

5. = FIRST DATA ON THE POLLINATION ECOLOGY OF *CAMPANULA MEDIUM* L. (CAMPANULACEAE), A SPECIES OF ORNAMENTAL AND CONSERVATION INTEREST

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Campanula medium L. (Campanulaceae) is a biennial herb, endemic to Italy (NW Tuscany and Liguria) and SE France (Provence) (1). However, presently it is widespread as sub-spontaneous across Europe, probably due to its high ornamental interest as cut flower, with many existing cultivars. The plant is also protected in Tuscany, listed in the annex A of the regional law n° 56/2000. Given the high economical and local conservational interest of this species, we decided to investigate its pollination ecology, whose knowledge represents a crucial step to optimise cultivation and conservation plans.

It is well known that Campanulaceae show secondary pollen presentation mechanism, in order to increase the accuracy of pollen capture and transfer by pollinators, and *Campanula* in particular shows also proterandry (2). Despite this, the pollination ecology of *C. medium* has never been investigated before.

A natural population in the Apuan Alps (Tuscany, Massa Carrara) was investigated from June to September 2008. To determine the breeding system, four experimental treatments were applied on 48 randomly chosen flowers from 24 different individuals: (i) spontaneous self-pollination, to test autonomous self-pollination within a single flower, (ii) forced self-pollination and (iii) forced geitonogamy; (iv) forced xenogamy, to test for outcrossing ability. A control group (14 flowers freely exposed to environment) was selected. Each flower was marked and checked daily, to document flower senescence, fruit production and fruit seed set. According to (3), Index of Self-Incompatibility (ISI) and Index of Automatic Self-pollination (IAS) were calculated. In addition, the percentage of pollen limitation within the population was assessed as indicated in (4). We investigated secondary pollen presentation and the temporal dynamics of the sexual phases. Flowers in different flowering stages were randomly sampled in order to estimate pollen viability (by means of the tetrazolium assay, using MTT) and stigma receptivity (by means of Perex test) (5). Concerning stigma biology, its opening and receptivity were studied in relation to the presence of the pollen on the style. In addition, the pollinators and their behavior during the visits were recorded. The most representative ones were collected for identification. To test correlations and significant trends ($p \leq 0.01$), the Spearman Index and Kruskal-Wallis test were applied.

Our study showed that *C. medium* is partially self-compatible, partially autogamous and mostly outcrossing. The fruit set from experimental xenogamy was higher than that resulting from controls, suggesting a pollen limitation in the population studied. Proterandry for the species is confirmed: male and female phases were clearly separated and the presence of pollen on the style affects negatively the receptivity and the opening speed of the stigma. In addition, our study highlighted that the time of anthesis was longer in plants with a self-pollination treatment (14.13 ± 4.32 days) than plants subject to xenogamy (4.15 ± 1.52). This delay in flower senescence, possibly due to a lower production of ethylene (6), could be an interesting issue concerning the knowledge of floral life span, which is one of the most important parameters in species of horticultural interest, and especially in cut flowers. The most frequent visiting insects, which can be regarded as putative pollinators, were bees belonging to Apoidea, such as *Apis mellifera* L., *Bombus terrestris* (L.), *Xylocopa violacea* (L.) and *Anthidium* sp.; Curculionidae were also observed as pollen foragers.

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