertical cliffs (Fig. 2) composed of hard, compact Mesozoic limestone of the Tahtalıdağ nappe (Şenel 1997a-b) in montane elevations. Some of the cliffs are enormously towering rock walls rising 200-400 m from extensive scree fans in the middle of the mountain forest belt. Being at the right place, *L. solymica* is a fairly abundant appearance, forming large cushions covering both rock edges and fissures of the vertical rock and step crevices. Occurrences at the feet of the rocks were also observed.

If not developing pure stands, it mainly grows together with two local paleoendemics, *Asyneuma pulvinatum* P. H. Davis and *Globularia davisiana* O. Schwarz, in "noble isolation" from the more common rock plants (Ulrich, pers. comm., 22.10.2004). More rarely it is found as-

Table 1. *Lomelosia solymica* community. Phytosociological relevés with *L. solymica* at the type locality [Turkey, C3 Antalya, Tahtalı D.], 6.8.2004.

Relevé [no.]	1	2	3
Altitude [m]	1625	1625	1625
Exposure	SW	SW	S
Inclination [°]	80	85	85
Cover of herb layer [%]	25	25	30
Square size [m^2]	4	3	2
Character species of the community			
Lomelosia solymica	1	1	1
Asyneuma pulvinatum P. H. Davis	1	1	1
Globularia davisiana O. Schwarz	1	+	.
Character species of the Silenetalia odontopetalae and Asplenietea trichomanis			
Hirtellina lobelii (DC.) Dittrich	1	1	1
Silene leptoclada Boiss.	1	1	.
Galium serotinum Boiss. & Heldr.	1	1	.
Inula heterolepis Boiss.	1	+	.
Asyneuma lycium (Boiss.) Bornm.	+	+	.
Arabis deflexa Boiss.	+	.	.
Arenaria deflexa Decne.	+	.	.

sociated with *Hirtellina lobelii* (DC.) Dittrich, *Asyneuma lycium* (Boiss.) Bornm. (endemic of the E Beydağları), *Salvia caespitosa* Benth. (in the Tahtalı and Teke Dağı encroaching to rock fissure communities, whereas everywhere else in the Taurus inhabiting dwarf-shrub and thorn-cushion communities; see also Quézel 1973) and, on only a single rock base, with *Origanum* cf. *solymicum* P. H. Davis. *L. solymica* forms the core of a yet unnamed, steno-endemic cliff community of the Silenion odontopetalae Quézel 1973 alliance (limestone rock fissure communities of the Western Taurus, see Eren & al. 2004, Quézel 1973 and especially Hein & al. 1998; see Table 1).

Recommended IUCN threat category. – Although being extremely localised, any direct threat of *Lomelosia solymica* can be excluded for the moment due to its abundance in high, inaccessible rock walls. Monitoring the stands, however, seems appropriate in the view of a widely developed plan to establish a ski circus, including a cabin ski elevator, on the summit of this unique mountain. The construction activities could well damage the few sites. We thus suggest to classify our species as "Vulnerable" (VU) according to criterion D2 of the IUCN threat categories (IUCN 2001).

Relationship. – Verlaque's important studies on *Dipsacaceae* (1984a-b, 1985a-b, 1986a-b) paved the way for Devesa (1984) and Greuter & Burdet (1985) to draw taxonomic conclusions by splitting the polyphyletic *Scabiosa* s.l. into more natural genera corresponding to the sections of *Scabiosa* as circumscribed by Verlaque (1986a-b). The main carpological characters (e.g., elongated horizontal epidiaphragma, a deeply foveolate epicalyx, second sclerenchyma ring, see Fig. 3) place our plant clearly into *Lomelosia,* those generic status was more recently supported by Caputo & Cozzolino (1994), Caputo & al. (2004) and Mayer & Ehrendorfer (1999, 2000).

Within *Lomelosia* and *L.* sect. *Lomelosia* (incl. *Tremastelma* Raf. and *Scabiosiopsis* Rech. fil., see Mayer & Ehrendorfer 1999), one is tempted to relate *L. solymica* to a group of fruticose, suffruticose to suffrutescent chamaephytes of the *L. cretica* agg. as first circumscribed and mapped by Davis (1953) and Greuter (1967). The West to Central Mediterranean *L. cretica* (L.) Greuter & Burdet s.str. excepted, it includes a complex of vicariads (*L. albocincta* (Greuter) Greuter, *L. hymettia* (Boiss. & Spruner) Greuter & Burdet, *L. minoana* (P. H. Davis) Greuter & Burdet, *L. variifolia* (Boiss.) Greuter & Burdet) spread along the Aegean Arc (Greuter & al. 1986). The *L. cretica* group shares, with a few exceptions, with our plant the entire leaves, a chamaephytic habit and the preference for rocky sites. Moreover, the members of this group have diminutive calyces,

Table 2. Differential characters of *Lomelosia solymica* and related species. – Measurements and features taken from the literature (Bornmüller 1908, Davis 1953, Greuter 1967, Huber-Morath 1963, Jahn & Schönfelder 1995, Matthews in Davis 1972, Meikle 1985, Tan & Iatroú 2001) and specimens kept at B; unique characters discriminating one species are in bold face.

Character	***L. solymica***	***L. hololeuca***	***L. paucidentata***	***L. cyprica***	***L. hymettia***	***L. albocincta***	***L. minoana***	***L. variifolia***
Habit	**pulvinate**	suffrutescent, caespitose	suffruticose	fruticose	suffrutescent, caespitose	fruticose	fruticose	fruticose
Height [cm]	3-5	5-20	7-13	30-100	10-47	20-50	10-30	10-100
Leaf size [mm]	10-40 × 2-6	20-40 × 2-3	5-20 × 3-6	10-30 × 3-15	11-72 × 3-14	30-60 × 8-20	20-65 × 5.5-16.5	25-70 × 7-45
Leaf shape	oblanceolate to spathulate; ± flat	linear, subacute; flat	ovate-spathulate, ± acute; ± plicate	ovate, obovate to spathulate; ± plicate	obovate to linear-lanceolate; flat	broadly elliptic to ovate; flat	(broadly) elliptic; flat	obovate to elliptic; flat
Leaf margin	entire, **hyaline**	entire	entire or dentate near apex	entire to serrate near apex, or with 1-2 lobes	entire to 3-fid to bipinnatifid	entire	entire or dentate near apex	mostly entire, or with 2-3(-5) lobes
Leaf venation	**parallel, midvein very prominent**	?	?	midvein prominent	reticulate	reticulate	reticulate	reticulate
Lateral leaf veins	indistinct	?	?	0-1(-2)	(0-)1-3	3-5(-7)	(5-)7	3-7
Leaf indumentum	**glabrous**	cano-sericeous	spreading-pilose	densely silvery-sericeous	densely silvery-sericeous	pilose to glabrescent, **denser on margin**	densely sericeous	sericeous, ± glabrescent
Peduncle [cm]	1-2	?	0.5-2.5	5-30	(1-)6-27(-35)	(8-)20-40	6-15(-20)	(1.5-)2-8(-11)
Involucral bracts	**8** in 2 series	10-14 in 2 series?	numerous in 2-3 series?	9-16? in 2-3 series	12-18 in 2-3 series	(9-)12-21 in 2-3 series	(9-)12-16 in 2-3 series	9-16(-19) in 2-3 series
Capitulum diam. [mm]	15-30 radiant	15-20 **not radiant**	20-30 radiant	15-30 radiant	25-35(-40) radiant	30-45 radiant	25-40 radiant	20-40(-45) radiant
Floret colour	pale mauve, lilac to pinkish	**yellow, with pink hue**	pink	mauve or purple	white, pale blue or purple	pink or mauvish pink	pink or mauvish pink	pink or mauvish pink
Involucel tube [mm]	3-4 × 2	?	c. 5 × 3	4 × 3	5-6 × 3	4.5 × 2	5 × 2.5	6-8 × 2.5-3
Involucel indumentum	densely pilose	pilose	densely white-setose	densely white-hirsute	densely white-sericeous at base	densely pilose to white-hirsute	densely pilose to white-hirsute	pilose
Corona shape	symmetrical	symmetrical	symmetrical	Symmetrical, **margin plicate**	asymmetrical	asymmetrical	asymmetrical	asymmetrical
Corona diam. [mm]	5-7	?	?	(5-)6-7	9-10	8-11	10-12	10-12
Corona veins	17-25	26-30	c. 25	28-33	25-28(-38?)	21-30(-34)	26-33	27-38
Calyx setae [mm]	**absent**	?; slightly exceeding corona	6-7; widely exceeding corona	2; included in corona	4-6; included in corona	5-6; widely exceeding corona	6-7; ± included in corona	4-5; included in corona

whose bristles are entirely included in the corona (being much shorter than the latter). Phytogeography seems to provide another argument: the Tahtalı Dağı area, is, as all of the Western Taurus, the extension of the Aegean Arc into mainland Anatolia. However, the whole *L. cretica* group is characterised by a probably synapomorphic asymmetric epicalyx corona (Table 2).

For further comparison (Table 2) one could add a few species that may perhaps be the closest relatives, namely *L. paucidentata* (Hub.-Mor.) Greuter & Burdet, localised around Finike, thus very close to Tahtalı Dağı, and especially *L. hololeuca* (Bornm.) Greuter & Burdet, recorded from the "Phrygian", western part of Inner Anatolia (Huber-Morath 1963, Matthews in Davis 1972), and the Cypriot endemic *L. cyprica* (Post) Greuter & Burdet (Meikle 1985). However, the Anatolian plants are imperfectly known. Because of their entirely different habit and phytogeography we have not extended our search for potential allies to species of the *L. caucasia* (M. Bieb.) Greuter & Burdet group, with entire leaves and short calyx bristles.

It is evident that *Lomelosia solymica* stands apart from all others species by a combination of highly discriminating features: the low height; the compact cushion habit; the always entire and nearly always glabrous leaves both in young and adult state (only one specimen of *Ulrich 24* has two leaves with very few scattered marginal cilia); the constant low number of 8 involucral bracts; the regular occurrence of both 4- and 5-fid corollae within one capitulum; the symmetric corona (with fairly few veins); and finally, most remarkable and unique within the genus, the lack of any calyx setae, resembling in this respect only *Succisella* Beck. and two W Mediterranean heterocarpic therophytes of *Scabiosa* sect. *Cyrtostemma* Mert. & Koch (= *Sixsalix* Raf.), viz. *S. arenaria* Forssk. and *S. semipapposa* DC., the latter two with some of the fruits of a capitulum without calyx setae (Devesa 1984, Meyer & Ehrendorfer 1999). In contrast, the calyx in all hitherto known *Lomelosia* species uniformly has five stiff and rough setae. It is persistent in all species except for *L. stellata* (L.) Raf., another W Mediterranean therophyte (Meyer & Ehrendorfer 1999). Although we have made no detailed ontogenetic study, our material suggests that the calyx setae are not precociously lost (as, e.g., in *Pycnomon rutifolium* (Vahl) Hoffmanns. & Link), but are altogether absent (as all setae in *Succisella* and three or four of them in *Scabiosa uniseta* Savi).

Discussion – *Lomelosia solymica,* another paleo-endemic?

The woody saxatile habit and disjunct distribution of the *Lomelosia cretica* aggregate, taken by Davis (1953) as a single, broadly defined species, *Scabiosa cretica* s.l., let him conclude that "the Scabious is a Tertiary relict; it probably became differentiated into distinct subspecies as a result of geographical isolation initiated in Pleistocene times". Disregarding the altered classification, this view may still be the state of the art, since no modern study considers more than one species of the *L. cretica* agg. to achieve conclusions about their relationship. With some reservation, Tertiary relics may be also seen in the other subshrubby species found on Cyprus and in Anatolia.

In view of the ecogeographical differentiation of the species in Table 2 one is easily tempted to assign *Lomelosia solymica* to the paleo-endemics of Tahtalı Dağı. Its synecology, i.e. its association with undoubted other such species in well-protected sea facing cliffs of a never glaciated mountain, seems to support this. The growth form of *L. solymica* with its basic architecture of a compact half-domed cushion (Halbkugelpolster) is totally different from all other *Lomelosia* species, encompassing besides many annuals also a wide range of semiscapose hemicryptophytes (e.g., *L. argentea* (L.) Greuter & Burdet), caespitose chamaephytes (*L. graminifolia* group) and fruticose nanophanerophytes to suffruticose chamaephytes, the latter two forming at most hollow cushion shrubs or shrublets (Hohlkugelpolster). *L. solymica* as pulvinate chamaephyte contrasts sharply to the *L. cretica* agg. in this respect and the true chasmophytic habit could be seen as derived. It should be mentioned that a pulvinate habit is also present in the narrow amphi-Adriatic endemics *L. crenata* subsp. *dallaportae* (Boiss.) Greuter & Burdet, *L. sphaciotica* (Roem. & Schult.) Greuter & Burdet and *Scabiosa silenifolia* Waldst. & Kit. (Caputo in litt.).

Recent studies (Mayer & Ehrendorfer 1999, Caputo & al. 2004) have contributed to the view that the adaptations in fruit dispersal have been a very strong driving force in *Dipsacaceae* evolution, with similar selective pressures causing convergent development of similar epicalyx shapes (e.g., in *Lomelosia* and *Scabiosa*) and dispersal types (meteorochory, epizoochory, stomatochory) in various taxa (Mayer & Ehrendorfer 1999, Caputo & al. 2004). It is therefore more likely to interpret the lack of calyx setae as derived rather than plesiomorphic.

Among all species compared (Table 2), *L. solymica* has the smallest corona (the asymmetric corona of some other species ought to be more strongly exposed to winds) in absolute values and in the ratio epicalyx body to corona, making an effective dispersal by wind fairly unlikely. We assume that *L. solymica* is ant-dispersed and may at least have myrmecochorous diaspores. The first author observed several times ants with fruits of *L. micrantha* (Desf.) Greuter & Burdet and *L. rotata* (Bieb.) Greuter & Burdet in Turkey. Wind-dispersal and subsequent transport by harvesting ants seems to be not infrequent in *Scabiosa* s.l. Small diaspores with small coronas and without spreading bristles doubtless would enable the transport into narrow clefts. Under this assumption, *L. solymica* may be interpreted as a ± modern upland taxon, derived from (sub)shrubby types with pterochorous diaspores (for speciation in Aegean cliff communities, see, e.g., Snogerup 1971). Further support for this hypothesis provides the ± horizontal orientation of the epidiaphragma, which is in *L. cretica* in a ± upright position in mature fruits, the latter character state considered as plesiomorphic by Mayer & Ehrendorfer (1999).

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