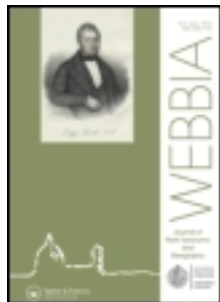


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Fumana laevis (Cav.) Pau (Cistaceae): new to the flora of Malta, and considerations on *Fumana* (Dunal) Spach from Maltese Flora

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Fumana laevis (Cav.) Pau (Cistaceae): nuova per la Flora di Malta, e considerazioni su *Fumana* (Dunal) Spach per la Flora di Malta — *Fumana laevis* (Cav.) Pau è riconosciuta per la Flora di Malta. Vengono fornite informazioni sulla tassonomia di *F. laevis* in relazione alle altre tre specie del genere presenti nella flora di Malta. Viene inoltre discussa la sua distribuzione locale e generale, la sua ecologia e condizione attuale.

Key words: Cistaceae, *Fumana*, *Fumana laevis*, Flora, Maltese Islands.

Fumana (Dunal) Spach is a genus of dwarf shrubs belonging to the *Cistaceae* Juss family. In Europe, *Fumana* spp. are native to the Mediterranean region and grow on dry, rocky or sandy ground, usually in low scrub (Heywood, 1978), Mediterranean garigue or/and phrygana (Polunin & Walters, 1985).

Three species of *Fumana* are confirmed on the Maltese islands (Haslam, 1977; Lanfranco, 2001; Weber & Kendzior, 2006; Tabone, 2008), of which, *Fumana arabica* (L.) Spach and *Fumana thymifolia* (L.) Spach are frequently found in several localities where phrygana and garigue habitats prevail. Both species were recorded in historical floras under different taxa, but somewhat first confirmed by Sommier & Caruana Gatto (1915) under the synonymous taxa of *Helianthemum arabicum* (L.) Pers. and *Helianthemum glutinosum* (L.) Pers. respectively. The third species, *Fumana laevipes* (L.) Spach has been recently discovered on coastal scree by Tabone (2008) and at present, it is localized in one station on the island of Gozo. All three species are considered native to the Maltese islands. However, the author found a population of *Fumana* sp. that its morphology did not match any of the three recorded species.

Methods & Materials

The morphology and identification of the specimens was chiefly based on the taxonomical keys and descriptions of *Fumana* spp. given by Alvarez (2001). This reference was chosen because apart it is a quite a recent flora, many *Fumana* spp. occur in Spain and have been hence studied profoundly. 13 *Fumana* species are listed by Guemes & Molero (1993) compared to 6 and 9 species listed by Pignatti (1982) and Heywood (1978) respectively.

The width of leaves was taken with the margins revolute, hence as found in situ. The measurement of the leaf-like stipules at the axils of the true leaves is not taken into consideration when giving leaf measurements. The indumentum and presence of glands were examined on site by a hand lens. Leaf arrangement is observed on the upper part of them stem (below the inflorescences) during flowering time.

15 morphological characters of the related *Fumana* species were compared to the specimens in question and presented in Table 1. These characters are chiefly based on Guemes & Molero (1993), but some

also on Heywood (1978) and Pignatti (1982). In addition, a ratio of the leaf length to leaf width, which was calculated on the mean of the leaf sizes given by Guemes & Molero (1993) is included because it has been found to distinct the 4 species better from the leaf length alone. At least 5 specimens from each different population have been studied on site.

Identification and Taxonomy

As shown in Table 1, the morphological features and measurements of these *Fumana* specimens studied from Malta concur to those of *Fumana laevis* (Cav.) Pau in Bol. Soc. Esp. Hist. Nat. 1: 209 (1901), bas.: *Cistus laevis* Cav. (1793).

Other synonyms of this taxon include *F. thymifolia* var. *laevis* (Cav.) Grosser (1903); *F. thymifolia* f. *frutescens* Mauricio & Sennen (1932); *F. thymifolia* subsp. *laevis* (Cav.) Molero & Rovira (1987) and several infraspecific taxa of *F. thymifolia*.

The arrangement, shape and size of the leaves, and the general indumentums of various parts of the plant are the most important characters to distinguish the 4 species of *Fumana* on the Maltese islands. *F. arabica* (L.) Spach is easily separated by its relatively wide (2-5 mm), flat leaves with unrevoluted

margins and arranged alternately below the inflorescence (Heywood 1978; Pignatti, 1982). They only bear 2 small stipules. (Pignatti, 1982). *F. laevipes* (L.) Spach also have alternately-arranged leaves, but it is easily distinguished by having cylindrical, needle-like leaves, that are only 0.5 mm wide. (Heywood, 1978; Pignatti, 1982; Guemes & Molero, 1993).

F. thymifolia (L.) Spach and *F. laevis* (Cav.) Pau are closely related and both have oppositely arranged leaves. However, according to Alvarez (2001), the two main distinguishing characters are that *F. laevis* has linear to linear-lanceolate leaves which are glabrous (or rarely eglandular-glabrescent) while in *F. thymifolia*, they are densely pubescent-glandular (making them viscid), with an oval-lanceolate shape. Interestingly, there is no concurrence on the size of the leaves of *F. thymifolia*, which is described with sizes of: 5-11mm x 0.5-1.0 mm (Heywood, 1978); 6-7 mm x 1-1.5mm (Pignatti, 1982) and 4-12(14) mm x 1-2(3) mm (Alvarez, 2001). The Maltese specimens of *F. thymifolia* normally concur with the measurements of the Italian populations as given by Pignatti (1982). The leaves of *F. laevis* are hence distinctly longer, normally 9-12mm. An even better distinguishable character from the leaf length alone is instead the ratio of the leaf length to width as shown in Table 1 or the key below.

Identification key for *Fumana* spp. occurring in Malta

- | | |
|--|----------------------|
| 1a. Leaves arranged alternately along stem below inflorescences | 2 |
| 1b. Leaves arranged oppositely along stem below inflorescences | 3 |
| 2a. Leaves 2-5mm wide, flat, narrow lanceolate, with 2 small stipules | <i>F. arabica</i> |
| 2b. Leaves 0.5mm, filiform, with numerous smaller stipules | <i>F. laevipes</i> |
| 3a. Leaves narrow-lanceolate, densely glandular pubescent, length:width ratio less than 6x | <i>F. thymifolia</i> |
| 3b. Leaves linear, glabrous (rarely glabrescent, eglandular), length:width ratio at least 6x | <i>F. laevis</i> |

General and local distribution of *Fumana laevis* and its ecology

Fumana laevis was first discovered from Malta on the 4th April 2011 from an area known as 'il-Bisqra' in the Northern town of Mellieha, in mainland Malta. Other populations were later identified during ad-hoc floristic surveys, mostly situated in the Northern locality of Mellieha. All populations had an exten-

sive size with numerous specimens. A list of Maltese stations where *F. laevis* was found is given below and further illustrated in a 1km x1km grid map in Fig. 1.

- 'Il-Bisqra', Mellieha (Malta); 4 Apr 2011.
- 'Tal-Palma'; 'San Martin' and 'Wardija', St. Paul's Bay (Malta); 10 Apr 2011.
- 'Ix-Xaghra l-Hamra', Mellieha (Malta); 10 Apr 2011.

Table 1 – Comparison of characters of *Fumana arabica* (L.) Spach, *F. thymifolia* (L.) Spach, *F. laevipes* (L.) Spach, *F. laevis* (Cav.) Pau and the Maltese specimens, showing that the specimens reported in this work correspond with *F. laevis*.

Character	<i>Fumana arabica</i> ⁽¹⁾	<i>Fumana laevipes</i> ⁽²⁾	<i>Fumana thymifolia</i> ⁽²⁾	<i>Fumana laevis</i> ⁽²⁾	Maltese specimens
Height (cm)	15-25cm	25-30(40)	Up to 20 cm ⁽¹⁾	20-30 (35)	20-30
Pilosity	Glandular-pubescent	Glabrous throughout, young stems glaucous	Lower part glandular or shortly glandular pubescent, apical part densely glandular-viscid	Glandular and pubescent; lower part, glands are 0.03mm; upper part, glands are 0.7mm	Lower part glabrous, apical part setose and glandular.
Leaf arrangement	Alternate	Alternate	Opposite	Opposite	Opposite
Leaf shape	Lanceolate, flat	Linear, cylindrical	Narrowly oval to oval-lanceolate	Linear	Linear-elliptic
Leaf margin	Not revolute	n/a (cylindrical)	Revolute	Revolute	Revolute
Leaf size - L X W (mm)	5-12 x 2-5	8-10(12) x 0.3-0.4	4-12(14) x 1-2(3) / 6-7 x 1-1.5 ⁽³⁾	8-12(14) x 0.5 x 1.0	8-14 x 1.0-1.5
Leaf length / width ratio	2.5	25(-28)	(3-5)	13(-15)	9
Leaf indumentum	Glandular-pubescent (sometimes glabrescent)	Glabrous and glaucous	Glandular-hispid to viscid-glandular	Glabrous (rarely pubescent)	Glabrous
Stipules	2 reduced scale-like stipules	Linear	Linear-triangular to subulate	Linear or subulate	Subulate
Cyme	2-7 flowers	5-10 flowers	4-8 flowers	4-6(8) flowers	4-8 flowers
Peduncle indumentum	Not given	Glabrous	Viscid-glandular	Both setose and glandular	Both setose and glandular hair
Pedicel	Not given	8-10(12)mm, glabrous, dark, curving down at the apex	8-10(12)mm, glandular	10-12mm, glandular	9-13mm, glandular
Internal sepals: Length (mm) and indumentum	Not given	5-6(7), glandular; not setose	3-5(6), densely viscid-glandular	3-5(6), densely glandular-pubescent	4-5, densely glandular-pubescent
Petal length or flower diameter	Petal length 6-10mm	Petal length 6-8mm	Petal length 6mm ⁽¹⁾	Flower diameter 10-12mm	Flower diameter 10-15mm
Capsule size (mm)	Not given	4-6	4-5	4-5	4-5
Seed size (mm)	Not given	1.5-1.8	1.2-1.5	1.2-1.4	1.5

⁽¹⁾ Adapted from Henwood (1978) and Pignatti (1982); ⁽²⁾ Adapted from Alvanez (2001); ⁽³⁾ Adapted from Pignatti (1982).

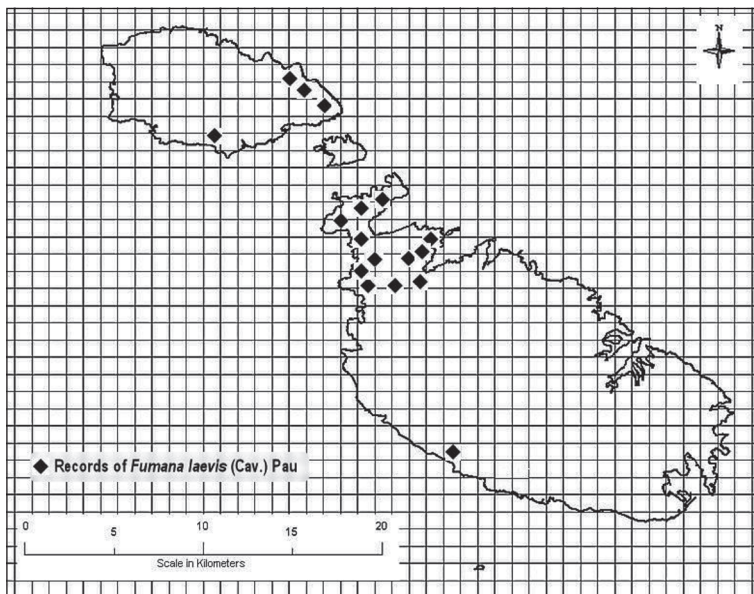


Fig. 1 – Current distribution of *Fumana laevis* (Cav.) Pau on the Maltese islands.

- ‘Xaghra tal-Kortin’ and ‘Selmun’ area, Mellieha (Malta); 19 April 2011.
- ‘Xaghra tal-Marfa’, Mellieha (Malta); 27 April 2011.
- ‘Qortin tal-Magun’ and ‘Qortin il-Kbira’, Nadur, (Gozo); 3 May 2011.
- ‘Ta’ Cenc’, Sannat (Gozo); 12 Mar 2012.
- ‘Dingli Cliffs’ and ‘Ghar il-Kbir’, Dingli (Malta); 16 Mar 2012.
- ‘Tal-Irdum’, Qala (Gozo), 24 Mar 2012.
- ‘Ta’ Isopu’, Nadur (Gozo); 24 Mar 2012.
- ‘Xemxija Roman Tombs’, St. Paul’s Bay (Malta); 30 Mar 2012.
- ‘Xaghra tal-Majjiesa’, Mellieha (Malta); 1 April 2012.
- ‘Qammieh’, ‘Mizieb’ and ‘l-Ahrax’ areas, Mellieha (Malta); 9 April 2012.

All populations of *Fumana laevis* were found in the same type of habitat of *F. thymifolia* and *F. arabica*, that is, Mediterranean garigue and phrygana and their ecotomes, as indicated by Polunin & Walters (1985). In Malta, dominant or characteristic vegetation of these habitats include several fruticose and suffruticose species like *F. arabica* (L.) Spach., *F. thymifolia* (L.) Spach, *Thymbra capitata* (L.) Cav., *Teucrium flavum* L., *T. fruticans* L., *Prasium majus* L., *Anthyllis hermanniae* L., *Ononis sieberi* DC., *Erica multiflora* L. small specimens of *Periploca angustifolia* Labill. and *Euphorbia melitensis* Parl. With these, one can add the rare and occasional species of *Cistus mon-*

speliacus L., *C. creticus* L., *Phlomis fruticosa* L., and *Coronilla valentina* L. s.l.

F. laevis grows on warm coasts with fairly deep soil at 0-800m asl and is widely distributed in the Mediterranean (Guemes & Munoz-Garmendia, 2004). Countries specified in [GBIF] are Cyprus, France, Greece, Israel, Italy, Morocco, Spain (largest occurrences), Tunisia and Turkey. In Italy, the species is recorded from Sicily in addition to 4 other regions (Conti et al., 2005; Giardina et al., 2007). Since the populations of *F. laevis* found in Malta occur in their typical phytocoenosis, dwelling in their expected natural habitats (often far from urban areas) and because the Maltese archipelago is well within the native distributional range of the species, *F. laevis* is considered indigenous in Malta. It is evergreen or partly deciduous in summertime and flowers between mid March and beginning of June.

Discussion

Fumana laevis is assumed by the author to be rather frequent throughout its natural habitat in Malta, principally in sites where *F. thymifolia* (and *F. arabica*) occurs in large numbers. For this reason, the current distribution illustrated in Fig. 1 must be considered to be partial and expected to be prevalent in other phrygana and garigue in the Maltese islands.

F. laevis was lectotypified by Molero & Rivera (1987) and this process was further refined by



Fig. 2 – *Fumana laevis* (Cav.) Pau in full bloom - Ghajn Tuffieha, Malta (10-Apr-2011, photo by S. Mifsud).

Guemes & Munoz-Garmendia (2004). It is a widely accepted taxon (eg: Molero & Rivera, 1987; Alvarez, 2001; Guemes & Munoz-Garmendia, 2004; TPL), and perhaps more recognised than it was used before, were often, it had been neglected or included without distinction in *F. thymifolia* (Pignatti, 1982).

In the description of *Helianthemum thymifolium*

(=*Fumana thymifolia*) Borg (1927) observed and additionally reported the variety - var. *viride* and remarked that it differed from *H. thymifolium* by being “light green; pubescent and viscid only in the upper parts near the inflorescence”. This raises the doubt if Borg was observing the same plants here reported as *Fumana laevis* or another variety of *F. thymifolia*.

Lack of further detail on the leaves and sepals by Borg (*ibid.*) makes it difficult to substantiate. Subsequently, this taxon was not further mentioned by later floristic work, such as by Haslam (1977), Lanfranco (2001), Weber & Kendzior (2006) and Tabone (2008) and so it was either omitted or included with the variability of *Fumana thymifolia*. For instance, Tabone (2008) states that his new discovery of *Fumana laevipes* “bring the total number of *Fumana* recorded for the Maltese Islands to 3”.

Interestingly, Weber & Kendzior (2006) observed a particular group of *Fumana* specimens that according to them, differed from *F. thymifolia* and *F. arabica*, and brought forward their hypotheses that these might be a hybrid species between the two. They stated that the flowers have gaping, non imbricated petals with red markings at the lower part. They are different from *F. laevis* which lack these characters. These plants have also been observed by the author and are currently further studied to determine their taxonomic status, while noting that only few images of *F. thymifolia* have been displayed with such characters on on-line floristic sites - for example [TS]. Lacking scientific experimentations or literature evidence, they are being provisionally considered as within the variation of *Fumana thymifolia*. It must be noted that *F. thymifolia* and *F. laevis* are often sympatric and since their reproductive isolation relies on differences of phenanthesis (Molero & Rovira, 1987), a study in cultivation of the two species would aid to confirm their reproductive isolation and possible introgression.

Fumana ericoides (Cav.) Gand. is another taxon reported from the Maltese Islands by Grech Delicata (1853) and Duthie (1874, 1875) the latter further specifying it as var. *pubescens*. The taxon was then not included in subsequent floras, namely that by Sommier & Caruna Gatto (1915) who claimed that it was a misidentification with the frequent *F. arabica* after examining the herbarium specimen collected by

previous authors (*ibid.*). This claim was accepted by subsequent scientists from Borg (1927) to Weber & Kendzior (2006) who did not include this taxon in their work, though one should not essentially neglect the possibility that it do occur - further studies must also be conducted!

Recent floristic studies in Sicily by Giardina et al. (2007) list 7 species of *Fumana*: *F. arabica* (L.) Spach; *F. thymifolia* (L.) Spach ex Webb s. str.; *F. laevis* (Cav.) Pau; *F. laevipes* (L.) Spach; *F. barrelieri* (Tenore) Ruoy & Foucaud (sometimes accepted as a subspecies or variety of *F. thymifolia*), *F. juniperina* (Lagasca ex Dunal) Pau (sometimes recognized as a subspecies of *F. laevis* or *F. thymifolia*) and *F. ericoides*, the latter considered as doubtful occurrence by the authors (*ibid.*) who states that it was excluded by Pignatti (1982) but re-introduced by Greuter et al. (1984) [cited from in Giardina et al. (2007)].

Owing to the unsubstantiated historical records here discussed, the strange form of *F. c.f. thymifolia* s.l with red markings and in line that in Sicily more *Fumana* spp. have been recently discovered, a study on the genus for the Maltese islands is further carried out by the author.

Conclusions

Fumana laevis was identified from the Maltese islands and is a substantiated addition to its flora. It is a species which is found in phryganas and garigue, amongst populations of *F. thymifolia* and *F. arabica*. The species is closely related to *F. thymifolia*, but some different characters, principally in the overall indumentum and the morphology of the leaves are considered distinct enough to separate the 2 species apart (Molero & Rivera, 1987; Guemes & Molero, 1993; Guemes & Munoz-Garmendia, 2004).

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Summary: *Fumana laevis* (Cav.) Pau. is reported for the Flora of the Maltese islands. An account on the taxonomy of *Fumana laevis* in relation with the other three *Fumana* spp. occurring in Malta is presented and summarised in an identification key. Notes on its local and general distribution, habitat and local status is given.