Habitat Studies for the Wild Stocks of *Ecballium elaterium* (L.) A. Rich.

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Introduction: *Ecballium elaterium* (L.) A. Rich. (Cucurbitaceae), is a wild Mediterranean medicinal plant which has been described to thrive in drastic environmental conditions. In one study, it has been described to be frost-tolerant as compared to other wild species of the Cucurbitaceae family (4). This study was conducted on *E. elaterium* wild stocks growing in Malta (Central Mediterranean), on several soil types in order to determine the soil conditions ideal for the growth of this disease-resistant wild species (1).

Materials and Methods: Four sites representative of the different soil types in Malta were selected for the habitat studies of *E. elaterium* wild stocks. The localities are illustrated in figure 1, while the description of the soil types is given in table 1. The experiments were subdivided into two groups:
(a) The soil physical characteristics. The soil moisture content was determined by air-drying the soil until a constant dry weight was obtained. The percentage weight loss corresponded to the moisture content. The gravel and soil contents were determined by using a 2-mm sieve to separate the large stones from the fine soil particles.
(b) The soil chemical characteristics. The pH and conductivity were determined using a pH meter (Dulcometer, from Prominent, Germany) and a conductivity meter (Jenway, U.S.A.). The organic matter was determined by using the dichromate oxidation test (3) while the carbonate content was determined using the sodium hydroxide-hydrochloric acid titration.

The results were analysed statistically by the one-way analysis of variance (ANOVA) followed by the Bonferroni post-hoc test for equality of means. Only $p \leq 0.05$ were considered statistically significant.

Results and Discussion: *Soil Physical Characteristics.* The moisture, gravel and soil contents are shown in table 1. There was no statistically significant difference in the moisture contents of the four soil types ($p > 0.1$, $v = 19$), while a statistical significance was recorded for the gravel and soil contents ($p < 0.0001$, $v = 19$). The highest difference was found in the carbonate raw soil that contained the highest soil content and the lowest gravel content, than the other soil types.

Soil Chemical Characteristics. The results for the four chemical parameters studied are shown in table 2. Most Maltese soils have a pH of normally above 7.5 to 9. The mean soil pH values for the four *E. elaterium* habitats range between 8.07 and 8.65. The ANOVA analysis shows a significant difference between the soils ($p < 0.0001$, $v = 19$) even though their pH's lie within the same range. The results obtained suggested that *E. elaterium* thrives on soils or disturbed land with an alkaline nature. As regards the electrical conductivity, the Terra type and the brown rendzina type different significantly from the other two ($p < 0.0001$, $v = 19$). The readings suggest that the sites at Marsascala, Mellieha and Rabat are practically saline-free while that at Siggiewi is slightly saline. The results indicate that the plant lives on soils with a very low salinity or none at all. The different sites

exhibited a great variability in the organic matter content. Terra soils such as that at Marsascala (*Terra rossa* type) have a high organic matter content of about 3.1 % (5). For the site studied, the mean organic matter content was of 1.847 %. This may be due to the fact that the soil was rather disturbed containing rubble and hence decreasing the organic matter in it. The same problem took place with the carbonate raw soil at Rabat (*Fiddien* series), where the organic matter content was about one-third the value stated earlier by Sacco (5). In the case of rendzina soils, i.e. Siggiewi and Mellieha, these gave a reasonable organic matter content (3.829 and 2.001 %) as compared to those in the mentioned study (5), i.e. a mean of 2.0 %. The organic matter content does not affect the ability of the plant to grow. The plant produces its own organic material. Underneath the vegetative canopy, it is separated from the soil by dead material from the plant itself. Although terra soils have a low carbonate content (<15 %) (2), in the case of the Marsascala site, the carbonate content was excessively high (i.e. 53.86 %). This might be reflected in the fact that this soil was loaded with limestone rubble (as it is a wasteland) and hence retaining a high amount of carbonate even with weathering. On the other hand, since the sites at Siggiewi and Mellieha are derived from fields with 'no limestone contaminants', the levels of carbonate were on the lower scale (53.69 and 54.25 %, respectively) of the range (55 - 80%) (2). For the carbonate raw soil at the Rabat site, the carbonate content (83.31 %) fell within the range of 80 to 90 % (2).

From the results obtained, it was concluded that *E. elaterium* grows on calcerous soils (53.86 – 83.31 %) that are salinity free or slightly saline (0.497 – 2.807 ppm), and with a high pH (8.08 – 8.65) and variable organic matter content (0.54 – 3.83 %). This study consolidates the resistance of *E. elaterium* to alkaline and calcerous soils.

Literature Cited

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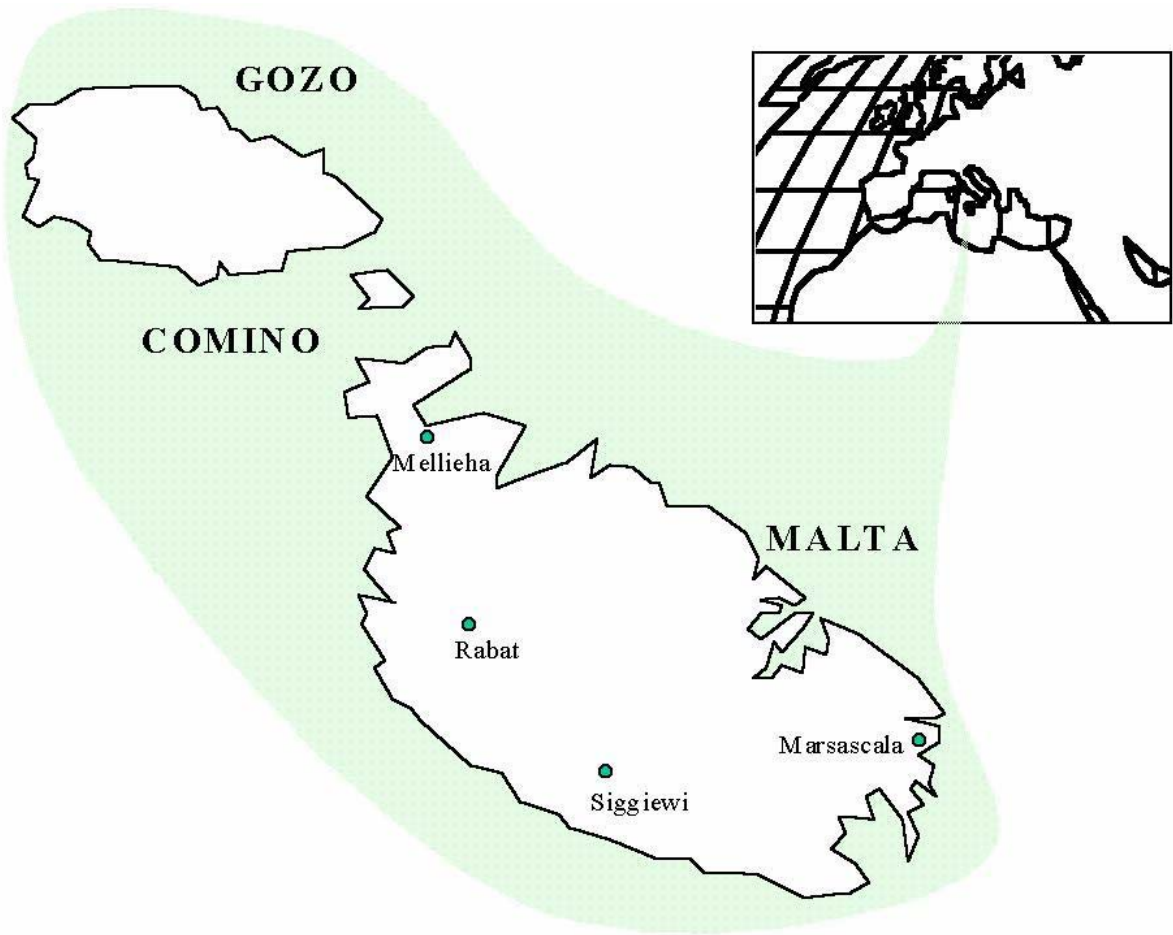
Figure 1. The localities chosen for soil sample collection

Table 1. The moisture, gravel and soil contents of the different soils on which *E. elaterium* grows.[z]

Localities	Soil Description	% Moisture Content	% Gravel Content	% Soil Content
M'Scala	Terra soil (*Terra rossa* type)	18.6600 ± 1.7106 (2.9629)	46.8467 ± 0.9192 (1.5921)	53.1533 ± 0.9192 (1.5921)
Siggiewi	Rendzina soil (Xerorendzina type)	17.9300 ± 2.7900 (3.9457)	29.9750 ± 0.1150 (0.1626)	70.0250 ± 0.1150 (0.1626)
Mellieha	Rendzina soil (Brown rendzina type)	10.5000 ± 1.0800 (1.5274)	36.1600 ± 0.5200 (0.7354)	63.8400 ± 0.5200 (0.7354)
Rabat	Carbonate raw soil (Fiddien series)	17.7900 ± 2.2303 (3.8629)	6.5033 ± 1.6734 (2.8985)	93.4967 ± 1.6734 (2.8985)
ANOVA		p>0.1232	*p<0.0001*	*p<0.0001*

[z]Values represent means ± S.E.M of 3 determinations. ANOVA results are also tabulated (v=19).

Table 2. Soil pH, electrical conductivity, the organic matter and carbonate contents of the different soils on which *E. elaterium* grows. [z]

Localities	pH	Conductivity (mS/cm)	Organic Matter	Carbonate
M'Scala	8.6483 ± 0.0210 (0.0515)	1.1083 ± 0.0260 (0.0637)	1.8447 ± 0.0025 (0.0061)	53.8583 ± 0.4696 (1.1502)
Siggiewi	8.3000 ± 0.0141 (0.0283)	6.1175 ± 0.1091 (0.2182)	3.8297 ± 0.3024 (0.6048)	53.6925 ± 0.4760 (0.9521)
Mellieha	8.0750 ± 0.0222 (0.0443)	1.2500 ± 0.0147 (0.0294)	2.0019 ± 0.0966 (0.1932)	54.2450 ± 0.1444 (0.2887)
Rabat	8.1667 ± 0.0169 (0.0413)	3.5100 ± 0.0605 (0.1482)	0.5443 ± 0.0011 (0.0026)	83.3067 ± 0.3091 (0.7571)
ANOVA	*p<0.0001*	*p<0.0001*	*p<0.0001*	*p<0.0001*

[z]Values represent means ± S.E.M of 4 - 6 determinations. Standard deviation values are indicated in brackets. ANOVA results aer also tabulated (v=19).