

DISAPPEARANCE, REDISCOVERY AND ATTEMPTED RE-ESTABLISHMENT OF 'SILENE TOMENTOSA' OTTH (CARYOPHYLLACEAE), A GIBRALTAR ENDEMIC

John E. Cortés / Instituto de Estudios Campogibaltareños

Introduction

There has been much recent work on the genus *Silene* in the western Mediterranean region (Jeanmonod 1984, Jeanmonod & Bocquet 1981, Talavera 1987, Talavera 1990, Talavera & Muñoz Garmendia 1989), as well as specific reference to *Silene tomentosa* Otth as an "Andalusian" endemic (Galán de Mera 1993, Garcia Murillo 1993).

Silene tomentosa is known only from limestone on the Rock of Gibraltar (Otth *in* Candolle, 1824, Boissier, 1839-1845, Kelaart 1846, Willkomm & Lange 1880, Ruoy 1887, Debeaux & Dautéz 1888). Other more recent references are to earlier authors or herbarium material, except for Cortes & Linares (1993) who describe the last known observations of the species, and the only recorded ones this century. These observations date from 1979 and 1985, when one plant and four plants respectively were seen and photographed. Some plants may have been seen in 1968 at an undetermined location on the Upper Rock (B.M. Allen pers. comm.).

No plants were observed since, despite searches of known sites and other suitable habitat every spring from 1991. It had been presumed extinct for a number of years (Jeanmonod & Bocquet 1981, Talavera 1987, Talavera 1990), although these authors were not aware of the 1979 and 1985 observations of Linares and Harper reported in Cortes & Linares (1993). Cortes & Linares (1993) also reported the species as presumed extinct.

Quite independently, Galan de Mera (1993) reported an alleged rediscovery of the species in the inland limestone outcrop of Peña Arpada in Alcalá de los Gazules, Cádiz, Spain, about 70 km north-west of Gibraltar. However, further studies by Garcia Murillo (1993) rejected this finding, attributing Galan de Mera's plants to the closely related *Silene andryalifolia* Pomel, and confirming *Silene tomentosa* as endemic to the Rock of Gibraltar and extinct.

Subsequent work at the Gibraltar Botanic Gardens and at the University of San Pablo-CEU in Madrid have since attributed the Alcala plant to a newly described species, *Silene gazulensis* Galán de Mera, Cortes, Vicente Orellana & Morales Alonso (Galán de Mera *et al.* 1999, Linares 2000), further confirming the true endemism of *Silene tomentosa* in Gibraltar.

The continued search for the species in Gibraltar by the Gibraltar Botanic Gardens and the Botanical Section of the Gibraltar Ornithological & Natural History Society, specifically the author, Leslie Linares and Arthur Harper, resulted in the finding, on 7 May 1994, of three plants in full flower, plus one seedling, on a ledge on a limestone face in the Middle Hill area of the Upper Rock of Gibraltar, about 300 metres south-east of the 1985 location. The three grown plants were woody and appeared at least several years old, having obviously been missed on searches in earlier years. The location was a west-facing slope, at an altitude of about 300m. Flowering in the three plants was over by 3 June, and the first ripe seed was collected on 8 June.

In describing the flowers, Boissier (1837-45) and Willkomm (1878), as well as Kelaart (1846) and Debeaux & Dautéz (1888) mention pale violet petals, reflected in Boissier's illustration (1939-1845:tab. 26a). Galán de Vera's (1993) Alcala plants were white. The 1979 and 1985 Gibraltar plants were pale violet to pink. The newly discovered Gibraltar plants have petal colours ranging from pale violet/pink to white, but even the whitest flowers always have a pink suffusion. In keeping with the herbarium specimens examined by Talavera (*pers. comm.*) the calyx hairs are non-glandular, which is considered diagnostic of the species (García Murillo 1993). The Gibraltar plants have a branched inflorescence. Details of the flowers are discussed by Linares (1998), based on observations of the three original wild plants plus other plants grown from seed in the Gibraltar Botanic Gardens.

Conservation

Silene tomentosa is one of a group of very similar species of limestone cliffs in the western Mediterranean (Jeanmonod & Bocquet 1981). It is the only species that now appears to be an undisputed Gibraltar endemic, with no observations from any other site in the Iberian Peninsula or north Africa (unlike, for example, *Iberis gibraltaria*, *Thymus wildenowii* or *Saxifraga globulifera*) and as such has great importance as a flagship of conservation in the territory.

Steps to save the species from the brink of extinction are being taken by the Gibraltar Botanic Gardens. Material collected by the gardens from the original three wild plants was sent for micropropagation in the Royal Botanic Gardens, Kew. Plants from this source have flowered and seed has been bank in the Kew seedbank. Seed was collected for storage and propagation both at Kew and in Gibraltar, with a view to growing both in cultivation in the gardens and for returning to the wild.

The species appears to have been rare throughout this century. Only Boissier (1839-1845) gives an impression of earlier abundance, referring to the "large tufts" on the eastern side of the Rock, where the species has not been located this century. The loss of the species from the eastern cliffs cannot be easily explained, as the habitat has not been subject to any disturbance by Man.

It may be significant that observations this century have only been from the western side, from which there are no records for the 19th century. García Murillo (*pers. comm.*) has commented that the related *Silene adryalifolia* only grows on vertical cliffs as goats in its Spanish habitats regularly graze it. Goats, present until the early 1900s on the western slopes of the Rock (Cortes 1994) may have reduced the species here, while allowing it to survive on the east cliffs. The removal of goats may account for its colonising the western slopes, but not for the loss from the eastern cliffs.

The present situation on the western slopes, however, is not encouraging, as vegetation succession is resulting in the developing of a dense scrub dominated by *Olea europea* (Cortes 1994), not suitable for *Silene tomentosa*. Indeed the location of the newly discovered plants was already being encroached upon by *Olea europea* scrub.



Figure 1. The newly re-discovered *Silene tomentosa* on Rock Gun Road, Gibraltar, May 1994 (Photo L. Linares)



Figure 2. *Silene tomentosa* in cultivation in the Gibraltar Botanic Gardens.

Silene tomentosa in its 20th century location was therefore at a disadvantage both in a situation where goats are present and where they are absent.

In any case, the three grown plants and the seedling discovered in 1994 did not survive the long four-year drought that affected the region and died in the summer of 1995 months before the drought ended, despite attempt to keep the alive through artificial watering. As no more plants have ever been discovered, the species can be considered to have become extinct in the wild in 1995.

Propagation

Seed is collected annually from all the plants in cultivation and several thousand seeds are kept in the seed bank in the Gibraltar Botanic Gardens.

Seed has been sown in the Gibraltar Botanic Gardens every year since autumn 1994. Seeds are sown at the time when it is likely they would germinate in the wild, after the first autumn rains. In order to ensure survival, the seedlings continue to be watered even during drought periods and are kept in a green house through their first winter, later being moved out first to a covered area for acclimatization, and later into the open where, being in pots, they continue to be watered through the summer about once a week.

Offspring of the seed of the three original plants were planted in raised beds in soil and continue to flower and set seed regularly. Germination of this seed and of further generations in greenhouse conditions is at least 95% (Cortes in prep.). However, plants in pots continue to die through the years with only about 50% surviving for one year or more.

The plants flower in April and May of their second year, spending one spring without flowering. They then flower every year. The plants from seed sown in 1994 first flowered in 1996 and were flowering for the sixth successive season in April 2001. A tentative count of growth rings in the woody parts of the wild plants after they died in 1995 suggested that they were about 12 years old.

This confirms *Silene tomentosa* as a woody perennial with a relatively short lifespan.

Whereas germination in greenhouse conditions is very successful, no germination of seeds has been noted in the beds where *Silene tomentosa* is allowed to flower and set seed freely.

Re-introduction and conservation considerations

An annual crop of about 100 plants is raised every year in the Botanic Gardens.

Young plants in their second winter (before they first flowered) were planted in the wild in the winters of 1995, 1996, 1997 and 1998 (Cortes in prep). Attempts were made in the original location at Middle Hill. However, the site was subsequently used as a nest by yellow-legged gulls *Larus cachinnans*, and later was frequented by Barbary macaques *Macaca sylvanus* and all three plants died. Barbary macaques were the cause of failure of three other plants at Mount Misery on the crest of the Rock of Gibraltar. Of twenty plants planted out only three remain. The others die apparently through lack of water during dry spells in the winter. Planting out was halted after 1998 in view of the lack of success, especially as the following winters (with the exception of 2000-2001) have been dry. The three plants flower every year, set seed, but only one seedling has been found in the wild, lasting only four months.

The lack of reliability of a wet winter is a problem in deciding to risk planting in the wild.

The reason for lack of germination other than in controlled conditions is unclear. Certainly it is a worry when considering the re-establishment of the planting the wild. It is possible that slugs or snails attack germinating seedlings.

The susceptibility to drought is certainly a restriction. The most successful of the re-introduced plants happens to grow in a sheltered area on the east side near the crest of the Rock. This site is shady and often under the cover of the levanter cloud, a local cloud formation that increases humidity in the summer months.

The relatively short lifespan of the plant also has conservation implications, particularly when viewed together with the nil success of establishment of seedlings in the wild.

The large population of Barbary macaques in some areas is also an obstacle to re-planting on the Upper Rock.

The search continues in order to establish whether any other specimens do survive on the cliffs. Conservation work needs to include both habitat management on the western slopes and attempts at re-establishing the plants on the cliffs, but research into viability of seedlings and young plants needs to precede this.

In the meantime *Silene tomentosa* appears safe within the Gibraltar Botanic Gardens, but its future as a truly wild plant in Gibraltar remains uncertain.

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