A new species of *Lavatera* Sect. Olbia (Medik.) DC. (Malvaceae) from north-east Morocco

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As a result of recent fieldwork in north-east Morocco, a new woody Malvaceae species, *Lavatera valdesii* Molero & J.M. Monts., is described here. The morphological characters that link it to other species in Sect. Olbia (Medik.) DC. are discussed, as are those traditionally used in defining the species that make up this section. A recently described species of this group, *Lavatera plazzae* Atzei, is established here as a synonym of *L. stenopetala* Coss. & Durieu ex Batt., a species previously considered as an endemic of east Algeria. On the basis of morphological characters, we propose the exclusion of both *L. thuringiaca* and *L. cashmiriana* Cambess. from Sect. Olbia. © 2007 The Linnean Society of London, Botanical Journal of the Linnean Society, 2007, 153, 445–454.


INTRODUCTION

The BIOGEO project has as its principal aims the completion of the Baetic/Rif vascular plant catalogue and the establishment of a biogeographical comparison between the vascular flora of south Spain and northern Morocco. Throughout this project, we carried out many field expeditions during the years 2004 and 2005, in an effort to complete our floristic knowledge of regional plant distribution in the western part of northern Morocco. As a result of these activities, some chorological and taxonomic novelties for the Checklist of Vascular Plants of North Morocco (Valdés et al., 2002) are in press (Molero & Montserrat, 2006a, b). During an expedition to the isolated and difficult Djebel Mezgout (1850 m), we collected *Lavatera* close to *L. olbia*, but with some very distinctive morphological features. When we started to study this material, we very soon met with difficulties concerning the delimitation of *Lavatera* and *Malva* species. This forced us to investigate here the taxonomic position of this new species and to establish its taxonomic affinities from our morphological and karyological data.

DELIMITATION OF THE GENUS *LAVATERA*

Tournefort (1706: 86, pl. 7) defined the genus *Lavatera* by the large membranous expansion of the columnar style completely covering the schizocarp, and limited this concept to only one species, *Lavatera trimestris* L. Linnaeus (1737: genus n. 588; 1753: 690–692) expanded Tournefort’s concept of *Lavatera* to include all those species with connate epicalyx segments. This character has been demonstrated as having evolved more than once (Ray, 1995) and, consequently, the genus *Lavatera*, as traditionally conceived, is polyphyletic. Fernandes (1968a, b: 251–253; 1969, 1993: 232–243) studied this problem in depth and made a comparative history of different proposals based on plant morphology.

Some of the different propositions analysed by her are clearly coincident with the two main clades identified by Ray (1995) in his studies on *Malva* and *Lavatera* using molecular techniques. In a recent synthesis of the Malvaceae (Bayer & Kubitzki, 2003:...
the definition of Lavatera is limited to the species included in the ‘Lavateroid clade’ as defined by Ray (1995).

Before choosing a new name for the recently discovered taxon, we had to answer the following questions. Should we conserve the genus Lavatera L.? Under which genus should we place the new species? Although there are few doubts that some species previously included under Lavatera [Sect. Axolophia DC. and Sect. Anthema (Medik.) DC.] should be transferred to Malva (Ray, 1998; Molero & Montserrat, 2005), it is not so clear for the species included in the ‘Lavateroid clade’. Furthermore, Banfi, Galasso & Soldano (2005), in a series of nomenclatural notes in preparation for a new edition of the Italian Flora, moved all species of Lavatera into Malva, thus returning to the position held by Visiani (1852: 206–207).

Although it seems clear that the genera have a common origin and, when considered together, are monophyletic (Puertas Aguilar et al., 2002; Tate et al., 2005), we have followed the definition adopted by Bayer & Kubitzki (2003: 304), as it is the most recent, complete and widespread treatment of the family.

**MATERIAL AND METHODS**

Plant material housed in the following herbaria has been consulted (see Appendix 2): BC, JACA, MPU, G, and W [acronyms according to Holmgren & Holmgren (1998)].

For chromosome counts, root tips obtained from seeds collected at the same type locality were cultivated at the Botanic Garden of Barcelona. Root tips were pretreated with 0.002 M hydroxyquinoline at room temperature for 6 h. They were fixed with Carnoy solution and stored at −18 °C. Acetic orcein at 2% was used for chromosome staining.

For observations on fruits and seeds by scanning electron microscopy, samples from herbarium sheets were cleaned by air pressure and mounted on an adhesive metal support before being coated with a fine layer of gold of 600–800 Å. The digital scanning electron micrographs (Fig. 2, see ‘Results’) were taken on a Hitachi model S2300 scanning electron microscope at the ‘Servei de Microscopía Electrònica’, University of Barcelona, Spain.

**RESULTS**

**Lavatera valdesii** Molero & J. M. Monts., sp. nov. [Sect. Olbia (Medik.) A. P. DC., Prodr. 1: 438 (1824)]

Suffrutex 40–70 cm altus, basi valde ramosus. Rami hornotini tomentosi, dense pilis stellatis vestiti. Folia lanceolata, integra, flavovirentia, coriacea, sed axil-
Figure 1. *Lavatera valdesii* Molero & J.M. Monts. (BC 8330329): A, flowering branch; B, sterile branch; C, leaf petiole; D, young stem with long stipitate-stellate hairs and small sessile ones; E, flower showing the staminal column and one petal obtusely emarginate with nectariferous trichomes at base; F, epicalyx with tricuspidate segments and acute triangular free part of sepals; G, schizocarp with dehiscing mericarps from the stylar column; H, mericarp showing acute angles of pericarp and central furrow; I, seed.
Figure 2. Scanning electron micrographs of fruits and seeds of three close species of Lavatera Sect. Olbia. *L. valdesii* (Djebel Mezgout, BC 833023): A, mericarp; B, seed. *L. oblongifolia* (Granada, Cuesta de las Balsicas, JACA): C, mericarp; D, seed. *L. olbia* var. *hispida* (Barcelona: Reixac, BC 97655): E, mericarp; F, seed. See text for details.
triangular lobes, 10–12 mm long, and accrescent. Petals truncate, emarginate, with an open and very obtuse angle between both lateral lobes, subobtuse, 15–17 mm, cuneate at base, rose changing to blue–mauve when dried. Simple nectariferous trichomes 0.5–0.8 mm, densely covering the base of petals, absent above. Anthers disporangiate 3.5 × 2.0 mm with papillose margins. Pollen grain globose, echinate, Malva-type, 5 µm diameter. Staminial column 13–15 mm, with nectariferous trichomes similar to those of the petals, covering the lower two-thirds of the column. Schizocarp with (10–)12–16 mericarps, glabrous, smooth, obscurely striate and with very thin lateral walls. Transverse wrinkles absent, with a dorsal furrow dividing the rest of pericarp into two valves when dehiscing, each with an acute dorsal angle (Fig. 2A). Mericarps do not completely enclose the seed and, at maturity, separate from the fruit axis leaving a flap between each pair of mericarps. Fruit axis narrower than in L. olbia but similar to that of L. oblongifolia. Receptacle terminating in a short conical exerted striate body, about 2 mm, not expanded laterally over the mericarps. Seed dark brown to black, about 3 mm, smooth, more or less asymmetrically reinniform, with one end rounded and the other one laterally truncate (Fig. 2B).

Habitat and distribution: Lavatera valdesii grows in open stony places, and forms five sparse populations of few individuals. Each plant has between 12 and 20 woody branches arising from a common basal stock, each ending in four or five single fertile branches, borne in the axils of a previous year's leaf.

This plant is known only from the Djbel Mezgout, 1600–1750 m. The Djbel Mezgout is a calcareous mountain of the south-eastern Rif chain, which runs from south of Saka to north of the Plain du Jel, an alluvial plain of the Msoun valley, above the city of Guercif.


We observed only a few individuals without flowers near the watershed that divides the western from the eastern slopes and located south of the main peak.

None of these individuals bore flowers or fruit, and revealed clear signs of having been grazed by goats. After a long journey with the help of some local goat-herds, we finally found one large population with at least 70 individuals, some still flowering. This population was growing in a nitrophilous situation, in a sort of natural sheepfold, orientated to the south. On the northern and western slopes, this species is very isolated and rare. We were told that there was another similar population some kilometres to the south on the same mountain. During this expedition, we were able to observe how goats ate only the inflorescences, leaving intact the rest of the plant, because of the presence of very fragile stellate hairs, which must make the coriaceous young leaves very unpalatable. Therefore, under an intensive grazing pressure, which is a general feature in all North African countries, the individuals can survive and expand laterally, but the plant is not allowed to reproduce sexually. This situation seems especially clear during the driest years, when goat-herds have greatest difficulties in feeding their animals, as was the case in 2005 in western Mediterranean countries. In wetter years, the reproductive chances of this plant may differ. We estimate that the overall population of this species is about 200 individuals. Thus, L. valdesii is an extremely rare species known only from five sites, and the number of mature individuals is quite small. According to the categories proposed by IUCN (2001) and the way in which they should be applied (Gardenfors et al., 2001), we propose that L. valdesii merits an EN status because of the small number of individuals known and the restricted distribution area.

DISCUSSION


The new species L. valdesii has a set of morphological characters that clearly matches with some species that configure this clade.

of Lavatera Sect. Olbia. This section was defined by De Candolle (1824: 438–439), but many species initially included in this section were rejected by Fernandes (1968a, 1969) and others. As defined by Fernandes, Lavatera Sect. Olbia has a wide Mediterranean distribution, with species growing from the Himalayas to central Europe, and in the Mediterranean Basin from Palestine to Morocco. The species included are perennial, with stellate or fasciculate hairs, solitary pedicels and 12–20 mericarps, with obtuse angles on the abaxial side, smooth lateral faces, and the mericarps separate from the fruit axis by leaving a flap between each pair of mericarps. The stylar column ends in a conical structure exceeding the mericarps.

Amongst the species included in this section, two have transversely rugose mericarps (see ‘Key to the species of Lavatera Sect. Olbia’, Appendix 1), with wrinkles not as strongly underlined as is the case in most European species of the genus Malva, but clearly differentiated. These two species are L. thuringiaca and L. cashmiriana. Both share some other unique characters in Sect. Olbia, such as the long pedunculate flowers, which are almost as long as the subtended bract, and the free part of the epicalyx segments, which are largely ovate-acuminate and more or less accrescent. All of these characters agree much more with the species included in Sect. Lavatera, in spite of the fact that they are all annuals, whereas those of Sect. Olbia are defined as being all perennial. Otherwise, both species have a Euro-Azian distribution area: L. thuringiaca ranging from central Europe to western Siberia and L. cashmiriana from central Asia to the Indian Himalayas. The rest of the species considered by Fernandes to be referred to Sect. Olbia share a strictly Mediterranean distribution.

Ray (1995) demonstrated the close correspondence between morphological fruit characters and the tree resulting from the analysis of internal transcribed spacer (ITS) sequence data. His results seem to be in accordance with this interpretation. L. thuringiaca and L. cashmiriana appear together in all topologies analysed. The same pattern is repeated with L. trimestris and L. punctata, and with L. olbia and L. triloba. However, L. olbia was the only one of this Mediterranean set of species of Sect. Olbia included in his studies.

If our interpretation is confirmed by future molecular analyses, Lavatera Sect. Olbia can remain limited to the group of species sharing a strict Mediterranean distribution, with the following common morphological characters: perennials; indumentum always composed only of stellate or fasciculate hairs, without simple or glandular hairs; epicalyx segments connate at least basally, giving the epicalyx a cup-like outline; flowers sessile or borne on short pedicels not exceeding the calyx length, solitary or in groups of one to three in short lateral racemes, never fasciculate; pericarp smooth, glabrous or tomentose, divided at maturity by a longitudinal furrow on the back, with edges rounded or acute, but never with transverse wrinkles (Table 1).

Very close to this section is another group of species included by Fernandes (1968) in Lavatera Sect. Glandelosae R. Fern. This section is distributed in the central and western Mediterranean area and is composed of L. triloba L., L. flava Desf., and L. agrigentina Tineo. The species of this section are differentiated from those of Lavatera Sect. Olbia by their fasciculate peduncles and indumentum composed of a mixture of stellate and glandular hairs. L. triloba was the only species of this group included in the ITS analyses conducted by Ray (1995), which appears closely associated with L. olbia.

During the morphological comparison of L. valdesii with other close species (Table 1), we realized that the recently described species from Sardinia, L. plazzei Atzei, is conspecific with L. stenopetala Coss. & Durieu ex Batt., considered, until now, a narrow endemic species of north-east Algeria, known only from the Tell Altas and the Constantine region (Quézel & Santa, 1962). The populations of Sardinia are located in the north-west part of the island, not far from Sassari (Atzei, 1995). The characteristic shape of the epicalyx, very short with almost inconspicuous largely triangular and obtuse lobes, oval-lanceolate sepals, ramified inflorescences, and bifid emarginated petals, and with long petiolate, obscurely five-lobate basal leaves, shows clearly the affinities between both plants. This species has a unique morphological character in Lavatera Sect. Olbia. The schizocarp has the mericarps completely fused, leaving inside a unique cavity. The lateral walls of the mericarps are almost absent, reduced to a vestigial membranous ring along the inner suture of each mericarp. As suggested by Ray (1995), this structure seems to be an intermediate state between a common schizocarp with completely isolated mericarps, as occurs in Malva spp., and a true capsule with free seeds inside.

We include in this paper the first chromosome count for L. valdesii. The number agrees with those known for the closest relatives [L. bryoniifolia, 2n = 42 (Snogerup, 1995); L. oblongifolia, 2n = 42 (Luque & Devesa, 1986); L. olbia, 2n = 42 (Luque & Devesa, 1986)], and is common in many other species of the genera Lavatera and Malva, which form the Malvae alliance as defined on the basis of earlier chromosomal studies by Bates & Blanchard (1970). Although there is a large variability in chromosome number in the Malvae alliance, the basic number seems to be x = 7 (Fuertes Aguilar et al., 2002). In conclusion, the new species L. valdesii Molero & J.M. Monts. has some
very different morphological traits that help to distinguish it easily from any other known species of *Lavatera*.

Morphologically, the two closest species to *L. valdesii* are *L. oblongifolia* and *L. olbia*. The former has a restricted distribution area in the south-eastern mountains of Andalusia, and the latter is widespread through the central and western Mediterranean Basin (Bolòs & Vigo, 1990: 274). Although it is quite a rare plant, locally it can be rather abundant. Amongst other characters, *L. valdesii* differs from *L. olbia* by its entire leaves, the narrow schizocarp axis, and the glabrous pericarp, with larger lateral walls (see Fig. 2). It is easily distinguishable from *L. oblongifolia* by the leaf outline, the epicalyx segments, the glabrous pericarp with acute dorsal angles (see Fig. 2), and the almost sessile lowermost flowers, as opposed to those of *L. oblongifolia*, which are borne on stout peduncles being equal to the calyx length. The different seed outline, which is asymmetrically kidney-shaped in *L. oblongifolia* and *L. valdesii*, contributes towards distinguishing these two narrow endemics from the other species included in Sect. *Olbia* (see Table 1, Fig. 2).

*Lavatera valdesii* was discovered on a recent floristic expedition, which suggests that there are still new species to be discovered in the Mediterranean area. It is an extremely local species and, as far as we know, an

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<tr>
<th>Table 1. List of the main qualitative and quantitative characters of the new species and other close relatives in <em>Lavatera</em> Sect. <em>Olbia</em></th>
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<tr>
<td><strong>L. valdesii</strong></td>
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<tr>
<td>Height (cm)</td>
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<tr>
<td>Leaf outline</td>
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<td>Inflorescence</td>
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<td>Petiole of middle leaves</td>
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<td>Peduncle</td>
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<td>Number of flowers per bract</td>
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<td>Epicalyx segments</td>
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<td>Dorsal angles of mericarp</td>
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<td>Fasciculate hairs</td>
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<td>Calyx length/epicalyx length</td>
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<td>Free part of sepal</td>
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<td>Mericarp</td>
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<tr>
<td>Number of mericarps</td>
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<td>Seed, length (mm)</td>
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<td>Seed, shape</td>
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<td>Chromosome number (2n)</td>
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<td>Petals</td>
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endangered endemic species of north-east Morocco. Some other narrow endemic plants from this region, such as Antirrhinum martenii (Font Quer) Rothm., Petrorhagia riphaea (Pau & Font Quer) P.W. Ball & Heywood, and Silene vidaliana Pau & Font Quer, are known only from their type locality and have never been collected again since the 1930s. A great effort to effectively conserve the highly rich biodiversity of this Mediterranean country is urgently needed.

ACKNOWLEDGEMENTS

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REFERENCES

Linnaeus C. 1753. Species plantarum exhibentes plantas rite cognitas ad genera relatas cum differentiis specificis, nominibus trivialibus, synonymus selectis, locis natalibus, secundum systema sexuale digestas. Estocolm: Laurent Salvi.
Tate JA, Puertoaguilar J, Wagstaff SJ, La Duke JC,
**APPENDIX 1**

**KEY TO THE SPECIES OF LAVATERA SECT. OLBIA (MEDIK.) DC. EMEND. R. FERN.**

1. Mericarps from slightly rugose to markedly transversely wrinkled, glabrous; flowers with pedicels much longer than calyx.................................................................2  
   1b. Mericarps smooth, glabrous or pubescent; flowers sessile or with pedicel shorter than or as long as calyx.................3  
2. Epicalyx strongly accrescent in fruit, much shorter than and distant from calyx.........................................................L. cashmiriana  
   2b. Epicalyx not strongly accrescent in fruit, slightly shorter than and barely separated from calyx....L. thuringiaca  
3. All leaves entire, with pinnate venation; inflorescence not branched; seeds asymetrically reniform .........................4  
   3b. At least some leaves lobate, with palmate venation; inflorescence branched or not. Seeds reniform to rounded.....5  
4. Leaves oblong-ovate; inflorescence bracts overlapping, longer than calices; inflorescence axis often in zig-zag; mericarps with dorsal angles subobtuse .........................................................................................L. oblongifolia  
   4b. Leaves triangular-lanceolate; inflorescence bracts not overlapping and only the basal ones longer than calices; inflorescence axis straight; mericarps with dorsal angles acute....................................................L. valdesii  
   5. Leaves suborbicular; obtusely five-lobate; epicalyx more than twice as short as calyx .......................L. stenopetala  
   5b. Leaves clearly three- or five-lobate, with acute or subobtuse lobes; epicalyx almost as long as calyx..................6  
6. Mericarps papillos; bracteoles of epicalyx obtuse, shorter than tube .........................................................L. bryoniifolia  
   6b. Mericarps covered with stellate hairs; bracteoles of epicalyx ovate-acuminate, longer than tube .............L. oblia

**APPENDIX 2**

Table 1 and the artificial key of Sect. *Olbia* were created from the study of the following herbarium material.

**L. VALDESI** MOLERO & J.M. MONTS.  
MOROCCO: Saka, Djbel Mezgout, subida por la cara W desde el Oued el Khir, collado al SE, 34°34’15.2”N, 03°26’38.7”W, 1500–1700 m, gleras y roquedos calizos, 5.viii.2004, J. Molero and J.M. Montserrat (BC); Djbel Mezgout, cara W sobre el Oued el Khir, 34°34’31.7”N, 03°26’41.7”W, 1750 m, rellanos calizo-pedregosos, 2.vii.2005, J. Molero & J.M. Montserrat 10461/2 (BC).

**L. OBLONGIFOLIA** BOISS, BIBLIOTHEQUE UNIVERSELLE GENEVE SER. 2, 13: 407 (1838)  

**L. STENOPETALA** COSS. & DURIEUX EX BATT. IN BATT. & TRABUT, PL. ALGÉRIE 1: 113 (1888)  

L. OLBIA L., SP. PL. 690 (1753) [INCL. VAR. HISPIDA (DESF.) GODR.]


MOROCCO: Melilla, Gurugurú, broussaille, 850 m, 8.vii.1930, Sennen & Mauricio 7537 (BCN); Oujda, Ain es Sfa, Oulad bou Jemaa Thata, 34°49′30.1″N, 02°07′24.2″W, roquedos y cantiles sobre la pista y barranco umbrio con sauces, J. Molero & J.M. Montserrat 9124b, 14.v.2004 (BC).

L. BRYONIFOLIA MILL., GARD. DICT. ED. 8, N. 11 (1768)

GREECE: Kreta, La Canée, lieux humides, E. Reverchon, 2.vii.1884 (W 8567; W 14186; W 1376); Chania, Agia Lake, 50 m, 24.vi.1996, Ch. Fournaraki (MAIC 3142); Hania, Souda to Vlites, 50 m, 20.v.1994, Ch. Fournaraki (MAIC 2297); Chania, road to Elafonífios, tunnel between Elos and Aglia Sofia, 200 m, 3.iii.2006, J.M.Montserrat JMM 10601 et al. (BC s/n). Insel Samos vom Monastir Vronda zum Prontis Ilias, c. 500–800 m, Pinus brutia wald, Blockhalden, Kalk, F. Krendl, 18.vi.1983 (W 1994-01091); Attica in collibus saxosis Laurii, supra Kyprianos, 18.vi.1856, Heldreich (W 1888.443; W 1935.4643).

CYPRUS: prope Panteleimon ad Palaeo Milo in fruticosis ad aquaeductum die 24.v.1862, T. Kotschy 936 (W 342821).