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## A review of *Romulea* Maratti (Iridaceae) in the Maltese Islands

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A revision of *Romulea* for the Maltese islands has been carried out using a classical morphometric analysis and cytological investigations. *Romulea* species on the southeast coast of Sicily were also included in this study. Changes are the removal of *R. columnae* subsp. *rollii* and *R. bulbocodium* from the Maltese flora and importantly, clarification on the ambiguous *R. melitensis* (here lectotypified) leading to a description of a new species: *R. variicolor*, which is further subdivided into three varieties. This new species replaces most of the Maltese records of *R. ramiflora*. Taxonomic observations on *R. columnae* subsp. *rollii* from Ragusa support its elevation to the species level *sensu* Parlato. New populations of *R. rollii* and *R. melitensis* are reported from Ragusa (Sicily). In addition, examples of hypothetical hybrids and terata are documented. The ecology, polymorphic characters and history of the *Romulea* species in Malta are discussed in detail. Finally, a key to the *Romulea* species present or recorded in Maltese literature is presented

**Keywords:** *Romulea*; Iridaceae; Flora of Malta; Maltese endemics; Mediterranean region

### Background and historical literature

*Romulea* is a genus of the tribe Croceae in the family Iridaceae, subfamily Crocoideae (syn. Ixioidae). It has two centres of diversity, one in sub-Saharan Africa with about 75 species and the other in the Mediterranean basin with only 15 species (Manning & Goldblatt 2001). *Romulea* seems to prefer insular or coastal habitats with a typical Mediterranean climate and in Europe it is mostly distributed in Sicily, Sardinia and Corsica (Frignani & Iiriti 2009). The genus is characterized by having short or no stems, grooved cylindrical-linear leaves, terminal solitary flowers on few floral branches, two herbaceous bracts with a hyaline margin, and actinomorphic flowers with tepals connate at the base forming a short tube (De Vos 1972).

The first record of *Romulea* in the history of Maltese flora is that of *R. bulbocodium* (L.) Sebast. & Mauri listed under the synonyms of *Ixia bulbocodium* (L.) L. (Zerapha 1827) and then as *Trichonema bulbocodium* (L.) Ker Gawl (Grech Delicata 1853).

Its listing in these historic and early Floras suggest that *Romulea* was common on the Maltese islands. Later, *R. columnae* and *R. ramiflora* were added to the Maltese flora (Gulia 1872) although from successive accounts the identity of *R. bulbocodium* had already become doubtful, for example, Duthie (1874) and Armitage (1889) believed that *R. columnae* and *R. ramiflora* only came from the Maltese islands, and not *R. bulbocodium*.

A revision of the Mediterranean *Romulea* (Beguinet 1907, 1908, 1909) showed that herbarium material examined from Malta (collected by Schlumberger and deposited in Palermo) consisted of *R. ramiflora*, *R. columnae*, and surprisingly, *R. bulbocodium*.

Moreover, a new endemic species was described – *R. melitensis* Beg. – from herbarium material collected by Sickenberger (Beguinet 1907).

The account of *Romulea* by Sommier and Caruana Gatto (1915) gives some interesting observations, despite the fact that they could not examine flowering specimens *in situ*. Their comments were based mainly on herbarium specimen examination. To start with, they could not confirm the presence of *R. bulbocodium*, and inferred that the previous records are likely to be misidentifications. They examined the collection by Schlumberger and matched it with *R. revellieri* and not *R. bulbocodium sensu* Beguinet. Lojacono examined the same herbarium specimen and determined it as *R. pulchella* Jord. & Fourr.

Sommier and Caruana Gatto (1915) found that *R. melitensis* and *R. ramiflora* were more variable and very similar in habit and morphology, but they still listed them as distinct species. A good example to show that these two species were confused are the specimens collected by Duthie from Selmun, which were determined by Beguinet as *R. ramiflora* var. *contorta* Beg. (a synonym of *R. ramiflora* according ThePlantList.org (2014)), whereas they were determined by Sommier and Caruana Gatto as a robust form of *R. melitensis*. Sommier and Caruana Gatto (1915) admitted the difficulty they had to delimit one species from the other in Malta and that the genus has been widely confused in the past. At last, they catalogued *R. melitensis*, *R. ramiflora* and *R. columnae* in their Flora and included *R. bulbocodium* as doubtful.

The identity of *R. melitensis* by Sommier and Caruana Gatto (1915) was solely based from the habit, habitat and dark violet colour of the perianth. They listed

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five records: Wied Bingemma, Ramla and Dwejra in Gozo, Comino (as doubtful) and Saint Paul's Bay ("San Paolo a mare! Presso il forte Figue"). Uncertainty arises in the location of this toponym because "forte Figue", which clearly is Forte Tigne on the holotype label, is found in Sliema not Saint Paul's Bay.

In the subsequent Flora by Borg (1927), the occurrence of *R. bulbocodium* in Malta was also doubted whereas the other *Romulea* species were catalogued as varieties of *Romulea columnae*: *Romulea columnae* var. *columnae*, *R. columnae* var. *melitensis*, *R. columnae* var. *ramiflora* and *R. columnae* subsp. *parviflora* Bubani var. *rollii* Parl. The latter is the first record of *R. rollii* in Malta. In Lanfranco's *Guide to the Flora of Malta and Field Guide to the Flora of Malta* (Lanfranco 1960, 1969), the species *R. melitensis*, *R. columnae* and *R. rollii* were listed. There was the first indication that *R. rollii* is distinguished from *R. melitensis* by its "light purple flowers". The treatment of *Romulea* species in Malta by Haslam et al. (1977) was identical to the five species reported by (Borg 1927).

The overview of *Romulea* in Malta has not changed much since Haslam et al. (1977) other than that *R. melitensis* is perceived to be a rare species that is distinguished by a dark-violet perianth and narrow tepals. Uncertainty and misconception in the identity of *R. melitensis* is evident in recent works. For example, in the Red Data Book for the Maltese Islands, Lanfranco (1989) states: "This endemism resembles other *Romulea* species quite closely as a result of which its frequency is difficult to assess. However it does not appear to be frequent. Endemic, status indeterminate". Statements along the same lines were expressed by Lanfranco (1995) and Lanfranco and Lanfranco (2003), indicating that the *Romulea* species are so closely related that they are very difficult to distinguish. Even the present author had difficulty in identifying *R. melitensis* in the past (Mifsud 2002–2014) simply because no *Romulea* specimen ever turned out to have tepals as narrow as 1.0–1.5 mm – a key character for *R. melitensis* (Beguinot 1907, 1908, 1909).

It is no surprise that Sommier and Caruana Gatto (1915) have concluded: "Percio speriamo che qualche botanico abbia agio di studiare questo genere in Malta nell'epoce delle fioritura." [translation: We hope that a botanist has the courage to study this genus in Malta during the flowering period] – a study that has never been carried out. For this reason, a revision of the genus in the Maltese islands has been conducted between 2011 and 2014 to determine which species occur in Malta and to investigate the taxonomy of *R. melitensis* and what morphological characters define it. Before this study, four species of *Romulea* were reckoned to be present in Malta: *R. ramiflora* Ten., *R. rollii* Seb. & Mauri (syn. *R. columnae* Parl. subsp. *rollii* (Parl.) Marais), *R. columnae* Seb. & Mauri and *R. melitensis* Beg. while *R. bulbocodium* was listed as doubtful (Haslam et al. 1977; Mifsud 2002–2014; Weber & Kendzior 2006; Brullo et al. 2009; Frignani & Iiriti 2011; Lanfranco 2012; Alex Casha 2013).

## Material and Methods

### Characters chosen for taxonomical segregation

A fresh study of all *Romulea* species in Malta was carried out using a number of morphological characters previously used in literature. Characters were derived from the identification keys and descriptions that distinguish *Romulea* species by Marais (1980), Pignatti (1982) and Cardeil Sanz (2013) (Refer to Appendix 2). The morphology of the corms is only important to distinguish African *Romulea* because the Eurasian species (Section *Romulea*, series *Romulea*) share the same type of corm (Manning & Goldblatt 2001). Hence morphological examination of corms was excluded in this study. The study carried out in the first year was useful as it was possible to include a few other characters that appeared to have diagnostic value. These *post priori* characters included: the shape of the petal apex, filament colour, hair occurring at the base of the filaments, style colour and pollen characters.

The full list of characters studied for this revision are: number of leaves; length of longest leaf; leaf habit; leaf shape in cross section; leaf anatomy\*; number of flowers; pedicel length at flowering; bract and bracteole texture and length; colour of tepals (adaxial and abaxial); tepal length; tip of tepals\*; throat colour; colour of veins on tepals; filaments colour and hairiness; colour of tip of style; length of stamens compared to tepals; height of styles compared to anthers; pollen colour and pollen sizes\* and structure of seed testa\* (\* examinations made only on some specimens). A field record sheet (Appendix 4) was created.

Material was collected and examined from numerous surveys throughout the Maltese islands and along the southeastern coast of Sicily in 2011, 2012 and 2014. Details on the material examined are listed in Table 5. Due to the wide variability and subjective interpretations in assessing several character states, this methodology employs the categorization of data into ranges or states that were indexed into quantifying numbers or qualitative letters as indicated below. The method of examination and recording of some characters is also defined below.

#### (a) Leaf and peduncle measurements

The longest leaf was measured from its emergence from the soil (its true base is actually below soil level) to the tip. The widest diameter of the leaf was measured by an electronic Vernier scale. Peduncles were similarly measured from their emergence from the soil to the base of the bracts at flowering.

#### (b) Type of bracts and bracteoles

*Romulea* species have a pair of bracts subtending the perianth, one inferior and the other superior and generally termed as bract and bracteole, respectively (Beguinot 1908; Manning & Goldblatt 2001). Sometimes they are referred

to as the lower and upper valves or spathes. The inferior bract is partly enveloping the superior. They are subequal in size and both have a similar lanceolate structure composed of herbaceous or/and scarious (hyaline) tissue. The proportion of these different tissues is diagnostic in *Romulea* (Beguinot 1908; Manning & Goldblatt 2001). Bracts were examined after being dissected out and spread open using a scalpel or blade. In this study, bracts were categorized in five types A to E: (refer to Fig. 1a):

- A. Completely herbaceous except for a thin (c. 0.5 mm) scarious margin.
- B. Herbaceous midrib with a wide scarious border. Herbaceous part solid throughout or patchy at the base and occupying about one-third of the widest part of the bract.
- C. Same as B, but herbaceous part weaker, more patchy and scarious at the basal third, often exhibited as scarious tissue with two parallel veins.
- D. Mostly scarious with the central keel reduced to a reddish-maroon sub-scarious, translucent tissue.

- E. Completely scarious, or with traces of herbaceous or semi-herbaceous parts at the upper third of the bract.

(c) *Length of tepals and examination of perianth*

Measurement of the diameter of the perianth was found to be inconsistent and it was difficult to take representative measurements. The aperture of the flower varied during the day, and measurements from tip to tip of opposite tepals was tedious and led to inaccuracies. Instead, as the perianth diameter is directly related to the length of the perianth segments (tepals), the length from the base of the perianth tube to the tip of the outer tepals was measured. The perianth was hence removed from the peduncle by a gentle pull and the length and width of the tepals was measured *ex situ* using a ruler to the nearest 0.5 mm.

(d) *Colour of adaxial surface of tepals*

The colour of the Maltese *Romulea* species varies from white to dark violet. Here the term 'violet' refers to the

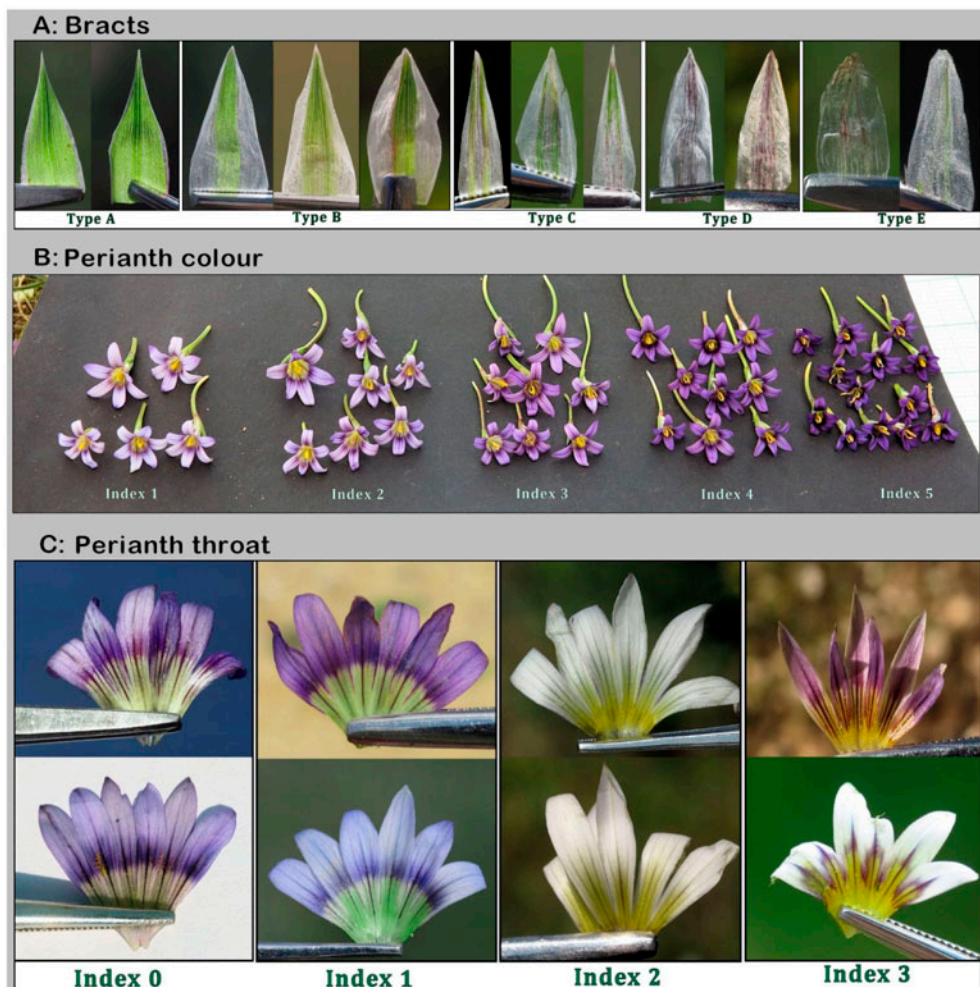


Figure 1. Indexed character states used in this synopsis. (A) Five different states of the bract and bracteole (herbaceous to scarious texture). (B) Five different states of the flower colour. (C) Four different states of the throat of the perianth.

general colour of *Romulea* that in other literature can be referred to as purple, pink, rose or mauve. The colour of the perianth is categorized and indexed into white and five states of violet (Fig. 1b) as follows:

0. Pure white
1. Lilac
2. Light violet
3. Violet (half tone)
4. Dark violet
5. Very dark violet.

(e) *Tip of tepals*

This character was subdivided into three states that were evaluated by direct visual examination: acute, obtuse or rounded and subacute or blunt (half-way between the former two states).

(f) *Colour of throat*

As it will be revealed later in this revision, the colour of the perianth throat is given high taxonomic importance. Correct examination was ensured by dissecting the perianth longitudinally, opening it flat, and brushing away any yellow pollen deposited on the throat prior to observation. Pollen may give a false interpretation that the throat is yellowish when flowers are observed *in situ* and in their natural state. In this investigation, *Romulea* species were found to have throat colour that varies from white to golden yellow and character states were categorized into four categories as follows (refer to Fig. 1c).

0. White or ash-grey
1. Pale green, sometimes with a hint of questionable yellow
2. Distinctly pale yellow or greyish yellow
3. Golden yellow.

(g) *Colour of abaxial surface of outer tepals (=undertepals)*

The colour and patterns of the abaxial surface of the outer tepals are highly diagnostic for the circumscription of *Romulea* species in Malta. For economy of text and simplicity, from here onwards this character will be referred to as the 'undertepal'. Five undertepal types have been qualitatively categorized in this study (refer to Figure 2).

- A. Pale green, greyish-green, ash or white without any hues of violet or lilac
- B. Mixture of green (or pale green) and violet in different proportions
- C. Violet, usually very dark violet and without any green hues
- D. Pale or pastel yellowish-green with dark greyish-violet pigmentation at the veins and basal third, rarely flushing out or up into the green areas

- E. A broad, central bright green midrib followed by vivid purple-maroon streaks flushing away externally to a white margin.

In category B, the ratio of the violet and green pigmentation is evaluated by a weighting from 1 (minimum) to 3 (maximum) by direct visual inspection. For example, V3:G1 represents a colour pattern composed mostly of violet; V3:G3 for an undertepal with vivid green and violet at equal proportions whereas V1:G1 for a similar equal composition of both colours but being paler or greyish.

(h) *Filament hair*

The hairs present on the basal half of the filament were found to have some taxonomic significance. Filaments were gently removed from the inner wall of an open-dissected perianth tube and checked by direct sight or with the aid of a 10× magnification lens. Three states have been attributed for this character: glabrous or subglabrous (hairs absent or very minute and hard to detect even with a lens); minute (easily visible with lens but difficult to detect with the naked eye); visible or conspicuous (easily visible with naked eye and often dense). Moreover, some specimens were examined under a stereomicroscope and measured with an ocular micrometer.

**Population studies**

In order to study intraspecific variation, population studies were carried out on different populations throughout the Maltese islands and the southeast coast of Sicily (Table 7). The aim of these examinations was to check the homogeneity between circumscribed taxa and determine delimitation of infraspecific taxa. Examination of the most diagnostic characters of randomly selected specimens within a population was carried out. Table 6 lists the populations that have been studied and the corresponding location, date, sample size and number of characters studied. A total of 446 specimens were examined. The most important characters included bracteole type and size, tepal length and width, colour of perianth, colour or pattern of undertepals, throat colour, filament colour and pilosity and sometimes peduncle length and leaf habit.

**DNA collections**

To complement this morphometric classification with phylogenetics, samples of leaves from 119 studied specimens were collected in 2014. The procedure consisted of cutting one or two leaf sections about 3 cm long from about one-third of their base. Each section was further dissected longitudinally in half and finally in shorter transverse pieces between 5 and 10 mm long. Disposable blades were used, one for each specimen to prevent cross contamination. Leaf material was stored in tea bags and placed in a temporary desiccation jar with silica gel for 24 h and then moved to another and larger desiccation

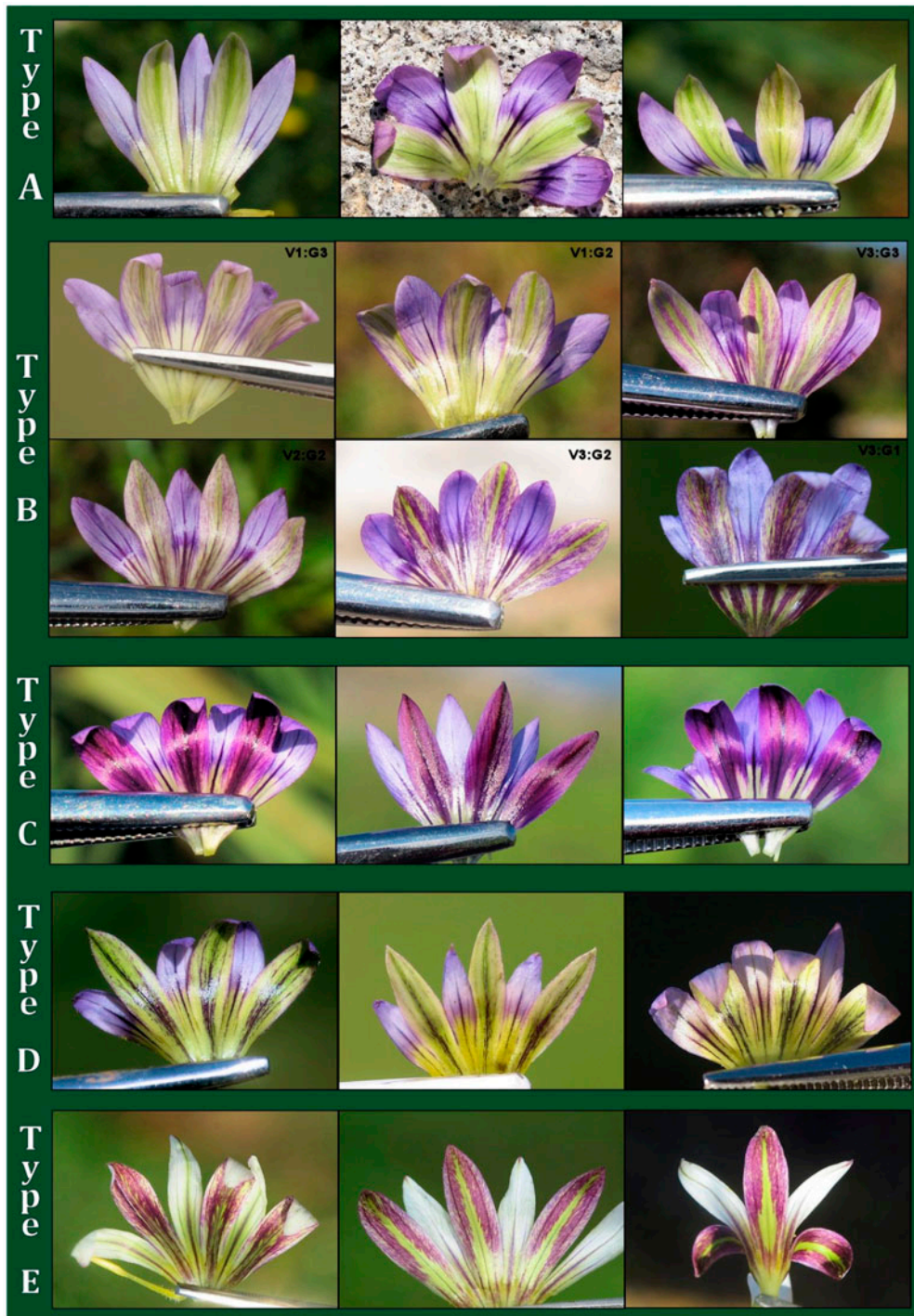


Figure 2. Five indexed character states of the colour pattern at the abaxial side of the outer tepals (=undertepals) showing several examples for each.

jar for permanent storage. Desiccated leaf samples were submitted to the Royal Botanic Garden of Edinburgh for storage and future chromosome and perhaps molecular investigations.

**Surveys of *Romulea* species on the south coast of Sicily**

Four expeditions were conducted in the coastal areas of Ragusa, Modica, Scicli, Ispica, Pachino and Noto, pro-

vinces of Ragusa and Syracuse. The expeditions were conducted in March 2011 (3 days), February 2012 (3 days), February 2014 (8 days) and April 2014 (3 days). The first visit was rather cursory and was quite late in the season for studying *Romulea* in flower, unlike in Malta where flowering of *Romulea* persists until April. However, it helped to set the period of study for the subsequent visits. The expedition carried out in April 2014 was mainly organized to examine the morphology

of fruit and seeds. Studies in Sicily were hence focused 24–27 February 2012 and 16–23 February 2014. Surveys carried out in 2012 showed that the habitat of *Romulea* species related to the study of the Maltese *Romulea*, was strictly coastal. Hence in 2014, *ad hoc* visits were then carried along the coast of southeast Sicily, about 75 km between Punta Secca and Capo Passero.

The following Sicilian sites were visited (west to east): Torre di Mezzo at Punta Secca (Ragusa, Feb. 2014); Donna Lucata (Scicli, Feb. 2014); Cava D'Aliga; (Scicli, Feb. 2014); Spiaggetta Sampieri (Scicli, Feb. 2014); Sampieri main beach; (Scicli, Feb. 2014); Pisciotto l/o Sampieri (Scicli, Feb. 2012, Feb 2014); west coast of Marina di Modica (Modica, Feb. 2012, Feb. 2014); Pozzallo beach (Pozzallo, Feb. 2012, Feb. 2014); Santa Maria del Focallo (Ispica, Feb. 2014); Punta Castellazzo and Ciriga (Ispica, Feb. 2014); Granelli (Pachino, Feb. 2014); Scogliera delle Concerie (Pachino, Feb. 2014); Portopalo di Capo Passero (Pachino, Feb. 2014).

The aim of these surveys was to assess the morphology of *R. bulbocodium* and *R. rollii* *in situ* and so establish if these species occur in Malta; to compare the Sicilian populations of *R. ramiflora* with those in Malta; and finally to find the small population of *R. melitensis* (Brullo et al. 2009) and understand better its species concept and their distinguishing characters. This approach was favoured instead of examining herbarium specimens where several important characters cannot be examined accurately (or would incorporate destructive sampling), or their states are not preserved in herbarium material.

## Results

On studying and comparing the morphological characters of the Maltese and Sicilian specimens, four distinct taxonomic groups were circumscribed and labelled C, L, R and M. A few specimens could not be placed in any of these groups and were placed in an out-group labelled U. The recorded characters of each taxon group are summarized in Table 1, while the entire morphological data recorded for all the 165 specimens are presented in Appendix 1. The characters that are highly diagnostic for circumscription are indicated in the column 'diagnostic importance' of Table 1. Characters that were useful to distinguish one taxon only are tagged as low, whereas those categorized as moderate and high were useful to distinguish two, or more taxa, respectively. Taxon group M, representing the largest circumscribed group (113 of 165 specimens), was further subdivided into five main subgroups: 1, 2, 3, 4 and 5. Details and taxonomic relevance of these subgroups are discussed below.

### Identity of taxon groups and criteria used

Each taxon group was compared with Mediterranean *Romulea* species recorded in or relevant to the Maltese islands for identification. Species selected in this

comparison are those recorded from Malta (see Introduction above), Sicily (Giardina et al. 2007) and related species from Italy (Pignatti 1982; Conti et al. 2005). These are *R. bulbocodium* (L.) Sebast. & Mauri, *R. columnae* Sebast. & Mauri, *R. linaresii* Parl. (endemic of Sicily), *R. melitensis*, Beg. (endemic of Malta), *R. ramiflora* Ten. (including subsp. *gaditana* (Kunze) Marais), *R. revelieri* Jord. & FourR. (endemic of Capraia, Sardinia and Corsica) and *R. rollii* Parl. (= *R. columnae* subsp. *rollii* (Parl.) Marais). *Romulea ligustica* Parl., *R. limbarae* Beg. and *R. requeinii* Parl. are endemic to Corsica and Sardinia and not included in the comparison, whereas *R. revelieri*, also endemic to that region, was taken into account only because its habit resembles *R. melitensis* (Beguinot 1907). *Romulea rosea* (L.) Eckl., also recorded in Italy, was excluded from comparison because it is native to Cape Town and an alien sand crocus to Europe, (Manning & Goldblatt 2001; Giardina et al. 2007). Results are presented in a comparison table in Appendix 2.

In this revision, circumscription is based on morphological characters that are constant within species limits and taxonomic importance is given to those characters that are unique to species. Effort was even made to seek a combination of two or more characters, hence forming a combination that is unique to the circumscribed taxa. Although in systematics based on morphology, there is always subjectivity in selecting diagnostic characters, the study of numerous specimens made it possible to select diligently and objectively diagnostic characters of taxonomic value. Some characters derived from previous revisions of *Romulea* spp. or floras have been maintained, some were found to be subordinate, and a few other characters are suggested for the first time as important for the classification of *Romulea* spp. in Malta and the rest of the Mediterranean.

In this revision, it was found that the most important diagnostic characters for discriminating *Romulea* in Malta (and the south coast of Sicily) are the colour or pattern of the undertepals, the texture (scarious : herbaceous ratio) of the bracteole, size and shape and to a lesser extent colour of tepals, colour and hairiness of stamens' filaments and colour of the throat as indicated in Table 1. Results of the character set for each taxon group are given below.

### Taxon group C

Taxon group C is characterized by an almost totally scarious bracteole (Fig. 1A, type E); white, (or rarely lilac) tepals measuring only about 11 mm in length; glabrous, mustard-coloured, filaments and a glabrous, deep yellow throat topped with dark veins forming a violet ring above the throat. The undertepals are moderately variable, but in general, they have a characteristic bright olive-green to yellowish colour with dull violet veins sometimes subfusing out only at the basal part. This group corresponds without doubt to *R. columnae*. This species is also characterized in being small plants often

Table 1. Four taxon groups (C,L,R,M) circumscribed by characters of taxonomic importance.

Character	Diagnostic Importance	Taxon group C	Taxon group L	Taxon group R	Taxon group M
Sample Number (total)	–	21	14	18	113
Sample Number (Malta)	–	21	0	14	94
Sample Number (Sicily)	–	0	14	4	19
Number of aerial leaves	Negligible	3 to 7	3 to 7	3 to 6	3 to 6
Leaf habit	Negligible	Mostly prostrate and curved, although young leaves are suberect and straight	Mostly straight or arched, suberect to prostrate	Variable, but mostly suberect and slightly curved,	Very variable, straight to C-shaped, erect to prostrate, contorted or not
Length of leaves	Low	4–14 cm	12–38 cm	10–22 cm	5–20 cm
Diameter of leaves	Low	0.9–1.4 mm	0.7–0.9	1.1–1.5 mm	1.0–1.5 mm
Cross section of leaves	Low	Terete, compressed	Terete, circularR.	Terete, compressed	Terete, compressed
Length of Peduncle	Negligible	2–8 mm	Variable, 3–15(–30) mm	15–25 mm, but variable	Variable, (3–)10–20(–25)
Length of bracts	Moderate	7–9 mm	12–16 mm	9–12 mm	9–12 mm
Length of bracteoles	Moderate	7–9 mm	12–16 mm	9–12 mm	9–12 mm
Type of bract	Negligible	A	A	A	A
Type of bracteoles	High	Mostly D and E	D	B, sometimes C	B, sometimes C
Number of flowers	Negligible	1 to 3	1 to 4	2 to 5	1 to 5
Colour of perianth	Moderate	White to lilac	White, rarely lilac.	Lilac to violet	Lilac to dark violet.
Length of tepals	Moderate	8–12 mm	14–17 mm	12–16 mm	13–19(–22)mm
Width of tepals	Moderate	2.0–2.5 mm	2.5–3.5 mm	3.0–3.5 mm	3.0–4.5 mm
Tip of tepals	Low	Acute	Acute	Acute	Variable but mostly subacute
Colour of throat	High	Deep yellow (Type 3)	Pale yellow (type 2)	Deep yellow (Type 3)	White to pale green (type 0 or 1)
Colour of tepal veins	Low	Dark violet	Pale greyish-violet	Dark reddish-violet	Dark violet
Filament colour	High	Mustard Yellow	Pale yellow	Mustard yellow	White to pale yellow
Filament pilosity	Low	Subglabrous	Pubescent, always visible with naked eye	Minutely pubescent, often visible with lens	Pubescent, often just visible with naked eye
Length of stamens compared to tepals	Negligible	Third to half tepals length	Third to half tepals length	Third to half tepals length	Third to half tepals length
Style length : anthers length	Negligible	Same level	Same level	Same level	Same level
Pollen Colour	Negligible	Yellow	Yellow	Yellow	Yellow
Colour of abaxial side of outer tepals (= 'undertepals')	High	D	E	D	A,B or C



found in dense clumps with a very short, subsessile peduncle. In Malta it forms homogeneous populations as can be seen from the results of a population study ( $n = 21$ ) in Table 8. The only variation detected is the size of flowers (up to 12 mm), the pattern of the undertepals and occasionally, the perianth colour is white instead of lilac.

#### **Taxon group L**

Taxon group L was only found in Sicily. At first sight, it looked like a large variant of *R. columnae*, with its medium-sized, white perianth, almost completely scarious bracteole (Fig. 1A, type D) and a short yellow throat but more important diagnostic characters were found to be very different from *R. columnae*. Taxon group L is distinguished in having much larger bracts (12–16 mm) and tepals (14–17 mm); perianth with greyish or somewhat faded veins; throat pale yellow (type 2) and elongated, gradually fading to the white colour of the tepals and with a rather conspicuous ring of hairs visible with the naked eye. Filaments are pale yellow, covered in their proximal half by long hair that is easy visible with the naked eye. The morphology of the leaves was distinct for this group only: erect, filiform and very narrow, less than 1 mm wide with a brighter hue of green and a circular, non-compressed cross sectional outline. Still the most distinctive and unique character of this group is the colour pattern of the undertepals. They have a bright green midrib, variably broad but usually making a quarter to a third of the width of the tepal, abruptly becoming vivid fuschia-purple laterally and often flushes gradually and elegantly to a white margin (Fig. 2, type E).

Although a restricted number of specimens could be studied during the short time in Sicily, they exhibited homogeneous morphology with variations present in the size of leaves, peduncles (very variable in this species), tepals and bracts.

The habitat of this species was found to be disturbed or moderately vegetated sand dunes on the south coast of Sicily. The character set of this taxon group matches perfectly and was therefore identified as *R. rollii*. Typical specimens of this taxon group have not been found in Malta and therefore *R. rollii* must be excluded from the flora of the Maltese islands. If this species does exist in Malta, it has to be searched for in similar sandy habitats close to karstic rocky areas, for example at l-Ghadira tat-Torri abjad, Ghadira Bay, Mgiebah, Gnejna and Ghajn Tuffieha (Mellieha) and Ramla Hamra Bay (Nadur, Gozo).

#### **Taxon group R**

Taxon group R, which was found both in Malta and Sicily is characterized by linear-lanceolate, pale to rose-violet tepals with acute tips. Perianth throat deep yellow with reddish-wine veins; filaments mustard-coloured with short hair at their basal third; undertepals with a charac-

teristic yellowish to pale green colour ornamented with dull mauve colour on the veins, and sometimes spreading out and colouring the basal third of the tepal (Figure 2, type D). The bracteoles are herbaceous with a scarious border (Figure 1a, type B or C). This taxon was identified as *R. ramiflora*. Results from populations studies convey that variations are minimal mostly in tepal size and habit, the latter linked with different environment conditions: straight, long and almost erect in shaded damp conditions, prostrate, curved and sometimes contorted in arid, exposed areas with shallow soil.

From the 129 specimens studied in Malta, only 14 have been found to fall in this group. This contradicts the numerous historical and current records inferring that *R. ramiflora* is the most common *Romulea* species in Malta, also an opinion of many authors and naturalists in Malta. Instead *R. ramiflora*, is a scarce to rare species in Malta, and the majority of the specimens examined were demarcated in taxon group M.

#### **Taxon Group M**

The species represented by taxon group M dominate the Maltese islands, comprising about 80% of the 500 specimens or so that have been examined. This group stood out from the other groups in being highly variable, especially in the colour of the perianth – pale lilac at one extreme to very dark violet on the other.

Despite being a variable group, it was characterized by few but important homogeneous characters. The perianth segments are lanceolate, often broad and valvate to imbricate, but sometimes narrow lanceolate and free. Tips obtuse to subacute. A very important distinct character is the perianth throat, which is white to pale green, appearing slightly yellowish in non-dissected flowers due to the reflection of pollen. The abaxial side of the outer tepals is different from the inner except in some specimens that are all completely dark violet. The undertepals are highly variable and painted in different patterns of green and deep violet (or just one colour) making another distinct character for this group.

##### *(a) Curvature and orientation (habit) of leaves*

Leaves have been found to vary greatly, from fully erect to completely prostrate; straight, arched, curved or C-shaped but never making an entire loop or coiled; sometimes twisted along their longitudinal axis. On the other hand they are always more than 1 mm thick (typically 1.2–1.5 mm), dark green, and compressed. Leaf variation is linked to habitat and environmental conditions, which also applies to some extent to other *Romulea* species, namely *R. columnae* and *R. ramiflora*. The same conclusion was reached by Frignani and Iiriti (2011) where plants growing in arid conditions such as in sites with exposed, shallow soil, usually have prostrate, very curved, twisted leaves. On the other hand, plants in damp or soggy soil, such as rock basins or

rocky ground close to water courses or percolating water, tend to have erect to suberect, straight to slightly curved leaves, usually longer than the average. This relationship was best observed in a large population at Wied il-Milied where *Romulea* specimens growing both in damp and heavily vegetated ground and in arid rocky ground with shallow soil had leaves and habit corresponding to the observation given above.

(b) *Size of leaves*

The length of the leaves is of little taxonomic value and has been found to range from a few centimetres to 40 cm. Specimens with long leaves were found in vegetated areas or shaded places, hence it is indicative that this is another ecotypic variation. The only distinctive relevance that can be encompassed is that between *R. columnae*, which tend to be short (c. 8 cm) and *R. rollii*, which tend to be very long (c. 22 cm) with wide overlap over all species.

(c) *Length of peduncle*

The peduncle length was found to vary considerably, a variation observed not only in taxon group M, but in all *Romulea* species in this study. *Romulea* have an adaptation to extend their flowering peduncles so that they surpass the surrounding vegetation, so ensuring that their flowers are exposed to pollinators. Exposed plants have very short peduncles, whereas plants within accompanying vegetation or in the shade have longer peduncles. The longest peduncle recorded for this taxon group was 6 cm in a plant with competing vegetation and partial sunlight. This adaptation was also observed in *R. columnae*, which normally have sessile peduncles (2–3 mm long) but some specimens at Wied Incita, Attard growing in short grass turf, had peduncles up to 22 mm long. The peduncle becomes even longer after the flowering stage, where in extreme cases old specimens of *R. rollii* had an outstanding long peduncles measuring 25 cm.

(d) *Bracteole (superior bract or spathe)*

Only slight variation was observed in the superior bract which is mostly type B (herbaceous with a scarious border). In some specimens, the basal half of the herbaceous part was weak and scarious (Fig. 1, type C). Few specimens had reddish streaks and patches in the scarious areas, which is considered to have no taxonomic value.

(e) *Colour of perianth*

The perianth colour of this taxon group varies in continuum from a whitish-lilac colour to very dark violet colour. Populations of taxon group M are always constituted of plants with different flower colours. This variable state is not common in other *Romulea* species,

which often have a particular perianth colour with minimal fluctuations. Only *R. bulbocodium* can also have various colour forms, but to a much lesser extent than taxon group M.

(f) *Size of perianth*

Flowers of this taxon group had also exhibited a wide range of sizes, ranging from a minimum value of 13.5 mm to a maximum of 22 mm (mean 16–17 mm). The Sicilian population had, on average, slightly shorter perianth segments (mean 15 mm).

(g) *Shape of perianth segments*

Variation was also found for this character, ranging from non-imbricated, linear-lanceolate to broadly lanceolate, imbricate tepals. The tips were either subacute to acute, with very few specimens having acute tips. Specimens in this taxon group from Sicily had a higher incidence of broad, imbricated tepals than the Maltese.

(h) *Colour of abaxial side of outer tepals ('undertepals')*

This character proved to be very important in the circumscription of *Romulea*. Surprisingly, it is barely used by other authors. *Romulea bulbocodium*, *R. rollii*, [*R. ramiflora* and *R. columnae*] and taxon group M can be readily identified or separated by using this character and colour of throat only. This is the most variable character in this taxon group, and in many cases it is a fingerprint for each different individual. Character states observed were a pale or pastel green without violet pigments (Figure 2, Type A) on one extreme; a very dark vivid violet without green pigmentation (Figure 2, Type C) on the other extreme and all imaginable intermediate patterns between the two colour forms, making no specimen identical to another. The pigmentation pattern of specimens having both violet and green varies so much that no general description could be made (Figure 2, Type B).

(i) *Throat colour*

The white or pale green colour (very rarely with a hint of pale yellowish tones) of the perianth's throat is specific to taxon group M and not shown in any other *Romulea* species found in Malta or Sicily. The throat is pale yellow in *R. rollii*, golden yellow in *R. ramiflora*, *R. columnae*, *R. bulbocodium* and *R. melitensis sensu* Beguinot and concolorous (hence violet) in *R. linaresii*. In some cases, a cursory examination of flowers gave a false indication that the throat of this taxon group is yellow, but when specimens were dissected open and cleaned from pollen, the true whitish colour becomes clear.

*(j) Stamens filaments*

The colour of the stamens was found to vary considerably in taxon group M: white, greyish-beige, pale yellow or less frequently lilac and pale violet, but never mustard colour as in *R. columnae* and *R. ramiflora*. The density and length of hairs also varied, but it was almost always present and visible with the naked eye. Occasionally, a few short hairs are also found at the throat, but are seldom detected without the aid of a lens.

*(k) Colour of style*

The colour of the style varies from white, pale yellow (most common), yellow, lilac to violet (rare). No taxonomic relationship could be attributed to this character and a correlation with hyperchromy was disproved by some specimens with pale-coloured perianths and conspicuously violet style. Nevertheless styles with lilac or violet tips seem to be specific to taxon group M only.

**Distinct characters of taxon group M**

Most Eurasian *Romulea* species have yellow throats including, *R. ramiflora*, *R. columnae*, *R. bulbocodium* and *R. rollii* (Beguinot 1908, 1909; Marais 1980; Pignatti 1982). The throat of *R. linaresii* and *R. requienii* is concolourous with the tepals (hence violet), while it is moderately but not distinctly paler in *R. revelieri*. Only taxon group M has an unique white to pale green throat (rarely with a hint of pale yellow), banded with longitudinal dark violet veins. With almost no exceptions, this character state was homologous in all of the >500 specimens examined in this taxon group. The white throat is hence considered as a specific, apomorphic character.

Another specific character for taxon group M is the colour of the undertepals. Although very variable it spans from pale green to dark violet with indefinite intermediate patterns, unique for every single specimen. Only the dark violet undertepal colour of *R. linaresii* can be said to match some specimens of taxon group M. The variability of the perianth colour is also specific to this taxon group. Very few *Romulea* species have flowers ranging from lilac to dark violet and only *R. bulbocodium* can be exemplified from the central Mediterranean region, for which at any rate, the variability is not as drastic as taxon group M. The combination, of these three characters makes taxon group M distinct from any other *Romulea* species. Moreover, it does not even correspond to *R. melitensis* (*sensu* Beguinot), as discussed below.

**What is *Romulea melitensis* Beg.?**

*Romulea melitensis* was described by Augusto Beguinot in 1907 from nine herbarium specimens collected in one gathering by Sickenberger on the 14 February 1876 from “Fort Fique”, Malta and deposited in Herborisations du Levant, Barbey-Boissier [HB] (G) (Beguinot 1907). The holotype and paratype specimens were investigated by

the present author. The label clearly states that the location is *Fort Tigne*, (not Fort Fique), an eastern coastal area in the limits of Sliema (mainland Malta) that is now completely developed so it is assumed that this population is no longer present in its *locus classicus*. According to subsequent works (Beguinot 1908, 1909) it became evident that Beguinot never visited Malta and his description was solely based on herbarium specimens collected by Sickenberger.

Distinct characters according to the description of *R. melitensis* (Beguinot 1907) (see Appendix 5) include perianth with a deep violet colour, perianth segments 13 mm long and only 1–1.5 mm wide; throat (= perianth tube) yellow with violet veins, an herbaceous upper bract with a hyaline margin, and rigid, compressed, slightly twisted, erecto-patent, recurved leaves. According to Beguinot (1907, 1908), the Maltese endemic is related to *R. linaresii* Parl. subsp. *graecae* in its morphology and colour of the tepals, but *R. melitensis* differs by having a yellowish throat and an herbaceous upper bract with a narrow hyaline margin; characters that are instead found in and resemble *R. ramiflora*. However, *R. melitensis* differs from *R. ramiflora* by having rigid and robust leaves and darker tepals. Finally, he also related *R. melitensis* with *R. revelieri* in its habit, but the morphology of the bracts and its yellow throat of the former are different from *R. revelieri* (Beguinot 1907, 1908).

According to the monograph of *Romulea* (Beguinot 1908), Dr Stefano Sommier sent dried material of *Romulea* spp. from the Maltese islands to Beguinot, collected in April 1907 from Qala tad-Dwejra, Gozo. Beguinot cultivated some bulbs and from cultivated plants *in vivo*, he identified them also as *R. melitensis*. A modified account of *R. melitensis* was then given in his monograph. He rewrote a diagnosis maintaining many of the characters of the protologue (Beguinot 1907) and amended that the plants are one or two flowered, the length of the tepals is 15–22 mm not 13 mm, the throat is whitish not yellow and the leaves are thicker and more robust than originally described. Additional characters included in the revised diagnosis are the pale violet or green hues of the undertepals, hair at the base of the filaments, a white style sometimes ending violet at the tip and an oblong-obtuse fruit capsule with slightly shorter spathes (= bracts). Further to this, Beguinot (1908) commented that the leaves are thicker and have a semi-xerophytic cytology and the colour of the tepals can sometimes be pale. Strangely Beguinot (1908) did not include the variability of the colour of the perianth in his amended diagnosis, which hence remained like the protologue’s description as dark violet.

Therefore, the small habit, the herbaceous bracteole with a hyaline border and more importantly the dark violet colour and the very thin (< 1.5 mm) tepals were the most distinctive characters for *R. melitensis sensu* Beguinot, which were used in his identification keys for the Mediterranean *Romulea* at the end of his monograph (Beguinot 1909). In this key, the couplets leading to the

clade in which *R. melitensis* is nested (four species characterized by robust, compressed leaves and herbaceous bracts) distinguish *R. melitensis* from *R. ramiflora* s.l. by having a dark violet perianth and then from the Algerian endemic *R. penzigii* Beg. by [*R. melitensis*] having the tepals linear and only up to 1.5 mm wide, stamens reaching one-half the length of the tepals and for being a Maltese endemic (Beguinot 1909). Moreover, *R. penzigii* has bracts around 20 mm long – twice the length of any *Romulea* spp. found in Malta (Beguinot 1908).

This concept that *R. melitensis* is a species defined and distinguished by a dark violet perianth with very narrow (1.0–1.5 mm wide) linear tepals and with a yellow throat was then carried into more recent floras such as by Haslam et al. (1977), Marais (1980), Pignatti (1982), Blamey and Grey-Wilson (2004) and Casha (2013). Other authors stated that they can hardly distinguish *R. melitensis* from the other sand crocuses in Malta (Lanfranco 1989, 1995; Lanfranco & Lanfranco 2003)

This ambiguity and confusion for the taxon *R. melitensis*, is primarily caused because the amended description (Beguinot 1908) no longer fitted with the type specimen and original description (Beguinot 1907). Moreover, the collection submitted by Sommier (Dwejra, Gozo) was not the same as collected by Sickenberger (Fort Tigne, Malta) on which the taxon is typified (Beguinot 1907). It is likely that Sommier sent material corresponding to taxon Group M, which was different from the type of *R. melitensis* (i.e. Sickenberger's collection) and Beguinot tried to combine both entities in his revision (Beguinot 1908). This makes *R. melitensis* as *nomen confusum* and explains why specimens with the character set of the revised description are not found in the wild. Given that the type and original description (Beguinot 1907) mismatch with the amended diagnosis (Beguinot 1908), the morphological characters of the type specimen and its corresponding original description should stand for *R. melitensis* in line with Art. 9 note 1 of the ICN (McNeill et al. 2012): “*Any designation made by the original author, if definitely expressed at the time of the original publication of the name of the taxon, is final*”.

The type material collected by Sickenberger (1876) consists of nine specimens divided into two sheets, one with three specimens (barcode G00370314, and here referred to as sheet A) and another with six specimens (barcode G00370315, and here referred to as sheet B). These specimens were originally labelled by Sickenberger as *Trichonema*. Three specimens in sheet A and four specimens in Sheet B possessed flowers. The tepals were indeed very narrow and almost linear with the following measurements: Sheet A: 12.5 × 1.5 mm; 13 × 1.6 mm and 13.5 × 1.7 mm and Sheet B: 14.5 × 1.6 mm; 14.5 × 1.3 mm; 12.0 × 1.5 mm and 12.5 × 2.4 mm. One of the specimens in sheet A retained the yellowish colour of the perianth's throat while three specimens still held, at least partially, their dark violet colour. These characters are all consistent with the protologue's description

(Beguinot 1907). A summary of these differences is given and compared with Taxon Group M in Table 2.

The small habit with short leaves, the small size of the yellow tepals and yellow throat give the impression the collection of Sickenberger is some abnormal and large form of *R. columnae*, but the dark violet colour does not match with that species. Sickenberger's collection is considered to be an atypical *Romulea* which was distinct from the rest of the *Romulea* species around and which led him to collect it. In this synopsis few abnormal specimens that could not be identified have been found and discussed further below. Such plants often have intermediate states of two species and hypothesized to be hybrids, an event that is also documented to be frequent in *Romulea* (Frignani & Iriti 2011). After examining the few characters available, Sickenberger's collection is here considered as a hybrid of *R. columnae* and the species represented by taxon group M.

The population of “*R. melitensis*” from Sicily (Brullo et al. 2009) was found to be identical to the Maltese specimens circumscribed in taxon Group M not to *R. melitensis sensu* Beguinot (1907). The outcome of the Sicilian surveys is documented below. Given the ambiguity of *R. melitensis* Beg., the lack of substantiated records matching the type, and that distinct characters of Taxon Group M differing from *R. melitensis sensu* Beguinot or any other described *Romulea* spp., a new species is here designated to accommodate the Maltese(-Siculo) endemic *Romulea* represented by taxon group M and mistaken in much of the literature as *R. ramiflora*.

### A new *Romulea* from the Maltese islands

***Romulea variicolor*** S. Mifsud, **sp. nov.** (Figures. 3b, 4a, 4b, 4c, 5, 6)

Type: Maltese Islands. San Dimitri area, Gharb, Gozo, on the side of a rural pathway, 100–150 m above sea level (asl), 10 March 2013, S. Mifsud SMIFS-17 [<http://data.rbge.org.uk/herb/E00649009>] (holo, E!).

*Romulea melitensis sensu* Sommier and Caruana Gatto (1915, p. 280), non Beguinot (1907)

*Romulea columnae* var. *melitensis sensu* Borg (1927, p. 704), non Beguinot (1907)

*Romulea columnae* var. *melitensis sensu* Haslam et al. (1977, p. 401), non Beguinot (1907)

*Romulea melitensis sensu* Marais (1980, p. 100), non Beguinot (1907)

*Romulea melitensis sensu* Pignatti (1982, p. 426), non Beguinot (1907)

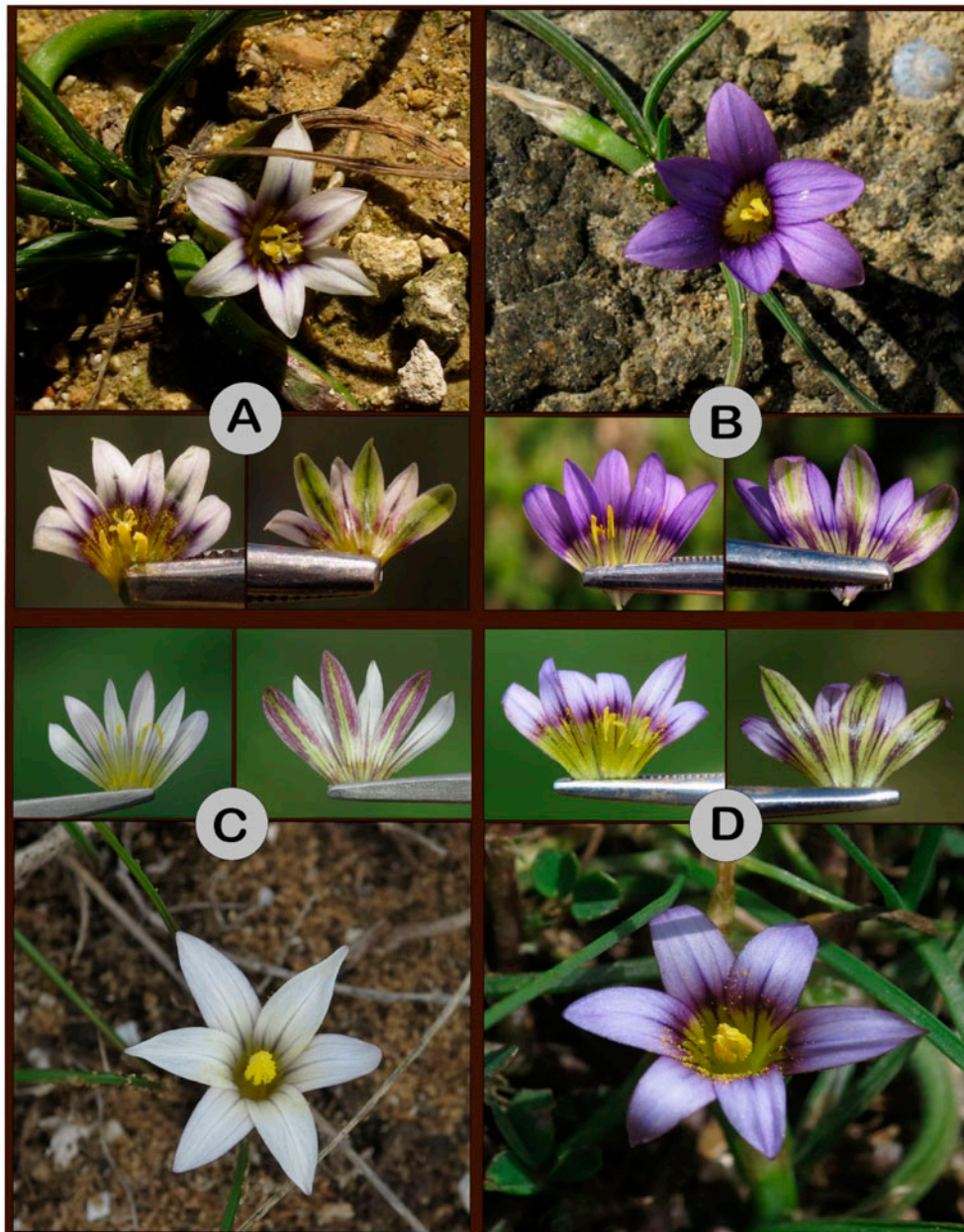
*Romulea ramiflora sensu* Lanfranco & Lanfranco (2003, p. 124–125, fig.169), non Tenore

*Romulea melitensis sensu* Blamey and Grey-Wilson (2004), non Beguinot (1907)

*Romulea ramiflora sensu* Weber (2004, pg.27), non Tenore (1826)

Table 2. Characters differing between the original protologue (Beguinot 1907) and revised description of *R. melitensis* (Beguinot 1908) and comparison with Taxon Group M.

	Description and type (Beguinot 1907)	Diagnosis (Beguinot 1908)	Taxon Group M
Material diagnosed	Sickenberger, Fort Tigne, Sliema.	Sommier, Dwejra Gozo.	Living specimens in Malta and Sicily.
No. of flowers	1	1–2	1–4
Tepal length	13 mm	15–22 mm	15–22 mm
Tepal width	1.0–1.5 mm	1.0–1.5 mm	3–5 mm
Tepal shape	Linear	Linear	Linear to broad lanceolate
Perianth colour	Dark violet	Dark violet	Lilac to Dark violet
Throat colour	Yellow	Whitish	Whitish

Figure 3. (A) *Romulea columnae* (specimen A301e). (B) *Romulea variicolor* var. *variicolor* (specimen C310a). (C) *Romulea rollii* (specimen C216a). (D) *Romulea ramiflora* (specimen C316b).

*Romulea ramiflora* sensu Weber and Kendzior (2006, pg.22), non Tenore (1826)

*Romulea ramiflora* sensu Lanfranco (2007, p. 77, 94), non Tenore (1826)

*Romulea ramiflora* sensu Mifsud (2007a), non Tenore (1826)

*Romulea rollii* sensu Mifsud (2007b), Parlatore (1858)

*Romulea melitensis* sensu Brullo et al. (2009), non Beguinot (1907)

*Romulea melitensis* sensu Frignani and Iriti (2011), non Beguinot (1907)

*Romulea ramiflora* sensu Casha (2013, pp. 99–101), non Tenore (1826)

*Romulea rollii* sensu Casha (2013, p. 103), non Parlatore (1858)

### Description

**Corm:** 8–12 mm diameter; tunic dark brown, glossy, with 3–5 mm long bristles at the apex of the bulb and surmounting the base of the stem. Upper part of bulb attenuate–truncate, base obtuse and rounded. **Stem:** rather short and slender (2–5 cm × 1.5–3 mm) mostly underground. **Leaves:** 4–6, always compressed cylindrical, glabrous, dark green, very variable in habit from suberect to completely prostrate and from slightly curved to C-shaped and sometimes twisted along their longitudinal axis, never coiled or forming an entire loop, normally found arcuate with the distal half resting on the ground; variable in size – widest diameter 1.0–1.5 mm, length (4– in arid areas) 8–20 (–32 cm in shaded areas); each with four tiny respiratory grooves running along its length. **Peduncle:** (4– in exposed areas) 10–20 (–40 mm in vegetated areas). **Bracts:** subequal, 9–12 (–14) mm × 3.5–5 mm; lanceolate. Inferior bract completely herbaceous with a very narrow membranous lining (<1 mm) and prominent parallel longitudinal veins; superior bract (bracteole) with a herbaceous central keel and a broad membranous border; width of herbaceous keel about one-third the entire width of the bracteole, sometimes turning membranous at the basal half; membranous border sometimes tinged with purple streaks. **Perianth:** six tepals in two whorls, subequal, narrow lanceolate and free to broad lanceolate and imbricate, tip subacute to obtuse; and (13–)15–21 (–23) mm long (including the tube 0 by 3.0–4.5 (5.5) mm wide; colour of adaxial side varies from lilac-white to deep violet, with a range of intermediate colours between the two extremes. Throat white to pale green (may appear yellowish with pollen) topped with a dark violet and contrasting ring; veins 3 (–5) per tepal, unbranched with the median vein being the longest and most conspicuous. The abaxial side of inner whorl of tepals is concolorous (or slightly paler) with the adaxial side, but the outer whorl is very variable – from a complete pale green and ash-grey colour (without any violet hue) at one extreme to a completely dark violet colour (without any green hue) at the other extreme and a mixture of these two colour forms in different ratio and patterns, but often consisting of central, narrow green longitudinal band, subfused towards the margin with violet dots, streaks or flushes to a violet edge. Throat glabrous to rarely finely and very shortly subglabrous. **Stamens:** more or less half the length of the

tepals, with deep yellow anthers and white, pale yellow, lilac or rarely violet firm filaments, glabrous above and with few, scanty, short (<1 mm), translucent hairs at the basal third. **Pistil:** superior ovary (3–4 mm long) with a glabrous style, completely white or sometimes turning violet towards the stigmatic end; stigma three branches each divided into two linear segments about 2 mm long, papillate. Style and stamens reaching same level. **Fruit:** trilocular, cylindrical capsule, 6–15 mm long, storing 18–30 seeds. Fruiting peduncle elongated and recurved down towards the ground making the capsule resting or penetrating the soil dehiscing in April–May. **Seeds:** spherical, finely reticulate, amber or orange-brown, 1.8–2.2 mm diameter.

### Etymology

The specific epithet *varicolor* refers to the variable colour forms that the perianth can have. The adaxial side of the perianth can be any colour from lilac to dark purple and the abaxial side can be any colour from pale green to deep purple in many different and often specimen-specific patterns. No other Mediterranean *Romulea* species has this extent of variability in perianth colour.

### Ecology and Distribution

*Romulea varicolor* S. Mifsud is only present in the Maltese archipelago and in the coastal parts of Ragusa, a southern province of Sicily. In Malta, it is frequent in its natural habitats namely steppe and exposed low garrigue, and particularly numerous in coastal areas or in rural pathways or clearings within these habitats. In Sicily it is very rare and restricted only in isolated patches at some rocky coasts between Marina di Modica and Cava d'Aliga. These populations were only found up to 100 m away from the sea. *Romulea varicolor* has not been reported further north and so the species is endemic to the Maltese archipelago and south of Sicily. The species is assessed as Endangered (EN) (IUCN 2012) because it is estimated to be constituted by more than 10,000 plants, but has a strict local distribution on the Maltese islands and few isolated small areas in south of Sicily. It is not excluded that this species originated and evolved primarily in Malta and was introduced in Sicily.

Like some other *Romulea* species, *R. varicolor* is ecotypic, manifesting polymorphism with different environment conditions. Most obvious is the orientation and shape of the leaves that are often linked with water content of the soil and the length of peduncle, which lengthens in shade as an adaptation to surpass surrounding vegetation. Phenology is also related to habitat where in arid conditions, plants blossom and complete their sexual cycle earlier than those in damp conditions. Flowering has been recorded from 28 January (earliest) located in an exposed garrigue in a mosaic with steppe characters to 14 April (latest) found in a semi-wetland area. This long flowering period of taxon group M is

unique among Mediterranean species, which usually have a flowering period of about a month. The vegetative adaptation of *R. variicolor* in different habitats is hence remarkable but variability within any population in the morphological characters of the perianth has been observed to be random and not linked to any environment pressures. These variations are hence considered to be genotypic and are given some taxonomic importance.

#### *Intraspecific variation and taxonomic significance*

Population studies were carried out on *R. columnae*, *R. rollii*, *R. ramiflora* and *R. variicolor*. The first three species resulted in an overall homogeneous morphology, where variation in non-vegetative parts was limited only in saturation of perianth colour and perianth sizes. However *R. variicolor* was distinct in being very variable in some perianth characters: perianth colour (lilac to dark violet); perianth size (14–22 × 2.5–5 mm); tepal shape (linear and free to broad lanceolate and imbricate with tips from rounded and obtuse to sub-acute); stamen filaments (white, pale yellow or lilac); stigmatic end of style (concolorous or different shades of violet); and most importantly the large variation exhibited at the undertepals. Summarized results are given in Table 8.

From several basic population studies of these variable characters, it became evident that *R. variicolor* exist in two forms with a large number of intermediates. These forms are primarily distinguished from the undertepal, where in one form it is completely pale green or ash-white without any violet pigmentation (Figure 2A), and in the other form it is completely dark violet and somewhat glossy, without any green pigmentation (Figure 2C). Gene flow between these forms takes place readily, resulting in specimens with different proportions of green and violet colours in different patterns and hence no intermediate specimen is precisely similar to another (Figure 2B).

Morphological relationships of other characters between these two forms hence (Figure 2A, C) have been found and summarized in Table 3. The violet-undertepal plants tend to have a smaller perianth (also reflected in bract size) with a dark perianth, while the green-undertepal forms have larger and paler perianth segments. At any rate, this is not an exclusive relationship, and different combinations between undertepals, perianth colour and sizes have been found. Exceptional specimens had a dark violet perianth with green undertepals (specimen B302a) or pale flowers with dark violet undertepals (specimen B303a), suggesting that the undertepal colour and colour intensity of the perianth are not as a result of hyperchromy or hypochromy but these characters are controlled independently by genetic influence.

As a whole, *R. variicolor* might represent a hybridogenic species formed by two related and relic species that merged into a single polymorphic species. In this

review, these forms are given taxonomic importance and as a result three varieties are here described, which are primarily distinguished by the colour of the undertepal, of which one is an intermediate of the two varieties.

***Romulea variicolor* var. *mirandae* S. Mifsud var. nov.** (Figure 4a)

Type: Maltese Islands. Gnien Ingraw, Mellicha, Malta, on bare rocky situated at the south side of the valley of Gnien Ingraw, 150–175 m asl, 7 Feb. 2014, S. Mifsud SMIFS-18 [<http://data.rbge.org.uk/herb/E00727276>] (holo, E!).

#### *Description*

Distinct from *R. variicolor* s.l. by having the abaxial face of the outer tepals completely pale green, sometimes turning ash grey towards the margin, always without violet pigmentation; perianth tends to be larger (16–22 mm) and with a paler violet colour.

#### *Etymology*

Variety named after the author's daughter, Miranda.

***Romulea variicolor* var. *martynii* S. Mifsud, var. nov.** (Figure 4b)

Type: Maltese Islands. San Dimitri area, Gharb, Gozo, on the side of a rural pathway, 100–150 m asl, 10 Mar. 2013, S. Mifsud SMIFS-15 [<http://data.rbge.org.uk/herb/E00649008>] (holo, E!).

#### *Description*

Distinct from *R. variicolor* s.l. by having the abaxial face of the outer tepals completely dark violet, glossy, without green pigmentation; perianth tends to be smaller perianth (14–16 mm) and with a dark violet colour.

#### *Etymology*

Variety named after the author's son, Martyn.

***Romulea variicolor* S. Mifsud var. *variicolor*** (Fig. 4c)

Type: Maltese Islands. San Dimitri area, Gharb, Gozo, on the side of a rural pathway, 100–150 m asl, 10 Mar. 2013, S. Mifsud SMIFS-16 [<http://data.rbge.org.uk/herb/E00649009>] (holotype E!).

#### *Description*

Distinct from *R. variicolor* s.l. and the other varieties by having the abaxial face of the outer tepals made of patterns composed of both violet and green colours; perianth size and colours within the entire range of *R. variicolor* s.l.

#### *Etymology*

The epithet *variicolor* refers to the variable colour forms that the perianth can have, including the mixed green and violet colours of the undertepals.

Table 3. Comparison of morphological characters of the two varieties of *R. variicolor*.

		<i>Romulea variicolor</i>		
		Green undertepal	Green & Violet undertepals	Violet undertepal
Sample No.		37	410	37
Bract Length	<b>Average</b>	<b>11.0</b>	<b>10.7</b>	<b>10.4</b>
	Range	10.1–11.9	9.8–11.6	9.4–11.4
	St. Dev	1.2	1.1	1.2
Tepal Length (mm)	<b>Average</b>	<b>17.1</b>	<b>16.1</b>	<b>15.5</b>
	Range	15.1–19.1	14.3–17.9	13.4–17.7
	St. Dev	2.5	2.3	2.6
Tepal Width (mm)	<b>Average</b>	<b>3.9</b>	<b>3.7</b>	<b>3.6</b>
	Range	3.6–4.2	3.3–4.1	2.9–4.2
	St. Dev	0.5	0.5	0.7
Perianth colour index	<b>Average</b>	<b>2.6</b>	<b>3.4</b>	<b>4.1</b>
	Range	1.5–3.7	2.4–4.3	3.3–4.9
	St. Dev	1.3	1.1	1.0

### Lectotypification of *Romulea melitensis*

As mentioned in detail above, *R. melitensis* was described on a collection of nine specimens of *Romulea* by Sickenberger (14 February 1876, Fort Tigne, Malta) and deposited in Herborisations du Levant, Barbey-Bossier [HB]. The protologue (Beguinot 1907) makes no reference to which specimen the taxon is typified. According to the typification rules Section 2, Art.9 of the ICN (McNeill et al. 2012), one specimen shall be chosen and typified as a lectotype and for this purpose, the first specimen (from the left) of the herbarium sheet G00370314 (H) is designated here as a lectotype for *R. melitensis* Beg. The colour of the throat, and the shape and dark violet colour of the tepals are best represented and preserved in this selected specimen.

### Investigation of *Romulea* spp. at the south coast of Sicily

Surveys have been carried out on the south coast of Sicily. The following *Romulea* spp. were found in the provinces of Ragusa and Siracusa:

- *Romulea rollii*: Marina di Modica, Modica, Ragusa (25-Feb-2012, 16-Feb-2014)\*; Sampieri (Pisciotta area), Scicli, Ragusa (17-Feb-2014)\*; Rocky area west of Sampieri beach, Scicli, Ragusa (19-Feb-2014)\*.
- *Romulea bulbocodium*: Riserva Naturale di Vendicari, Noto, Siracusa (12-Mar-2011); between Marina di Modica and Sampieri, Modica, Ragusa (24-Feb-2012, 16-Feb-2014).
- *Romulea ramiflora*: between Sampieri and Marina di Modica, Modica, (close to Pisciotta area) Scicli, Ragusa (16-Feb-2014)\*.
- *Romulea variicolor*: Sampieri (Pisciotta area), Scicli, Ragusa (24-Feb-2012, 17-Feb-2014); Rocky area west of Sampieri beach, Scicli, Ragusa (19-Feb-2014)\*; Spiaggetta Sampieri (rocky area west of beach), Scicli,

Ragusa (19-Feb)\*; Cava d'Aliga, Scicli, Ragusa (21-Feb-2014)\*

\*New records for Sicily based on records by Giardina et al. (2007) and Brullo et al. (2009).

*Romulea rollii* was found in sparingly vegetated sandy soil (Marina di Modica) or in shallow sandy soil with scarce accompanying vegetation (Spiaggetta di Sampieri). It was frequent but very local in isolated patches. Only one population of *R. ramiflora* was found between Marina di Modica and Sampieri in damp rocky soil on a passage close to a summer residence area. *Romulea variicolor*, was restricted to non-sandy, exposed, sub-halophytic, karstic rock close to the coast. Its extent stops when the habitat becomes sandy or crowded with plants, and so it appears to be less adapted to compete with surrounding vegetation than the population in Malta. Although these surveys in south Sicily were not extensive, *R. variicolor* was not found on garrigue/steppe areas where it was often found in Malta.

Comparing the population of *R. variicolor* in Sicily with that in Malta, a few slight differences were noted in the former as follows:

1. Tepals are broader, imbricate and with rounded blunt tips.
2. Range of length of perianth slightly shorter (15–18 mm) instead 14–22 mm.
3. Colour of perianth varies less and there were fewer incidences of var. *martynii* and var. *mirandae*
4. The herbaceous portion of the bracteole was often observed to be weaker (Type C) and hence more scarious in nature, especially at the base.
5. Terata much more frequent.

At this stage, these differences are considered to be weak for any taxonomic considerations resulting in a new infraspecific taxon of *R. variicolor* for the Sicilian



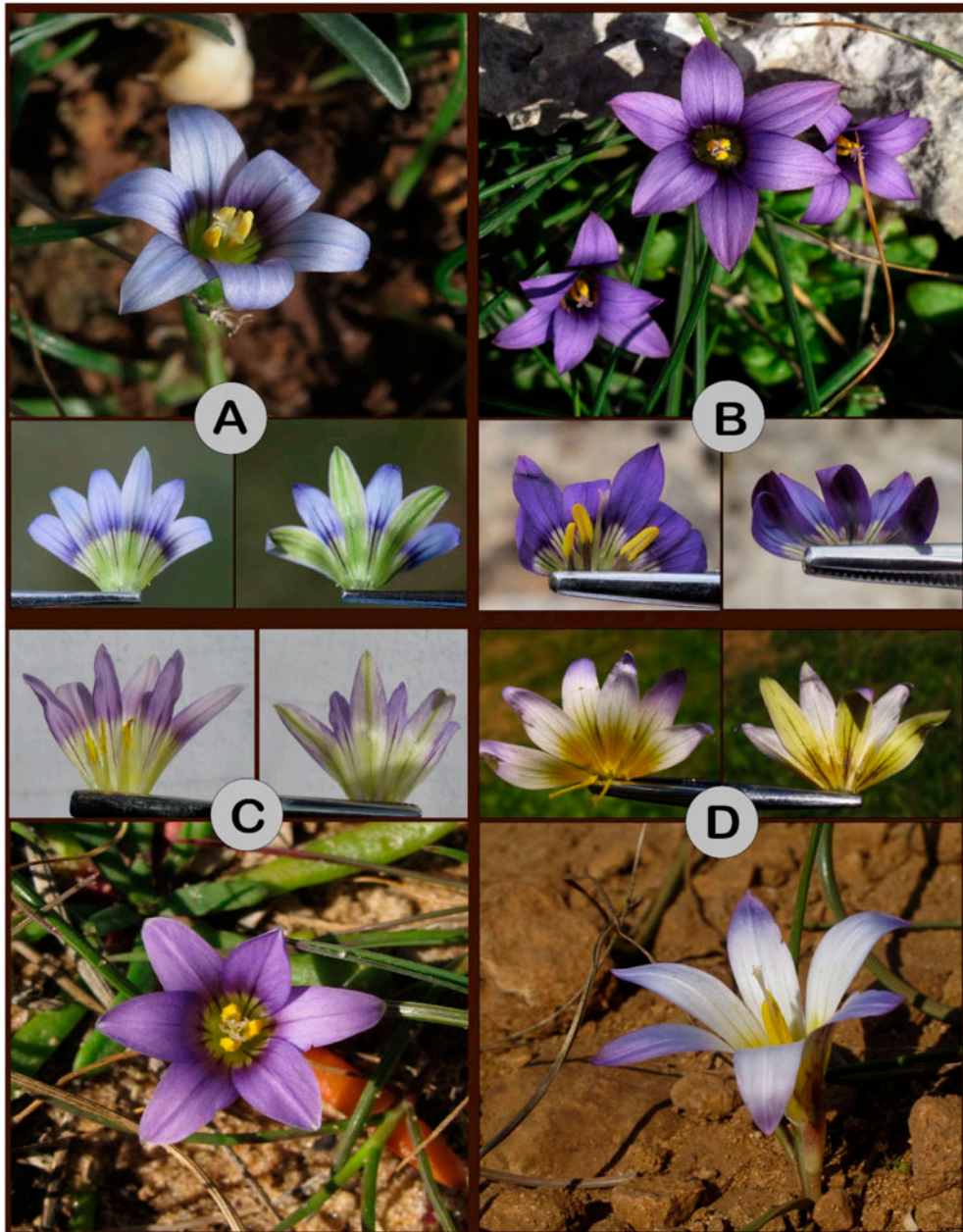


Figure 4. (A) *Romulea variicolor* var. *mirandae* (specimen C206a). (B) *Romulea variicolor* var. *martyinii* (specimen B312b). (C) *Romulea variicolor* var. *variicolor* (specimen B227a). (D) *Romulea bulbocodium* (from Vendicari nature reserve, Noto, Syracuse, Sicily, Mar 2011).

population. The Sicilian specimens seem to be a narrower and more homogeneous subset population of the much variable population in Malta. For example, specimens with broad imbricate tepals are found in Malta, but the frequency of this character in the Sicilian population is higher. A more detailed population study might be co-ordinated with Sicilian scientists to provide further clarifications.

More interesting is the frequent finding of terata specimens (see below) in the Sicilian populations. At least 20 specimens were observed in Ragusa, compared with just one (Rdum tal-Madonna, Mellieha) in Malta, considering that the number of specimens examined or

observed in Malta is about 20 times that in Sicily. Finally, a patch of about 10 specimens that could not be placed within any taxon group (or species) were found within the *R. variicolor* population. These unplaced specimens and others found in Malta often had a character set that did not fully match any species, and are dealt with in detail below.

#### Additional Taxonomic notes

##### *Notes on R. bulbocodium from the Maltese islands*

Upon examining several specimens of *R. bulbocodium* s.l. in Ragusa, Sicily it was confirmed that this species does

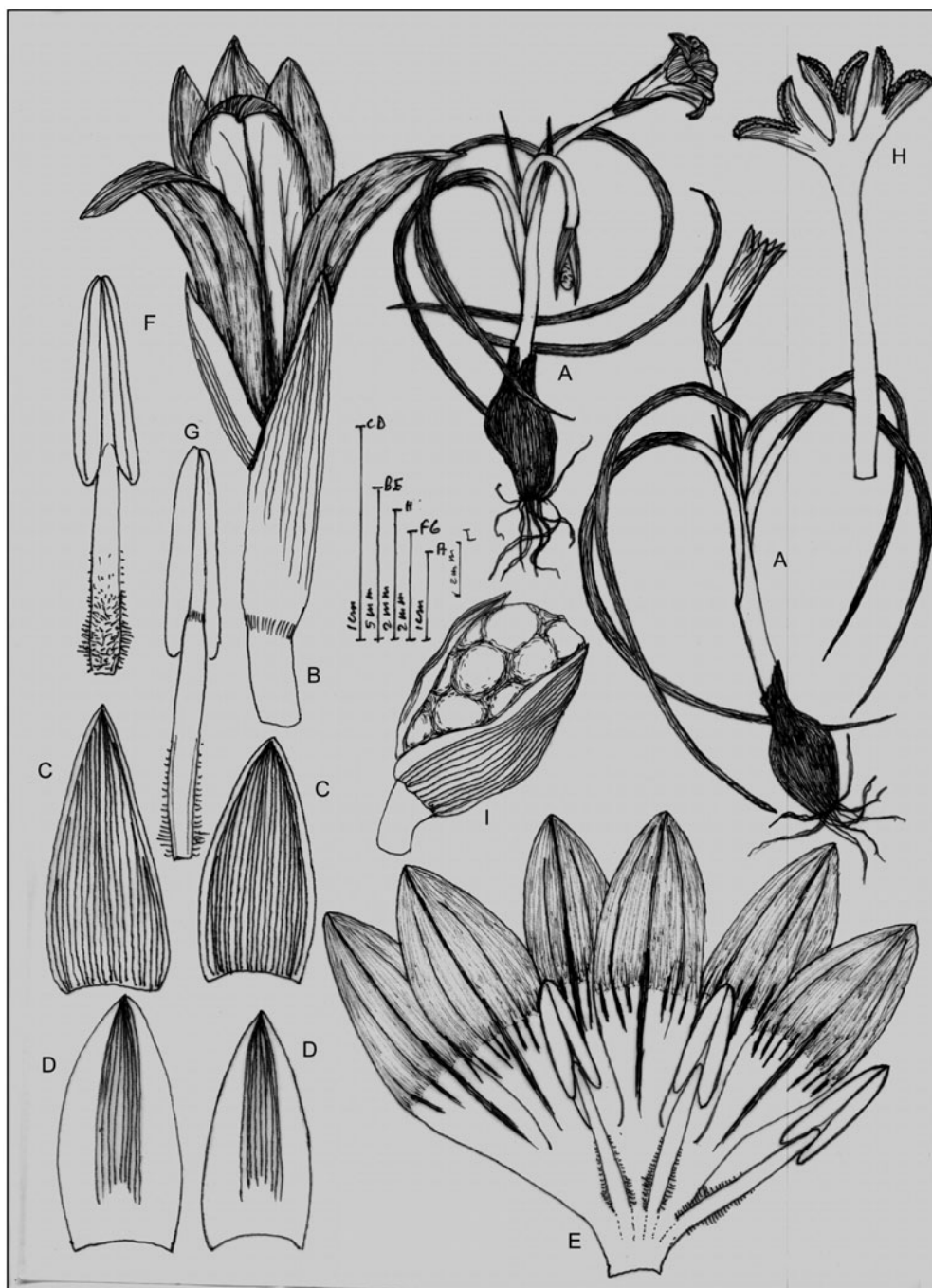


Figure 5. Line drawing representing *Romulea variicolor* from Sampieri, Sicily. Courtesy of Prof. Salvo Brullo.

not exist in Malta. Despite the morphological variability of the species, no specimen from Malta can vaguely be ascribed to *R. bulbocodium*. This species is easily distinguished by having larger tepals, with a conspicuous large yellow throat, rose undertepals and styles well above the anthers by 3–7 mm: it cannot be mistaken with any other *Romulea* spp. occurring in Malta. The suspicions that the historical records were a misidentification (Sommier & Caruana Gatto 1915) are therefore supported here.

The specimens reported as *R. bulbocodium* and illustrated by the present author on his website (Mifsud 2010) based on a specimen having styles slightly longer

from the anther ring is now admitted to be a misidentification of *R. variicolor*. Although it is one of the most common *Romulea* species in Sicily (Giardina et al. 2007), and is also present in North Africa (Frignani & Iiriti 2011), *R. bulbocodium* does not presently occur on the Maltese islands, and it is suggested that it be removed from the Maltese flora.

#### **Taxonomic notes on *Romulea rollii***

First, upon examining *R. rollii* in Ragusa, it was concluded that the species does not occur in Malta. Apparently, since pioneer Maltese botanists perceived

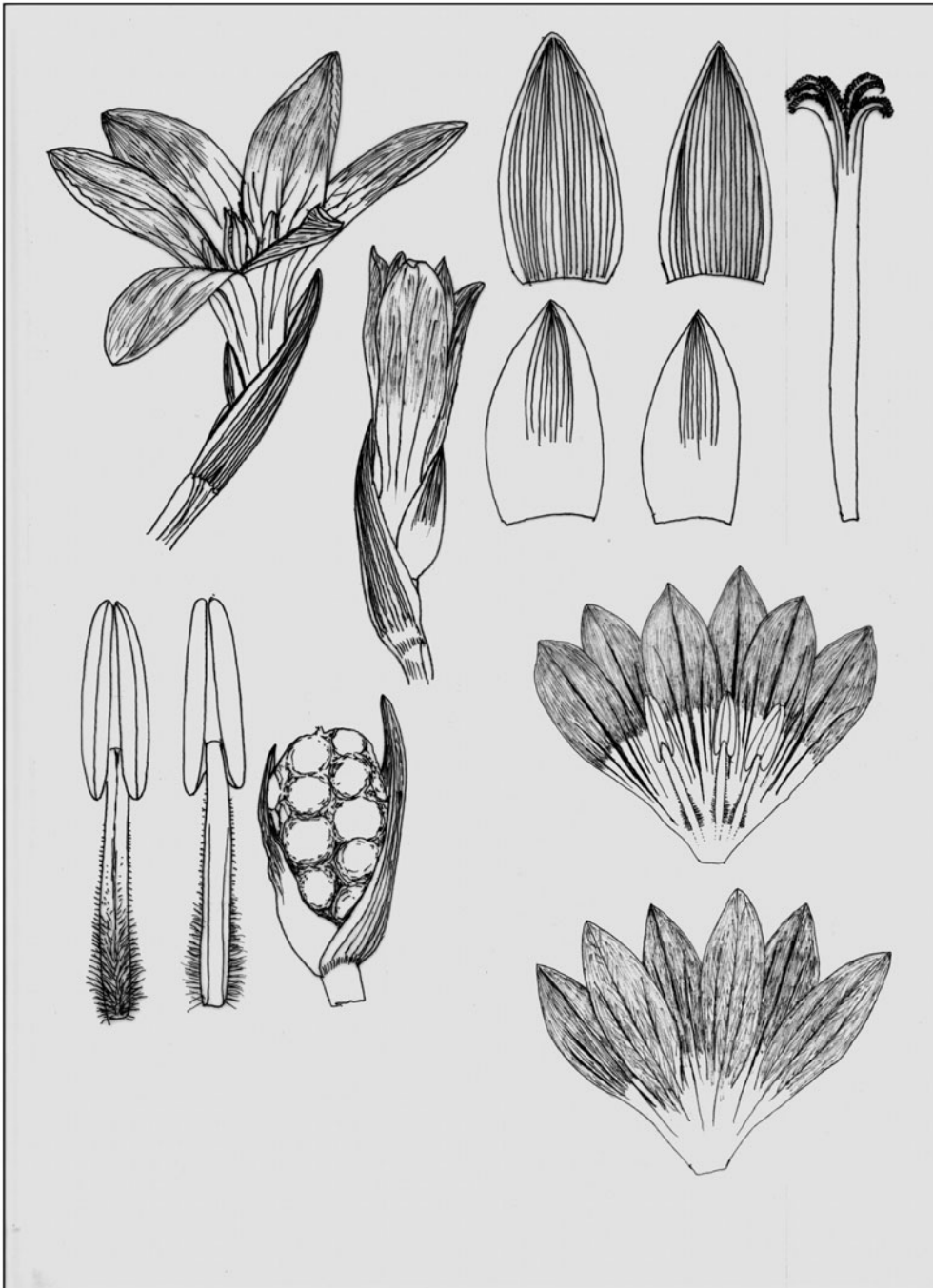


Figure 6. Line drawing representing *Romulea variicolor* from Malta. Courtesy of Prof. Salvo Brullo.

*R. melitensis* to have dark violet tepals, and since *R. ramiflora* has a vibrant rose-violet colour, whereas *R. columnae* have a much smaller perianth, it is believed that the pale-flowered forms of *R. variicolor*, like those in Figure 1B (index 1) were then considered as *R. rollii*. Unless typical specimens are substantiated, *R. rollii* does not presently occur on the Maltese islands, and it is suggested that it be removed from the Maltese flora.

In addition, some taxonomic observations have resulted from this study. *Romulea rollii* Parl. was described from littoral habitats in Latium (Parlatore 1858). It was maintained at its species rank by the

revision of Beguinot (1908, 1909) but was relegated as a subspecies of *R. columnae* by Marais (1975) without any explanation to support this treatment. Some authors had also synonymized *R. rollii* as *R. columnae* (Cardeil Sanz 2013) but the current taxonomic status on Tropicos.org (2014) and ThePlantList.org (2014) is *R. columnae* subsp. *rollii* in accordance with Marais (1975), Giardina et al. (2007) and Frignani and Iiriti (2011).

In this study, both *R. columnae* and *R. rollii* were examined: the two species are very distinct from each other. Many major differences are found in the habitat, habit, leaves, flowers and fruit. *Romulea rollii* is restricted

to vegetated sand dunes, whereas *R. columnae* is found in arid foothpaths and exposed rock. *Romulea rollii* have slender leaves (diameter of 0.6–0.9 mm), much longer (about three to five times longer than *R. columnae*), paler and normally straight or slightly curved. The cross section of *R. rollii* is squarish–circular with a length : width ratio of 1.1, whereas it is more compressed and elliptic with a length : width ratio of 1.5 in *R. columnae*. While both species have membranous bracteoles, (and perhaps that is what instigated Marais (1975) and Giardina et al.

(2007) in their combination), they are much larger in *R. rollii* and the central sub-herbaceous portion was reddish-mauve in the specimens examined in Ragusa.

The flowers of *R. rollii* are distinctly larger, with an average tepal length of 16 mm compared with 11 mm in *R. columnae*, and the throat is pale yellow, not golden as in *R. columnae*. *Romulea rollii* does not have a dark violet ring above its throat and its veins are weakly pigmented and inconspicuous. Both species have white to lilac tepals, but the undertepals are very different:



Figure 7. Specimens with morphological characters that could not be placed in any circumscribed taxa. (A) Specimen B224g with characters from *Romulea variicolor* and *R. ramiflora*; (B) B302h with characters from *R. columnae* and *R. variicolor*. (C) A213b with characters from *R. columnae* and *R. variicolor*. (D) A331c which superficially resembles an intermediate between *R. columnae* and *R. ramiflora*. (E) An example of few aberrant specimens met in this study within the variable *R. variicolor*.



Figure 8. Examples of terata of *Romulea variicolor* sharing an odd morphology with four tepals (two of which are often wider and hence indicating fusion of two adjacent tepals) and lack of one of the three stamens. These forms were often albinos.

Table 4. Anatomical and cytological data of leaves of *Romulea* species from Malta and Sicily.

Species	LEAF ANATOMY														
	n	Diameter longest side (mm)	Diameter shortest side (mm)	L:W ratio	Leaf Circumference (µm)	Cross sectional area (mm <sup>2</sup> )	Cuticle thickness (µm)	Epidermis thickness (µm)	Length of largest V.B. (µm)	Width of largest V.B. (µm)	Area of largest V.B. (µm)	Respiratory groove length (µm)	Papillae diameter (µm)	% groove to leaf circum.	% V.b. to leaf area
<i>columnnae</i> (mt) (Fig. 9)	5	1.23	0.67	1.84	3101	0.65	8.1	19.8	171	113	15,172	414	7.64	53.4	2.46
<i>varicolor</i> (mt) (Fig. 10)	5	1.28	0.74	1.74	3289	0.76	11.5	20.5	196	133	20,650	511	8.26	62.6	2.89
<i>varicolor</i> (si) (Fig. 11)	5	1.39	0.81	1.72	3578	0.88	10.0	27.0	215	148	24,875	679	9.00	76.0	2.7
<i>ramiflora</i> (mt) (Fig. 12)	5	1.28	0.75	1.71	3283	0.76	12.7	20.2	185	137	20,037	597	8.37	71.3	2.71
<i>ramiflora</i> (si) (Fig. 13)	5	1.37	0.81	1.69	3545	0.89	8.7	23.6	218	163	28,148	554	8.88	63.3	3.31
<i>rollii</i> (si) (Fig. 14)	5	0.82	0.71	1.16	2470	0.46	5.4	15.4	193	135	20,463	423	7.02	68.4	4.52

Table 5. Results of measurements of filament hairs and pollen of *Romulea* spp.

Species	HAIR on filament base					POLLEN							
	n	Min length (µm)	Max length (µm)	Average length (µm)	Tepal length : Hair length ratio	n	Min length (µm)	Max length (µm)	Mean length (µm)	Min width (µm)	Max width (µm)	Mean width (µm)	Mean L:W ratio
<i>columnae</i>	24	50	130	90	8.2	37	42.5	62.5	52.1	37.5	57.5	46.5	1.12
<i>variicolor</i> (mt)	47	80	520	300	17.6	119	45.7	72.5	55.6	35.0	61.4	49.2	1.14
<i>variicolor</i> (si)	45	110	450	290	17.1	91	47.5	77.5	60.6	42.5	67.5	53.1	1.14
<i>ramiflora</i> (mt)	96	220	470	220	16.9	124	46.3	67.5	55.3	42.5	60.0	49.9	1.11
<i>ramiflora</i> (si)	29	110	420	270	20.8	35	42.5	60.0	52.3	35.0	57.5	46.3	1.14
<i>rollii</i>	66	180	400	340	17.9	41	52.5	72.5	60.6	45.0	65.0	54.7	1.11

*R. rollii* has a characteristic green keel, followed by a deep purple-mauve colour that gradually (sometimes abruptly) flushes away to a white margin (Type E, Figure 2); in *R. columnae* it is yellowish-green with slender dark violet-maroon streaks at the centre and base (Type D, Figure 2). Finally, the flowers of *R. columnae* are always subtended by subsessile to very short scape (sometimes flowers are at ground level), but the scape of *R. rollii* is very long, at least 2 cm, and elongates during fruiting up to 20 cm. Due to these numerous and taxonomically important differences, it is strongly suggested that *R. rollii* is erected back to species level.

Besides that, another related sand dune taxon described from Sicily is *R. tenuifolia* Tod. Ex Lojac. (Fl. Sicula 3: 63; 1909). In his revision of *Romulea*, Beguinot (1909) included *R. tenuifolia* in *R. rollii* but the geographical gap at Basilicata and Calabria (Conti et al. 2005) leaves a doubt as to whether the southern population is different from that in central mainland Italy; a doubt also expressed by Giardina et al. (2007). Further studies are currently being carried out to confirm if Beguinot's treatment to synonymize *R. tenuifolia* with *R. rollii* was correct.

### Anatomical and cytological studies

Cytological investigations were carried out on the leaves, filament hairs and pollen of the species in this study (Tables 4 and 5) to find direct relationships or new characters attributed to *Romulea* species in this study. It would also give first cytological results of the newly described Maltese endemic to science and probably to the understudied species *R. rollii*.

### Leaves

Dissected leaves, either fresh or rehydrated from dry specimens with 5% NaOH were sliced in several thin sections with a sharp blade, mounted in water, and examined with a stereomicroscope. Biometric studies were carried out by measuring characters from microscopic images using ImageJ software. The states of the following anatomical characters were recorded: longest and shortest diameter of leaf cross section and of the largest vascular bundle; depth of cuticular and epidermal layer; length of curvature of respiratory groove and diameter of papillae. From these results, the percentage ratio of groove length to leaf diameter and ratio of the

area of the large vascular bundle with the area of the leaf section were extrapolated.

The results from a sample of five leaves from each species are presented in Table 4. Microscopic images of the leaf cross section of each species is displayed in Figures 9 (*R. columnae*), 10 (*R. variicolor* from Malta), 11 (*R. variicolor* from Sicily), 12 (*R. ramiflora*) and 13 (*R. rollii*). A line drawing of the cross section of a leaf of *R. variicolor* is shown in Figure 14, drawn by Prof. Salvo Brullo and kindly supplied to be included in this paper.

The results clearly show that overall, there is no significant difference in leaf anatomy between *R. columnae*, *R. variicolor* and *R. ramiflora*. Small differences include a smaller groove area in *R. columnae* (53% versus 63–76% in the other species) and variations in cuticle thickness. The most significant distinction is clearly in the leaf cytology of *R. rollii*, which differs from the other studied species. Major differences are the smaller leaf cross-sectional area, a more circular outline (length : width ratio close to 1); a remarkably thinner cuticle and epidermal layer, and larger area of vascular bundle in relation to the leaf cross-sectional area (4.5% compared with 2.5–3.3% in the other species). Anatomical differences of taxonomic importance are hence also found between *R. rollii* and *R. columnae* with which *R. rollii* is sometimes synonymized (see Discussion below).

Differences between the Maltese and Sicilian populations were not detected except in variations of cuticle depth. In both *R. ramiflora* and *R. variicolor*, the Maltese populations have a slightly thicker cuticle layer and thinner epidermis layer, variations linked to the different environments of the two populations.

### Filament hairs and pollen characters

Using image-measuring software (ImageJ) the length of the longest hair growing at the base of the stamen filaments and the shape and size of the pollen were compared between the *Romulea* species carried out in this study. The results are displayed in Table 5.

The pollen shape and size were found to be similar in all species, ranging between 52–60 × 46–54 µm and a Q-ratio of about 1.1. Filament hair is more diagnostic

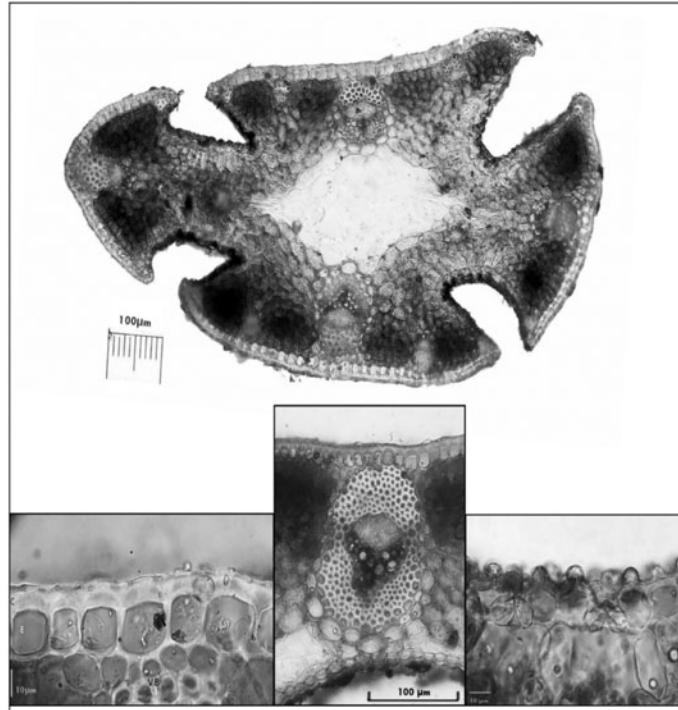


Figure 9. Leaf cytology of *Romulea columnae* showing an entire cross section (top image); cuticle and epidermis (lower left image); main vascular bundle (lower central image) and papillae of epidermal cells in the respiratory groove (lower right image).

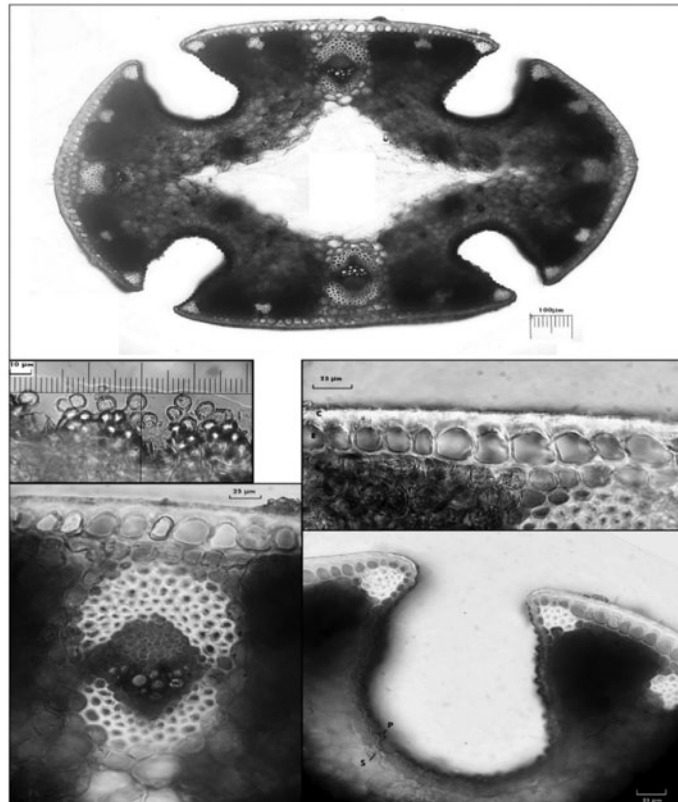


Figure 10. Leaf cytology of *Romulea variicolor* (Maltese population) showing an entire cross section (top image); papillae (p) and stomata (s) of epidermal cells in the respiratory groove (middle left image); cuticle and epidermis (middle right image), main vascular bundle (lower left image) and outline of respiratory groove (lower right image).

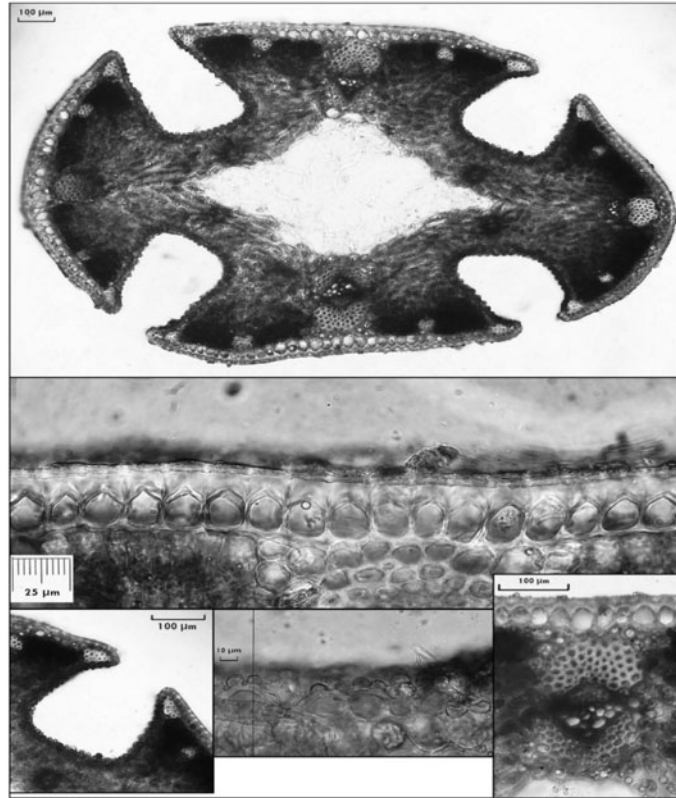


Figure 11. Leaf cytology of *Romulea variicolor* (Sicilian population) showing an entire cross section (top image), cuticle and epidermis (middle image); outline of respiratory groove (lower left image); papillae of epidermal cells (lower central image, main vascular bundle (lower right image).

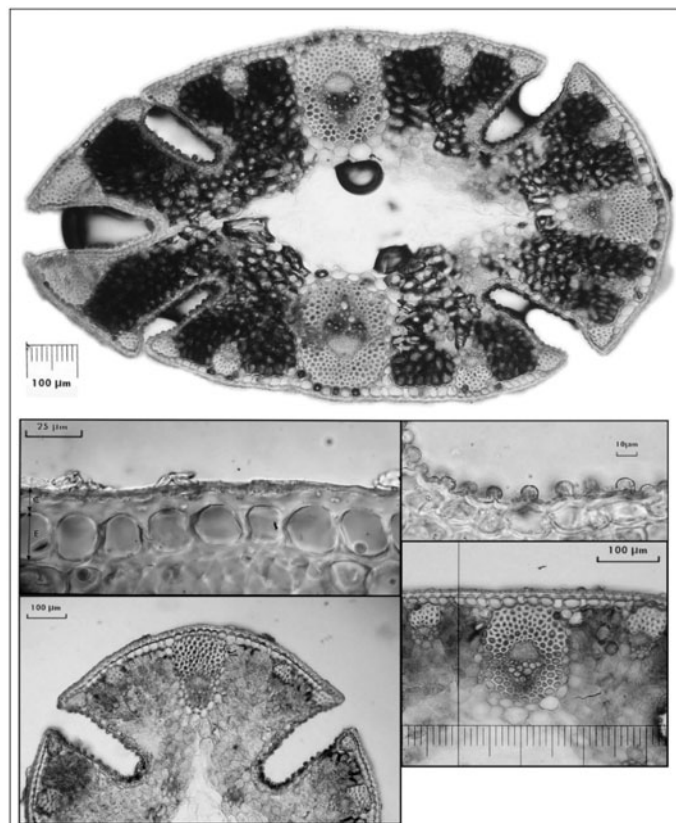


Figure 12. Leaf cytology of *Romulea ramiflora* (Maltese population) showing an entire cross section (top image), cuticle and epidermis (middle left image); papillae of epidermal cells (middle right image); outline of respiratory grooves (lower left image) and main vascular bundle (lower right image).



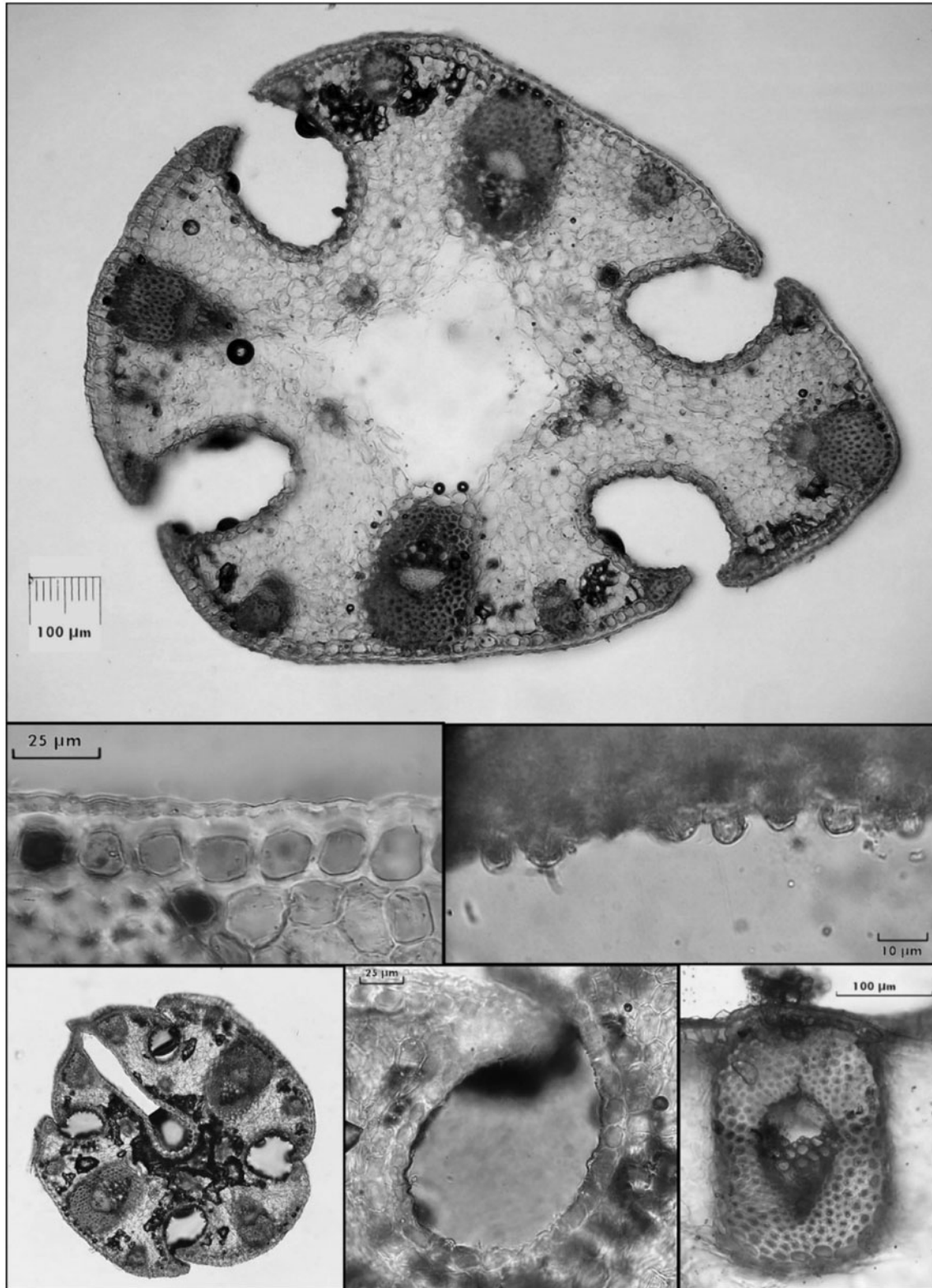


Figure 13. Leaf cytology of *Romulea rollii* showing an entire cross section (top image), cuticle and epidermis (middle left image); papillae of epidermal cells (middle right image), entire cross section showing the circular uncompressed outline (lower left image); outline of respiratory grooves (lower central image) and main vascular bundle (lower right image).

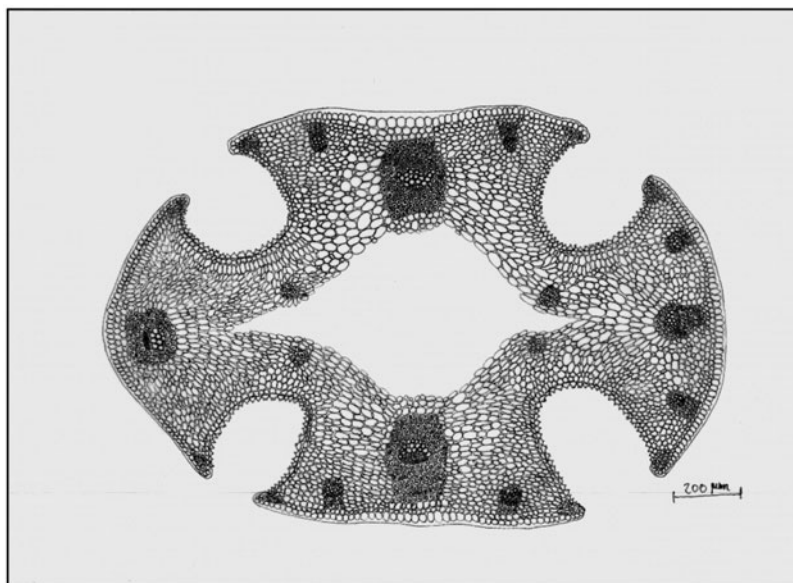


Figure 14. Line drawing of a foliar cross section of *Romulea variicolor*. Courtesy of Prof. Salvo Brullo.

where it was found to be very short in *R. columnae* (90  $\mu\text{m}$ ) and so not visible to the naked eye and about 0.3–0.5 mm in the other species. The difference between *R. columnae* and *R. rollii* with filament hairs measuring on average 90  $\mu\text{m}$  and 340  $\mu\text{m}$ , respectively, is once again remarkable.

#### Other specimens outside circumscribed taxa

##### *Terata and albino specimens*

During this study, a number of aberrant specimens of *R. variicolor* have been encountered. These can be divided into two types: exceptional specimens that their character set would not fit within any delimited taxon groups and specimens that showed a constant morphological pattern of monstrosity (Figure 8). With regards the latter case, some 20 specimens were encountered from Sicily (e.g. specimens C217e, 218b, 218c and C220e) and only one from Malta (specimen C408e). All these specimens presented themselves with four tepals, two of which were much wider and two stamens. Many were albinos. In one particular spot in Pisciotto, Modica (Sicily), seven terata were present within an area of about 10  $\times$  10 m of which five were albinos. The habit, leaves and bracts of the plants were normal.

##### *Specimens not fitting within delimited taxon groups*

The morphological characters of seven specimens did not match any of the four circumscribed species. These specimens exhibited mixed characters of two species. Four of these specimens were found from the same site in Sampieri, Sicily (B224g, B225b, C216g,

C217f). Specimens A213b, A331c, B302b and B302h (the latter two from same site in Dingli), were recorded from Malta.

The Sicilian specimens had a light violet perianth with a yellow throat (characters of *R. ramiflora*), and their tepals had blunt-obtuse tips and were 14–16 mm long (characters of *R. variicolor*). More interesting was the undertepal pattern, which was unique and interpreted as a mix of both species (see Figure 7A). Both *R. ramiflora* and *R. variicolor* were found in this site and further studies querying if these are hybrids is being carried out.

B302b and B302h (Figure 7b) both had the habit of *R. columnae*, growing in tufts with many flowers. The short peduncles, a yellow throat and a membranous bracteole are also similar to those found in *R. columnae*. B302b had a very pale violet perianth while B302h was intense violet (not typical of *R. columnae*). The size of the tepals was 12.5  $\times$  3 mm and 13.5  $\times$  3.5, respectively, somewhat between the mean size of *R. columnae* and *R. variicolor*. The undertepal was completely dark violet (type C) and hence characteristic of *R. variicolor* var. *martynii* in B302h and resembling *R. columnae* (type D) in B302b. The filaments were mustard yellow (as in *R. columnae*) and distinctly hairy, unlike *R. columnae* which are glabrous. Both *R. variicolor* and *R. columnae* grew together on the same spot and hence the hypothesis that these represent *R. columnae*  $\times$  *R. variicolor* hybrids is currently being studied. Interestingly, specimen B302h is in fact very close to the description of *R. melitensis sensu* Beguinot.

Similarly, specimen A213b (Figure 7c) shared characters of both *R. columnae* and *R. variicolor* with a completely scarious bracteole, acute tepal tips and pale

Table 6. Material from Malta and South Sicily examined for 18–22 characters.

Code	Island	Locality	Toponym	Alt	Year	Date	Code	Island	Locality	Toponym	Alt	Year	Date
A205a	Malta	Dingli	Tal-Madalena	5	2011	05-Feb	<b>B302a</b>	Malta	Dingli	Bittija	5	2012	02-Mar
A205b	Malta	Dingli	Tal-Madalena	5	2011	05-Feb	<b>B302b</b>	Malta	Dingli	Bittija	5	2012	02-Mar
A205c	Malta	Dingli	Tal-Madalena	5	2011	05-Feb	<b>B302c</b>	Malta	Dingli	Bittija	5	2012	02-Mar
A205d	Malta	Mellieha	Wied il-Mizieb	4	2011	05-Feb	<b>B302d</b>	Malta	Dingli	Bittija	5	2012	02-Mar
A206a	Gozo	Xewkija	Ta' Blankas	3	2011	06-Feb	<b>B302e</b>	Malta	Dingli	Bittija	5	2012	02-Mar
A206b	Gozo	Xewkija	Ta' Blankas	3	2011	06-Feb	<b>B302f</b>	Malta	Dingli	Bittija	5	2012	02-Mar
A207a	Gozo	Gharb	San Dimitri	3	2011	07-Feb	<b>B302g</b>	Malta	Dingli	Bittija	5	2012	02-Mar
A207b	Gozo	Gharb	San Dimitri	3	2011	07-Feb	<b>B302h</b>	Malta	Dingli	Bittija	5	2012	02-Mar
A210a	Malta	Mellieha	Gnien Ingraw	4	2011	10-Feb	<b>B302i</b>	Malta	Mellieha	Ghajn Tuta	1	2012	02-Mar
A210b	Malta	Mellieha	Gnien Ingraw	4	2011	10-Feb	<b>B303a</b>	Malta	Zurrieq	Ta' Wied Moqbol	2	2012	03-Mar
A210c	Malta	Mellieha	Gnien Ingraw	4	2011	10-Feb	<b>B303b</b>	Malta	Zurrieq	Ta' Wied Moqbol	2	2012	03-Mar
A210d	Malta	Mellieha	Gnien Ingraw	4	2011	10-Feb	<b>B303c</b>	Malta	Zurrieq	Ta' Wied Moqbol	2	2012	03-Mar
A213a	Gozo	Nadur	Qortin tal-Magun	3	2011	13-Feb	<b>B303d</b>	Malta	Zurrieq	Ta' Wied Moqbol	2	2012	03-Mar
A213b	Gozo	Nadur	Qortin tal-Magun	3	2011	13-Feb	<b>B303e</b>	Malta	Zurrieq	Ta' Wied Moqbol	2	2012	03-Mar
A213c	Gozo	Nadur	Qortin tal-Magun	3	2011	13-Feb	<b>B303f</b>	Malta	Zurrieq	Ta' Wied Moqbol	2	2012	03-Mar
A213d	Gozo	Nadur	Qortin tal-Magun	3	2011	13-Feb	<b>B312a</b>	Gozo	Mgarr	Zewwieqa	1	2012	12-Mar
A213e	Gozo	Qala	Tat-Taksis	3	2011	13-Feb	<b>B312b</b>	Gozo	Mgarr	Zewwieqa	1	2012	12-Mar
A213f	Gozo	Qala	Tat-Taksis	3	2011	13-Feb	<b>B316a</b>	Malta	St.Paul's Bay	Ballut tal-Wardija	4	2012	16-Mar
A213g	Gozo	Qala	Tat-Taksis	3	2011	13-Feb	<b>B316b</b>	Malta	St.Paul's Bay	Ballut tal-Wardija	4	2012	16-Mar
A213h	Gozo	Qala	Tat-Taksis	3	2011	13-Feb	<b>B316c</b>	Malta	St.Paul's Bay	Ballut tal-Wardija	4	2012	16-Mar
A215a	Gozo	Xaghra	Qasam Barrani	4	2011	15-Feb	<b>B316d</b>	Malta	St.Paul's Bay	Ballut tal-Wardija	4	2012	16-Mar
A215b	Gozo	Xaghra	Qasam Barrani	4	2011	15-Feb	<b>B316e</b>	Malta	St.Paul's Bay	Ballut tal-Wardija	4	2012	16-Mar
A215c	Gozo	Xaghra	Ghajn Damma	4	2011	15-Feb	<b>B318a</b>	Gozo	Mgarr	Zewwieqa	1	2012	18-Mar
A215d	Gozo	Xaghra	Ghajn Damma	4	2011	15-Feb	<b>B318b</b>	Gozo	Mgarr	Zewwieqa	1	2012	18-Mar
A216a	Malta	Mgarr	Bingemma	3	2011	16-Feb	<b>C202a</b>	Gozo	Xewkija	Ta' Blankas	3	2014	2-Feb
A216b	Malta	Mgarr	Bingemma	3	2011	16-Feb	<b>C202b</b>	Gozo	Xewkija	Ta' Blankas	3	2014	2-Feb
A216c	Malta	Mgarr	Bingemma	3	2011	16-Feb	<b>C206a</b>	Malta	Marfa	Paradise Bay area	1	2014	06-Feb
A219a	Malta	M'xiokk	Xrob l-Ghagin	2	2011	19-Feb	<b>C206b</b>	Malta	Marfa	Paradise Bay area	1	2014	06-Feb
A219b	Malta	M'xiokk	Xrob l-Ghagin	2	2011	19-Feb	<b>C206c</b>	Malta	Marfa	Paradise Bay area	1	2014	06-Feb
A219c	Malta	M'xiokk	Xrob l-Ghagin	2	2011	19-Feb	<b>C206d</b>	Malta	Marfa	Rdum tal-Madonna	1	2014	06-Feb
A221a	Gozo	Gharb	Ponta San Dimitri	2	2011	21-Feb	<b>C206e</b>	Malta	Wardija	San Martin	4	2014	06-Feb
A221b	Gozo	Gharb	Ponta San Dimitri	2	2011	21-Feb	<b>C207a</b>	Malta	Gudja	Hal Saptan	2	2014	07-Feb
A221c	Gozo	Gharb	Ponta San Dimitri	2	2011	21-Feb	<b>C209a</b>	Gozo	Ghasri	Wied il-Ghasri	3	2014	09-Feb
A221y	Gozo	Gharb	Ponta San Dimitri	2	2011	21-Feb	<b>C209b</b>	Gozo	Ghasri	Wied il-Ghasri	3	2014	09-Feb
A222a	Gozo	Xemxija	Roman tombs	2	2011	22-Feb	<b>C209c</b>	Gozo	Ghasri	Wied il-Ghasri	3	2014	09-Feb
A222b	Gozo	Xemxija	Roman tombs	2	2011	22-Feb	<b>C209d</b>	Gozo	Ghasri	Wied il-Ghasri	3	2014	09-Feb
A222c	Gozo	Xemxija	Roman tombs	2	2011	22-Feb	<b>C211a</b>	Malta	Attard	Wied Incita	3	2014	11-Feb
A226a	Malta	Qrendi	Mnajdra	3	2011	26-Feb	<b>C211b</b>	Malta	Attard	Wied Incita	3	2014	11-Feb
A226b	Malta	Qrendi	Mnajdra	3	2011	26-Feb	<b>C211c</b>	Malta	Attard	Wied Incita	3	2014	11-Feb
A301a	Gozo	Xewkija	Ta' Blankas	3	2011	01-Mar	<b>C211d</b>	Malta	Attard	Wied Incita	3	2014	11-Feb

(Continued)

Table 6. (Continued).

Code	Island	Locality	Toponym	Alt	Year	Date	Code	Island	Locality	Toponym	Alt	Year	Date
A301b	Gozo	Xewkija	Ta' Blankas	3	2011	01-Mar	<b>C216a</b>	Sicily	Modica	Marina di Modica	1	2014	16-Feb
A301c	Gozo	Xewkija	Ta' Blankas	3	2011	01-Mar	<b>C216b</b>	Sicily	Modica	Marina di Modica	1	2014	16-Feb
A301d	Gozo	Xewkija	Ta' Blankas	3	2011	01-Mar	<b>C216c</b>	Sicily	Modica	Marina di Modica	1	2014	16-Feb
A301e	Gozo	Xewkija	Ta' Blankas	3	2011	01-Mar	<b>C216d</b>	Sicily	Scicli	Sampieri	1	2014	16-Feb
A301f	Gozo	Xewkija	Ta' Blankas	3	2011	01-Mar	<b>C216e</b>	Sicily	Scicli	Sampieri	1	2014	16-Feb
A312a	Sicily	Syracuse	Vendicari	3	2011	12-Mar	<b>C216f</b>	Sicily	Scicli	Sampieri	1	2014	16-Feb
A312b	Sicily	Syracuse	Vendicari	3	2011	12-Mar	<b>C216g</b>	Sicily	Scicli	Sampieri	1	2014	16-Feb
A312c	Sicily	Syracuse	Vendicari	3	2011	12-Mar	<b>C217a</b>	Sicily	Scicli	Sampieri (Pisciotta)	1	2014	16-Feb
A322a	Gozo	Dwejra	Qattara	5	2011	22-Mar	<b>C217b</b>	Sicily	Scicli	Sampieri (Pisciotta)	1	2014	16-Feb
A322b	Gozo	Dwejra	Qattara	5	2011	22-Mar	<b>C217c</b>	Sicily	Scicli	Sampieri (Pisciotta)	1	2014	16-Feb
A322c	Gozo	Dwejra	Qattara	5	2011	22-Mar	<b>C217d</b>	Sicily	Scicli	Sampieri (Pisciotta)	1	2014	16-Feb
A322d	Gozo	Gharb	San Dimitri	4	2011	22-Mar	<b>C217e</b>	Sicily	Scicli	Sampieri (Pisciotta)	1	2014	16-Feb
A322e	Gozo	Gharb	San Dimitri	4	2011	22-Mar	<b>C217f</b>	Sicily	Scicli	Sampieri (Pisciotta)	1	2014	16-Feb
A322f	Gozo	Gharb	San Dimitri	4	2011	22-Mar	<b>C218a</b>	Sicily	Scicli	Sampieri	1	2014	18-Feb
A322g	Gozo	Gharb	Wied Millied	3	2011	22-Mar	<b>C218b</b>	Sicily	Scicli	Sampieri (Pisciotta)	1	2014	18-Feb
A322h	Gozo	Gharb	Wied Millied	3	2011	22-Mar	<b>C218c</b>	Sicily	Scicli	Sampieri (Pisciotta)	1	2014	18-Feb
A322i	Gozo	Gharb	Wied Millied	3	2011	22-Mar	<b>C218d</b>	Sicily	Scicli	Sampieri (Pisciotta)	1	2014	18-Feb
A331a	Malta	SPB	Xemxija	2	2011	31-Mar	<b>C220a</b>	Sicily	Scicli	Spiggetta Sampieri	1	2014	20-Feb
A331b	Malta	SPB	Xemxija	2	2011	31-Mar	<b>C220b</b>	Sicily	Scicli	Spiggetta Sampieri	1	2014	20-Feb
A331c	Malta	SPB	Xemxija	2	2011	31-Mar	<b>C220c</b>	Sicily	Scicli	Spiggetta Sampieri	1	2014	20-Feb
A409a	Malta	Wardija	Tal-Palma	3	2011	9-Apr	<b>C220d</b>	Sicily	Scicli	Spiggetta Sampieri	1	2014	20-Feb
B201	Malta	Mgarr	Bingemma	3	2012	01-Feb	<b>C220e</b>	Sicily	Scicli	Spiggetta Sampieri	1	2014	20-Feb
B202a	Malta	Mgarr	Bingemma	3	2012	02-Feb	<b>C220f</b>	Sicily	Scicli	Spiggetta Sampieri	1	2014	20-Feb
B202b	Malta	Mgarr	Bingemma	3	2012	02-Feb	<b>C228a</b>	Gozo	Xewkija	Wied Mgarr ix-Xini	2	2014	28-Feb
B202c	Malta	Mgarr	Bingemma	3	2012	02-Feb	<b>C228b</b>	Gozo	Xewkija	Wied Mgarr ix-Xini	2	2014	28-Feb
B202d	Malta	Mgarr	Bingemma	3	2012	02-Feb	<b>C228c</b>	Gozo	Xewkija	Wied Mgarr ix-Xini	2	2014	28-Feb
B202e	Malta	Mgarr	Bingemma	3	2012	02-Feb	<b>C228d</b>	Gozo	Xewkija	Wied Mgarr ix-Xini	2	2014	28-Feb
B202f	Malta	Mgarr	Bingemma	3	2012	02-Feb	<b>C228e</b>	Gozo	Xewkija	Wied Mgarr ix-Xini	2	2014	28-Feb
B202g	Malta	Mgarr	Bingemma	3	2012	02-Feb	<b>C228f</b>	Gozo	Xewkija	Wied Mgarr ix-Xini	2	2014	28-Feb
B202h	Malta	Mgarr	Bingemma	3	2012	02-Feb	<b>C228g</b>	Gozo	Xewkija	Wied Mgarr ix-Xini	2	2014	28-Feb
B224a	Sicily	Scicli	Sampieri	1	2012	24-Feb	<b>C308a</b>	Malta	Mellieha	Manikata	4	2014	08-Mar
B224b	Sicily	Scicli	Sampieri	1	2012	24-Feb	<b>C308b</b>	Malta	Mellieha	Manikata	4	2014	08-Mar
B224c	Sicily	Scicli	Sampieri	1	2012	24-Feb	<b>C310a</b>	Malta	St.Paul's Bay	Bahar ic-caghaq	1	2014	10-Mar
B224d	Sicily	Scicli	Sampieri	1	2012	24-Feb	<b>C310b</b>	Malta	St.Paul's Bay	Bahar ic-caghaq	1	2014	10-Mar
B224e	Sicily	Scicli	Sampieri	1	2012	24-Feb	<b>C310c</b>	Malta	St.Paul's Bay	Bahar ic-caghaq	1	2014	10-Mar
B224f	Sicily	Scicli	Sampieri	1	2012	24-Feb	<b>C316a</b>	Malta	Dingli	Ta' Ghar Bittija	5	2014	16-Mar
B224g	Sicily	Scicli	Sampieri	1	2012	24-Feb	<b>C316b</b>	Malta	Dingli	Ta' Ghar Bittija	5	2014	16-Mar

B224h	Sicily	Scieli	Sampieri	1	2012	24-Feb	<b>C316c</b>	Malta	Dingli	Ta' Ghar Bittija	5	2014	16-Mar
B225a	Sicily	Scieli	Sampieri	1	2012	25-Feb	<b>C316d</b>	Malta	Dingli	Ta' Ghar Bittija	5	2014	16-Mar
B225b	Sicily	Scieli	Sampieri	1	2012	25-Feb	<b>C316e</b>	Malta	Dingli	Ta' Ghar Bittija	5	2014	16-Mar
B225c	Sicily	Scieli	Sampieri	1	2012	25-Feb	<b>C318a</b>	Gozo	Xewkija	Wied Mgarr ix-Xini	2	2014	18-Mar
B227a	Sicily	Scieli	Sampieri	1	2012	27-Feb	<b>C318b</b>	Gozo	Xewkija	Wied Mgarr ix-Xini	2	2014	18-Mar
B227b	Sicily	Scieli	Sampieri	1	2012	27-Feb	<b>C323a</b>	Malta	Mgarr	Bingemma	4	2014	23-Mar
B228a	Malta	Ghanghur	Nigret	3	2012	28-Feb	<b>C323b</b>	Malta	Mgarr	Bingemma	4	2014	23-Mar
B228b	Malta	Ghanghur	Nigret	3	2012	28-Feb	<b>C323c</b>	Malta	Mgarr	Bingemma	4	2014	23-Mar
B228c	Malta	Ghanghur	Nigret	3	2012	28-Feb	<b>C408a</b>	Gozo	Gharb	Wied Milled	2	2014	08-Apr

Alt = Altitude (m); 1 = 0–50 m; 2=51–100 m; 3=101–150 m; 4=151–200 m; 5=201–300 m.

Table 7. List of population studies from 23 sites in Malta, Gozo and South East Sicily where 7 to 14 of the most diagnostic characters are examined for a sample of specimens within the population.

Code	Island	Locality	Toponym	Alt.	Year	Date	Characters Examined	Sample size
A221	Gozo	Gharb	Maxwell	4	2011	21-Feb	9	n=21
A227	Malta	Qrendi	Mnajdra	3	2011	27-Feb	10	n=21
A318	Gozo	Gharb	Wied Millied	4	2011	18-Mar	10	n=21
A320	Gozo	Gharb	San Dimitri	4	2011	20-Mar	10	n=21
B228	Malta	Gharghur	Nigret	3	2012	28-Feb	10	n=10
B302	Malta	Dingli	Bittija	5	2012	02-Mar	8	n=11
B302	Malta	Dingli	Bittija	5	2012	02-Mar	8	n=8
B303	Malta	Zurrieq	Ta' Wied Moqbol	2	2012	03-Mar	10	n=16
B306	Gozo	Ta' Sannat	Ta' Cenc	5	2012	06-Mar	10	n=16
B312	Gozo	Mgarr	Zewwieqa	1	2012	12-Mar	10	n=7
B401	Gozo	Gharb	Wied Millied	4	2012	01-Apr	14	n=79
C216	Sicily	Modica	Marina di Modica	1	2014	16-Feb	12	n=10
C217	Sicily	Modica	Marina di Modica	1	2014	17-Feb	10	n=18
C221a	Sicily	Scicli	Sampieri (Pisciotta)	1	2014	21-Feb	11	n=36
C221b	Sicily	Scicli	Spiagetta Sampieri	1	2014	21-Feb	11	n=10
C221c	Sicily	Scicli	Cava d'Aliga	1	2014	21-Feb	11	n=24
C228	Gozo	Xewkija	Wied Mgarr ix-Xini	2	2014	28-Feb	10	n=9
C310	Malta	St. Paul's Bay	Vicinity of Ghallis	1	2014	10-Mar	14	n=30
C311	Malta	Mellicha	Rdum tal-Madonna	3	2014	11-Mar	7	n=38
C318	Gozo	Xewkija	Wied Mgarr ix-Xini	2	2014	18-Mar	14	n=5
C323	Malta	Bingemma	Ghattuqa	4	2014	23-Mar	12	n=12
C408	Gozo	Gharb	Wied Millied	4	2014	08-Apr	10	n=12
							Total:	N=446

Alt = Altitude: 1 = 0–50 m; 2=51–100 m; 3=101–150 m; 4=151–200 m; 5=201–300 m.

Table 8. Mean and range (mean + 2SD) of most diagnostic characters from population studies on *Romulea* spp. in Malta and Sicily.

Population Code	Romulea Species	n	Bract Length		Tepal Length		Tepal Col		Throat Col	V:G Ratio
			Mean	Mean ± S.D.	Mean	Mean ± S.D.	Mean	Mean±S.D.		
A221	Variicolor	21	–	–	17.38	15.3–19.4	3.48	2.9–4.1	0.19	0.86
A227	Variicolor	21	10.10	9.4–10.8	16.95	15.6–18.3	3.05	2.1–4	0.33	0.52
A318	Variicolor	21	10.62	9.5–11.7	17.19	15.9–18.5	3.33	2.8–3.9	0.10	1.88
A320	Variicolor	21	10.69	9.9–11.5	16.38	14.5–18.2	3.71	3.1–4.4	0.33	1.62
B228	Variicolor	10	11.30	10.4–12.2	17.65	13.1–22.2	2.60	1.3–3.9	0.30	0.81
B302	Ramiflora	11	9.73	8.9–10.5	10.86	9.9–11.8	1.00	0.2–1.8	3.00	n/a
B302	Columnae	8	6.81	6.4–7.3	9.19	8.2–10.2	0.00	0–0	3.00	n/a
B303	Variicolor	16	9.88	8.8–11	16.44	14–18.9	2.19	1–3.4	0.56	0.22
B306	Variicolor	16	10.50	9.7–11.3	15.94	13.8–18.1	3.94	2.6–5.2	0.63	1.25
B312	Variicolor	7	11.50	10.2–12.8	17.29	14.7–19.8	4.43	3.3–5.6	0.86	2.83
B401	Variicolor	79	10.89	9.7–12.1	16.44	14.3–18.6	3.84	2.9–5	0.37	1.34
C216	Rollii	10	14.40	12.7–16.1	15.20	13.7–16.7	0.00	0–0	2.00	n/a
C217	Ramiflora	18	12.28	10.2–14.3	14.67	13–16.3	2.94	2.7–3.2	3.00	n/a
C221a+b+c	Variicolor	70	10.76	9.8–11.7	14.67	13–16.4	3.01	3.3–4	0.90	0.86
C228+C318	Ramiflora	14	9.79	8.6–11	12.14	10.4–13.9	1.21	0.8–1.6	2.71	n/a
C310	Variicolor	30	10.87	9.8–11.9	16.57	13.8–19.4	3.13	2.1–4.2	0.47	1.20
C311	Variicolor	38	–	–	15.11	12.8–17.4	3.26	1.8–4.7	0.74	1.22
C323	Ramiflora	12	10.79	10–11.5	10.88	10.2–11.6	1.42	0.9–1.9	3.00	n/a
C408	Variicolor	12	10.04	8.6–11.5	15.04	13.9–16.2	3.17	2.2–4.1	0.33	2.64

V:G ratio is the ratio of green and violet at the undertepal (1: equal proportion;<1: green dominant within the population;>1: violet dominant).

yellow throat of the former and undertepal pattern, colour of perianth, and pubescent filaments of the latter species. The perianth segments length of 14 mm and a weakly semi-transparent bracteole are more or less intermediate between these two species. Other specimens with unique morphologies (e.g. Figure 7d) or colour patterns (e.g. Figure 7e) were also found.

#### Key to species including species recorded in literature

- 1a.** Style longer than anthers by at least 3 mm; perianth segments normally > 24 mm long..... ***R. bulbocodium***  
**1b.** Style same level of anthers or longer by < 3 mm; perianth segments segments < 24 mm long..... **2**  
**2a.** Throat\* distinctly yellow; perianth colour uniform within a population.....**4**

**2b.** Throat\* white to a pale green (rarely having a hint of yellow) with a dark violet ring above; perianth colour varies from lilac to dark violet within a population..... **3** *R. variicolor* s.l.

**3a.** Colour of abaxial side of outer tepals with both green and violet pigments.....var. *variicolor*

**3b.** Colour of abaxial side of outer tepals pale green to ash-white (violet absent)..... var. *mirandae*

**3c.** Colour of abaxial side of outer tepals dark violet (green or ash-white absent)..... var. *martynii*

**4a.** Bracteole with a wide herbaceous keel; flowers rose-violet..... **5**

**4b.** Bracteole mostly scarious; flowers white or lilac. .... **6**

**5a.** Tepals > 2 mm wide; colour of perianth pale (rose-violet) never dark violet..... *R. ramiflora*

**5b.** Tepals 1.0–1.5 mm wide; colour of perianth described as dark violet..... *R. melitensis* (*non vide*)

**6a.** Perianth segments c. 11 mm long; filaments mustard yellow and glabrous to the naked eye; throat golden yellow with a dark violet ring above; leaves robust and usually curved, 1.0–1.5 mm across..... *R. columnae*

**6b.** Perianth segments c. 15 mm long; filaments pale yellow and conspicuously hairy below; throat pale yellow fading to a white tepal; leaves filiform < 1 mm across..... *R. rollii*

\* Throat colour is best determined by dissecting and opening a flower longitudinally, remove sex organs and brush throat from pollen.

### *Romulea* species occurring in Malta

*Romulea columnae* Sebast. & Mauri – Florae Romanae Prodromus (1818)

Exposed rocky ground, rural pathways and clearings. In suitable habitats throughout the Maltese islands. Frequent, native, Feb–Mar.

*Romulea ramiflora* Tenore – App. Ind. Sem. Horti Neapol. 1827: 3 (1827)

Rocky ground especially damp and not heavily vegetated, in low garrigue and steppe.

**Malta:** Ta' Ghattuqa and Victoria Lines, Bingemma, Mgarr (2-Feb-2012 and 23-Mar-2014), Ghar Bittija, Dingli (16-Mar-2014); Wardija, St Paul's Bay (9-Apr-2011). **Gozo:** Wied Mgarr ix-Xini, Xewkija (18-Mar-2014), Gnien Blankas, Xewkija (6-Feb-2011). Rare (scarce?), native, Feb–Mar. More records are expected to be found after this publication, but nevertheless, it is the least common among the *Romulea* species in the Maltese islands.

*Romulea variicolor* S. Mifsud

Exposed or low-vegetated rocky ground, from arid to damp sites in steppe, garrigue or rural rocky pathways. In suitable habitats throughout the Maltese islands.

Common; Sicily: exposed rock by the coast. Rare, sub-endemic (Jan-)Feb–Apr.

*Romulea melitensis* Beguinot – Bot. Jahrb. Syst. 38 (4–5): 327. (1907)

Not observed in this study but described from coastal areas. Status unknown.

### Conclusions

This study departed from the knowledge that *R. ramiflora* (very common), *R. rollii* (common), *R. columnae* (frequent), *R. melitensis* (uncertain status) and *R. bulbocodium* (recorded in the past without recent findings) was the picture that represented *Romulea* spp. in Malta. This revision brought significant changes in the genus for the flora of Malta.

*Romulea rollii* and *R. bulbocodium* are here excluded from the Maltese flora, *R. ramiflora* becomes rare and *R. melitensis* remains a doubtful species with a yellow throat, dark violet perianth and very narrow tepals. The most common sandcrocus in Malta (previously misidentified as *R. ramiflora* and/or *R. rollii*) was described as a new species: *R. variicolor* S. Mifsud. This species was found to be very variable and three varieties (var. *variicolor*, var. *mirandae* and var. *martynii*) were further described, primarily based on the colour and patterns of the abaxial side of the outer tepals.

The synonymization of *R. rollii* with *R. columnae* (Cardeil Sanz 2013) is not supported and instead, it is proposed that *R. rollii* is erected back to species level rather than treated as a subsp. of *R. columnae* (Marais 1975). This was supported also by anatomical investigations on leaves and filament hairs. Surveys in Sicily resulted in three new records for the Siculo-Maltese endemic *R. variicolor* at coastal sites in Ragusa, in addition to the first record of this species for Sicily by Brullo et al. (2009). An in-depth study of *R. melitensis* revealed that this species is a *nomen confusum*, where the later species diagnosis by the same author (Beguinot 1908) was based on a different collection from the type, and so the original description and type referred in the protologue (Beguinot 1907) is final.

Specimens that could not be placed with any *Romulea* species, were hypothesized to be of hybrid origin, in line with (Frignani & Iiriti 2011)) and further study is carried out by the present author. Synonymization of *R. tenuifolia* with *R. rollii* (Beguinot 1909) is also questioned and under investigation. DNA samples from 119 specimens have been submitted to (E) for future karyological investigations.

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### Disclosure statement

No potential conflict of interest was reported by the author.

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### Appendix 1: Record sheet of diagnostic morphological data

The table in Appendix A gives all the diagnostic morphological characters of 165 specimens of *Romulea* spp. examined between January 2011 and May 2014. Other characters have been examined for each specimen (see Appendix C for a full record sheet) but are omitted from this table because they were homogeneous or not diagnostic. Omitted characters and their range within all studied specimens are: number of leaves: 3–7; habit of leaves: variable from erect and straight to prostrate and curved; length of longest leaf: (4 cm in *R. columnae*) 8–25 (–38 cm in *R. rollii*); width of longest leaf (widest axis): 1.0–1.5 mm (<1.0 mm in *R. rollii*); leaf cross section: compressed terete (except *R. rollii* which is terete); number of flowers: 1–5; peduncle length: 2–30 mm (shortest in *R. columnae*; longest in *R. rollii*); colour of tepal veins: dark violet except in *R. rollii* which is paler; length of stamens compared to tepals: half length of tepals or shorter; level of style compared to anther: more less equal

Refer to the Materials and methods for coded or indexed data and to Table 1 for further information about the locality of examined specimens. Cells with the acronym [nr] refers to non-recorded data (1: character not studied in 2011; 2: specimen a teratum). Code Mt and Si represent Malta and Sicily respectively in the country code column. Letter U in the taxon group column represents unplaced specimens (hybrids?).

Specimen code	Specimen No.	Country	Bracteole		Bract type	Bracteole length (mm)	Tepal Length (mm)	Tepal Width (mm)	Tepal tip	Perianth		Filament Colour	Filament Phloisty	Style tip (stigma) colour	Undertepal pattern code	Undertepal		Taxon Group	Taxon subgroup	Comment	
			length (mm)	type						colour	code					Violet index	Green index				
<b>2011</b>																					
A205a	1	Mt	11	A	B	16	3.5	nr <sup>1</sup>	3	0	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	2	1	M	1			
A205b	2	Mt	12	A	C	16	4	nr <sup>1</sup>	4	0	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	2	1	M	1			
A205c	3	Mt	11	A	C	16	4	nr <sup>1</sup>	4	0	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	1	2	M	1			
A205d	4	Mt	11	A	B	18	3.5	nr <sup>1</sup>	4	0	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	1	2	M	1			
A206a	5	Mt	11	A	B	15	3	nr <sup>1</sup>	1	3	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	2	3	M	1			
A206b	6	Mt	12	A	B	16	3	nr <sup>1</sup>	5	0	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	2	2	M	1			
A207a	7	Mt	16	A	C	17	4	nr <sup>1</sup>	4	0	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	C	3	0	M	3	var. martynii		
A207b	8	Mt	17	A	B	18	4	nr <sup>1</sup>	4	0	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	3	1	M	1			
A210a	9	Mt	12	A	C	22	5	nr <sup>1</sup>	1	0	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	2	1	M	1			
A210b	10	Mt	10	A	B	15	3	nr <sup>1</sup>	1	3	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	1	3	M	1			
A210c	11	Mt	11	A	B	20	4.5	nr <sup>1</sup>	3	0	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	2	3	M	1			
A210d	12	Mt	11	A	B	20	3	nr <sup>1</sup>	4	0	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	3	1	M	1			
A213a	13	Mt	11	A	B	15	4	nr <sup>1</sup>	4	1	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	1	1	M	1			
A213b	14	Mt	11	A	C	11	3.5	nr <sup>1</sup>	2	2	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	2	1	U	-	? varicolor × columnae		
A213c	15	Mt	11	A	B	17	4	nr <sup>1</sup>	3	0	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	2	1	M	1			
A213d	16	Mt	11	A	B	20	4	nr <sup>1</sup>	3	1	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	A	0	3	M	2	var. mirandae		
A213e	17	Mt	11	A	B	21	4.5	nr <sup>1</sup>	2	1	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	3	1	M	1			
A213f	18	Mt	10	A	C	14	3.5	nr <sup>1</sup>	4	1	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	3	1	M	1			
A213g	19	Mt	11	A	B	20	3	nr <sup>1</sup>	3	0	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	1	3	M	1			
A213h	20	Mt	11	A	B	23	3.5	nr <sup>1</sup>	3	0	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	2	2	M	1			
A215a	21	Mt	11	A	B	17	4	nr <sup>1</sup>	4	0	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	C	3	0	M	3	var. martynii		
A215b	22	Mt	11	A	B	17	4	nr <sup>1</sup>	4	0	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	C	3	0	M	3	var. martynii		
A215c	23	Mt	11	A	B	17	3.5	nr <sup>1</sup>	4	0	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	C	3	0	M	3	var. martynii		
A215d	24	Mt	11	A	B	18	4	nr <sup>1</sup>	4	0	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	C	3	0	M	3	var. martynii		
A216a	25	Mt	12	A	B	16	3.5	nr <sup>1</sup>	3	1	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	3	1	M	1			
A216b	26	Mt	12	A	B	22	3.5	nr <sup>1</sup>	2	1	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	2	3	M	1			
A216c	27	Mt	11	A	B	20	3.5	nr <sup>1</sup>	4	1	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	3	1	M	1			
A219a	28	Mt	12	A	B	15	3.5	nr <sup>1</sup>	4	1	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	3	1	M	1			
A219b	29	Mt	13	A	C	20	4	nr <sup>1</sup>	2	1	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	0	3	M	1	var. mirandae		
A219c	30	Mt	11	A	B	17	3	nr <sup>1</sup>	3	1	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	1	3	M	1			
A221a	31	Mt	12	A	C	17	3.5	nr <sup>1</sup>	3	0	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	2	2	M	1			
A221b	32	Mt	11	A	C	17	4	nr <sup>1</sup>	3	0	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	0	3	M	2	var. mirandae		
A221c	33	Mt	11	A	C	18	4.5	nr <sup>1</sup>	4	0	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	2	1	M	1			
A222a	34	Mt	10	A	B	17	3	nr <sup>1</sup>	2	0	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	1	1	M	1			
A222b	35	Mt	10	A	B	19	4	nr <sup>1</sup>	3	1	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	0	3	M	2	var. mirandae		
A222c	36	Mt	10	A	C	15	3	nr <sup>1</sup>	3	0	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	C	3	0	M	3	var. martynii		
A226a	37	Mt	11	A	B	18	4	nr <sup>1</sup>	2	1	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	2	2	M	1			
A226b	38	Mt	8	A	B	13	3	nr <sup>1</sup>	3	1	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	1	3	M	1			

A301a	39	Mt	9	8	A	D	11	2.5	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	D	2	2	C	-		
A301b	40	Mt	8	n/a	A	D	10	2.5	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	D	1	3	C	-		
A301c	41	Mt	9	9	A	C	12	2.5	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	D	1	3	C	-		
A301d	42	Mt	8	8	A	E	9.5	2.5	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	D	1	1	C	-		
A301e	43	Mt	9	8.5	A	E	8.5	2.5	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	D	1	3	C	-		
A301f	44	Mt	11	11	A	B	12	3	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	D	2	2	R	-		
A322a	45	Mt	12	11	A	B	16	3	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	C	3	0	M	3	var. martyinii	
A322b	46	Mt	10	10	A	B	13	3.5	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	C	3	0	M	3	var. martyinii	
A322c	47	Mt	11	10	A	B	15	4	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	3	1	M	1		
A322d	48	Mt	10	9.5	A	C	15	3.5	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	3	1	M	1		
A322e	49	Mt	10	11	A	B	17	4	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	3	1	M	1		
A322f	50	Mt	10	9	A	C	13	3	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	3	1	M	1		
A322g	51	Mt	12	11	A	C	17	4	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	3	1	M	1		
A322h	52	Mt	14	13	A	B	21	5	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	2	2	M	1		
A322i	53	Mt	11	11	A	B	18	4.5	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	3	1	M	1		
A331a	54	Mt	10	10	A	B	12	3	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	D	0	3	C	-		
A331b	55	Mt	12	11	A	B	15	3.5	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	B	1	1	M	1		
A331c	56	Mt	10	10	A	C	13	3	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	D	0	3	U	-	? ramiflora	
A409a	57	Mt	9	8.5	A	B	14	3.5	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	nr <sup>1</sup>	D	0	3	R	-		
<b>2012</b>																				
B201a	58	Mt	12	12	A	C	18	4.5	Subacute	1	2	Pale violet	Visible	White	A	0	3	M	2	var. mirandae
B202a	59	Mt	13	12	A	n/a	21	5	Subacute	1	0	Pale yellow	Visible	Pale yellow	B	3	1	M	1	
B202b	60	Mt	12	12	A	n/a	21	4	Subacute	1	0	Pale yellow	Visible	Pale violet	B	2	1	M	1	
B202c	61	Mt	12	11	A	B	16	3.5	Acute	2	3	Mustard	Glabrous	Pale yellow	D	1	3	R	-	
B202d	62	Mt	7	6.5	A	D	7	2	Acute	0	3	Mustard	Glabrous	Yellow	D	1	3	C	-	
B202e	63	Mt	8	7.5	A	D	8	2	Acute	0	3	Mustard	Glabrous	Yellow	D	1	3	C	-	
B202f	64	Mt	8	7.5	A	E	11	2.5	Acute	0	3	Mustard	Glabrous	Yellow	D	1	3	C	-	
B202g	65	Mt	7	7	A	E	9	2	Acute	0	3	Mustard	Glabrous	Yellow	D	1	3	C	-	
B202h	66	Mt	7	6.5	A	E	8.5	2	Acute	0	3	Mustard	Glabrous	Yellow	D	1	3	C	-	
B224c	67	Si	10	10	A	B	15	3	Acute	2	3	Mustard	Minute	White	D	1	3	R	-	
B224d	68	Si	10	10	A	C	17	3	Acute	2	3	Mustard	Visible	White	D	1	3	R	-	
B224e	69	Si	11	11	A	C	14	4	Subacute	3	0	Pale yellow	Visible	Pale violet	B	3	1	M	1	
B224f	70	Si	10	10	A	B	16	4	Obtuse	3	0	Pale yellow	nr	Pale violet	B	2	1	M	1	
B224g	71	Si	11	11	A	C	16	4.5	Obtuse	2	3	Mustard	Glabrous	B	2	1	U	-	? ramiflora × varicolor	
B224h	72	Si	12	12	A	B	17	4	Obtuse	2	0	nr	nr	A	0	3	M	2	var. mirandae	
B225a	73	Si	14	14	A	D	20	4	Acute	0	2	Yellow	Distinct	White	E	3	2	L	-	
B225b	74	Si	11	11	A	B	14	4	Subacute	3	3	Mustard	Glabrous	Yellow		1	1	U	-	? ramiflora × varicolor
B225c	75	Si	10	10	A	B	18	4	Obtuse	2	0	Pale yellow	Minute	Pale yellow	B	2	3	M	1	
B227a	76	Si	11	11	A	B	16	4	Subacute	2	0	Pale yellow	Minute	Pale yellow	B	1	3	M	1	
B228a	77	Mt	11	11	A	B	19	5	Subacute	4	0	yellow	Visible	Violet	B	3	1	M	1	
B228b	78	Mt	13	12	A	B	18	4.5	Acute	5	1	White	Visible	Violet	B	3	2	M	1	
B228c	79	Mt	14	13	A	B	22	4	Subacute	1	1	White	Visible	White	A	0	3	M	2	
B302a	80	Mt	11	10	A	B	17	3.5	Acute	1	1	nr	nr	C	3	0	M	3	var. martyinii	
B302b	81	Mt	9	8.5	A	?	14	3.5	Acute	1	3	nr	nr	B	1	3	U	-	columnae?	
B302c	82	Mt	13	11	A	C	20	4	Subacute	1	0	nr	nr	A	0	3	M	2	var. mirandae	

(Continued)

Appendix 1. (Continued).

Specimen code	Specimen No.	Country	Bract length (mm)	Bracteole length (mm)	Bract type	Bracteole type	Tepal Length (mm)	Tepal Width (mm)	Tepal tip	Perianth colour code	Throat colour code	Filament Colour	Filament Ploidy	Style tip (stigma) colour	Undertepal pattern code	Undertepal Violet index	Undertepal Green index	Taxon Group	Taxon subgroup	Comment	
B302d	83	Mt	7	6	A	D	10	2	Acute	0	3	nr	nr	nr	D	1	3	C	-		
B302e	84	Mt	7	7	A	E	9	2	Acute	0	3	nr	nr	nr	D	1	3	C	-		
B302f	85	Mt	10	10	A	E	13	3	Acute	2	3	nr	nr	nr	D	1	3	C	-		
B302g	86	Mt	14	12	A	C	20	4	Subacute	0	0	nr	nr	nr	A	0	3	M	2	var. mirandae	
B302h	87	Mt	9	9	A	C	12	3	Acute	2	3	Mustard	Minute	Pale yellow	C	3	0	U	-	? varicolor × columnae	
B302i	88	Mt	12	11	A	B	14	3.5	Subacute	5	1	Pale yellow	Visible	Dark violet	B	3	2	M	1		
B303a	89	Mt	10	10	A	B	15	3.5	Subacute	4	1	nr	nr	nr	A	0	3	M	2	var. mirandae	
B303b	90	Mt	9	9	A	C	14	3.5	Subacute	3	0	Pale yellow	Visible	White	A	0	3	M	2	var. mirandae	
B303c	91	Mt	8	8	A	D	12	3.5	Obtuse	5	0	Pale yellow	Visible	White	B	3	1	M	1		
B303d	92	Mt	11	11	A	C	19	3.5	Subacute	2	1	nr	nr	nr	B	1	3	M	1		
B303e	93	Mt	11	11	A	C	21	4.5	Subacute	1	1	White	Visible	Pale violet	A	0	3	M	2	var. mirandae	
B303f	94	Mt	12	12	A	B	17	4	Acute	0	1	White	Visible	White	A	0	3	M	2	var. mirandae	
B312a	95	Mt	13	12	A	C	21	5	Acute	2	2	Pale yellow	Visible	Pale violet	A	0	3	M	2	var. mirandae	
B312b	96	Mt	13	12	A	B	20	5	Subacute	5	1	Violet	Minute	Pale violet	C	3	0	M	3	var. martyinii	
B316a	97	Mt	12	11	A	B	24	4.5	Acute	3	1	Pale yellow	Visible	White	B	1	1	M	1		
B316b	98	Mt	13	11	A	B	19	4	Subacute	3	0	Pale yellow	Minute	Pale violet	B	3	1	M	1		
B316c	99	Mt	10	10	A	B	17	4	Acute	3	0	Pale yellow	Minute	Pale violet	B	2	3	M	1		
B316d	100	Mt	12	12	A	B	19	4	Subacute	1	0	Pale yellow	Visible	Pale violet	B	3	1	M	1		
B316e	101	Mt	11	10	A	B	18	4	Acute	2	0	White	Visible	Pale violet	B	1	3	M	1		
B318a	102	Mt	11	11	A	B	15	4	Subacute	4	1	Violet	Minute	Pale violet	C	3	0	M	3	var. martyinii	
B318b	103	Mt	10	9.5	A	B	16	4	Subacute	5	1	Pale violet	Visible	Violet	C	3	0	M	3	var. martyinii	
<b>2014</b>																					
C202a	104	Mt	10	9	A	C	12	3	Acute	2	3	Mustard	Minute	White	D	1	3	C	-		
C202b	105	Mt	9	8	A	D	10	2.5	Acute	1	3	Mustard	Glabrous	White		2	2	C	-		
C206a	106	Mt	12	12	A	B	15	3.5	Subacute	1	1	Pale yellow	Minute	White	A	0	3	M	2	var. mirandae	
C206b	107	Mt	11	11	A	B	17	3.5	Subacute	2	0	Pale yellow	Visible	Pale violet	C	3	0	M	3	var. martyinii	
C206c	108	Mt	13	12	A	B	17	4	Acute	5	0	Pale yellow	Visible	Pale violet	B	3	1	M	1		
C206d	109	Mt	14	13	A	B	22	4.5	Subacute	1	0	Pale yellow	Visible	Violet	A	0	2	M	2	var. mirandae	
C206e	110	Mt	13	13	A	B	17	3.5	Subacute	3	1	Pale yellow	Visible	Violet	B	1	3	M	1		
C207a	111	Mt	7	7	A	E	9.5	2	Acute	0	3	Mustard	Glabrous	White	D	2	2	C	-		
C209a	112	Mt	14	13	A	B	20	4	Acute	2	0	Pale yellow	Visible	White	C	3	0	M	3	var. martyinii	
C209b	113	Mt	14	14	A	B	18	4.5	Obtuse	2	1	Pale yellow	Minute	Violet	C	3	0	M	3	var. martyinii	
C209c	114	Mt	13	12	A	B	16	4	Subacute	1	0	Pale yellow	Minute	-	B	3	2	M	1		
C209d	115	Mt	11	11	A	B	17	4	Subacute	3	0	Pale yellow	Minute	Violet	B	3	1	M	1		

C211a	116	Mt	9	8	2	Acute	0	3	Mustard	Glabrous	White	D	1	3	C	-
C211b	117	Mt	10	9.5	2	Subacute	0	3	Mustard	Glabrous	-	D	1	3	C	-
C211c	118	Mt	8	7.5	2	Acute	0	3	Mustard	Glabrous	White	D	1	3	C	-
C211d	119	Mt	8	7.5	2	Subacute	0	3	Mustard	Glabrous	White	D	1	3	C	-
C216a	120	Si	13	13	3	Acute	0	2	Pale yellow	Dense	White	E	3	1	L	-
C216b	121	Si	16	16	4	Acute	0	2	Yellow	Dense	White	E	3	1	L	-
C216c	122	Si	12	12	4	Subacute	0	2	Pale yellow	Dense	White	E	3	1	L	-
C216d	123	Si	12	12	3	Acute	2	3	Yellow	Minute	Pale yellow	D	1	3	R	-
C216e	124	Si	12	12	3	Acute	2	3	Mustard	Dense	Pale yellow	D	1	3	R	-
C216f	125	Si	13	13	3	Acute	2	3	Mustard	Dense	Pale yellow	D	1	3	R	-
C216g	126	Si	12	11	4	Obtuse	3	2	Yellow	Minute	Pale violet	B	2	2	U	-
C217a	127	Si	11	11	4	Subacute	3	1	White	Minute	White	B	3	1	M	1
C217b	128	Si	11	12	4	Obtuse	3	0	Pale yellow	Visible	Pale yellow	B	3	1	M	1
C217c	129	Si	12	12	4	Subacute	4	1	Pale yellow	Visible	Pale violet	B	3	2	M	1
C217d	130	Si	12	12	4	Obtuse	2	1	Pale yellow	Visible	Pale yellow	B	3	1	M	1
C217e	131	Si	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	M	5
C217f	132	Si	11	11	4.5	Subacute	3	3	Mustard	Visible	Pale violet	B	3	3	U	-
C218a	133	Si	14	14	3	Subacute	2	3	Mustard	Glabrous	Pale yellow	D	1	3	R	-
C218b	134	Si	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	M	5
C218c	135	Si	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	M	5
C218d	136	Si	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	M	1
C220a	137	Si	10	9	3.5	Obtuse	4	1	Pale yellow	Minute	Pale violet	B	2	3	M	1
C220b	138	Si	11	11	3.5	Obtuse	3	0	White	Visible	White	B	1	1	M	1
C220c	139	Si	10	10	3	Subacute	2	1	Pale yellow	Visible	Pale violet	B	1	3	M	1
C220d	140	Si	10	9.5	4	Obtuse	2	1	Pale yellow	Visible	Pale violet	B	2	1	M	1
C220e	141	Si	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	nr <sup>2</sup>	M	5
C220f	142	Si	11	11	3	Obtuse	2	1	White	Minute	White	A	0	3	M	2
C228a	143	Mt	11	11	3	Subacute	4	0	White	Visible	Pale violet	B	3	1	M	1
C228b	144	Mt	10	9.5	2.5	Acute	2	2	Yellow	Minute	Pale yellow	D	1	3	R	-
C228c	145	Mt	10	9.5	2.5	Acute	1	2	Yellow	Minute	Pale yellow	D	1	3	R	-
C228d	146	Mt	8	7.5	2	Subacute	4	0	White	Minute	White	C	3	0	M	4
C228e	147	Mt	9	9	2	Subacute	3	0	White	Minute	Pale violet	C	3	0	M	4

? *ramiflora* ×  
*varicolor*Terata; 4  
white tetals  
? *ramiflora* ×  
*varicolor*Albino  
Terata; 4  
white tetals  
Terata; 4  
white tetalsTerata; 4  
white tetals  
var. *mirandae*? narrow  
tepals

(Continued)

## Appendix 1. (Continued).

Specimen code	Specimen No.	Country	Bract length (mm)	Bract length (mm)	Bract type	Bract type	Bracteole length (mm)	Bracteole type	Tepal Length (mm)	Tepal Width (mm)	Tepal tip	Perianth colour code	Throat colour code	Filament Colour	Filament Pilosity	Style tip (stigma) colour	Undertepal pattern code	Undertepal Violet index	Undertepal Green index	Taxon Group	Taxon subgroup	Comment
C228f	148	Mt	9	9	A	C			13	2	Subacute	4	0	White	Minute	White	C	3	0	M	4	? narrow tepals
C228g	149	Mt	10	9.5	A	D			17	4	Acute	2	2	Mustard	Visible	White	D	1	3	R	-	? narrow tepals
C308a	150	Mt	13	11	A	C			17	3.5	Acute	2	1	Pale yellow	Minute	White	B	3	1	M	1	
C308b	151	Mt	10	10	A	B			17	4.5	Subacute	2	1	Pale yellow	Minute	White	A	0	2	M	2	var. mirandae
C310a	152	Mt	10	10	A	B			17	3.5	Acute	3	0	White	Visible	Pale violet	B	2	3	M	1	
C310b	153	Mt	13	12	A	C			18	4	Subacute	2	1	White	Visible	Violet	A	0	3	M	2	var. mirandae
C310c	154	Mt	11	11	A	C			17	4.5	Acute	4	0	White	Minute	Violet	C	3	0	M	3	var. martyinii
C316a	155	Mt	11	11	A	D			14	3	Subacute	3	1	White	Visible	Pale violet	B	1	3	M	1	
C316b	156	Mt	10	9.5	A	C			13	2.5	Acute	2	2	Mustard	Visible	White	D	1	3	R	-	
C316c	157	Mt	11	11	A	B			17	4	Subacute	3	1	Pale yellow	Visible	Pale violet	B	3	1	M	1	
C316d	158	Mt	8	8	A	D			13	2	Acute	2	2	Mustard	Visible	Pale yellow	D	1	3	R	-	
C316e	159	Mt	9	8.5	A	D			13	2	Subacute	2	0	White	Minute	Pale violet	C	3	0	M	3	var. martyinii
C318a	160	Mt	10	9.5	A	B			11	3	Subacute	1	3	Mustard	Visible	Pale yellow	D	1	3	R	-	
C318b	161	Mt	12	12	A	B			14	3.5	Subacute	1	3	Mustard	Visible	Pale yellow	D	1	3	R	-	
C323a	162	Mt	12	11	A	D			16	3	Acute	1	3	Mustard	Visible	Pale yellow	D	1	3	R	-	
C323b	163	Mt	11	11	A	D			13	2.5	Acute	2	3	Mustard	Visible	Pale yellow	D	1	3	R	-	
C323c	164	Mt	11	11	A	D			12	2.5	Acute	1	3	Mustard	Visible	Pale yellow	D	1	3	R	-	
C408a	165	Mt	12	12	A	D			13	4	Subacute	3	1	Pale yellow	Visible	Pale violet	B	3	1	M	5	Terrata, 4 tepals, violet

## Appendix 2.

Comparison of morphological characters of *Romulea* spp. recorded or related to Maltese species: *Romulea varicolor* S. Mifsud; *R. melitensis* Beg., *R. ramiflora* Ten. including subsp. *gaditana* (Kunze) Marais, *R. rollii* Parl., *R. columnae* Sebast. & Mauri, *R. linaresii* Parl., *R. revelieri* Jordan & FourR., *R. bulbocodium* (L.) Sebast. & Mauri. Many characters are taken from Marais (1980) denoted as [FE], Pignatti (1982) denoted as [IB], Cardell Sanz (2013) denoted as [IB], Beguinot (1907) original protologue for *R. melitensis* (including cross checks with type material) and personal observations denoted as [?]

Character	<i>R. varicolor</i> [?]	<i>R. ramiflora</i>		<i>R. rollii</i>	<i>R. columnae</i>	<i>R. linaresii</i>	<i>R. revelieri</i>	<i>R. bulbocodium</i>
		subsp. <i>ramiflora</i>	subsp. <i>gaditana</i>					
<b>Length of leaves (cm)</b>	Variable, 6–20(–32!)	(8–)10–45 [IB]; 6–30 [FE]	10–40 (–45) [IB]	10–25 [FI]	(3–)6–32 [FI]	5–20 [FE]	up to 15 cm [FE]	(5–) 7–30 (–45) [IB]; 5–30 [FE]
<b>Leaf longest width (mm)</b>	(0.7)0.8–1.5(–1.7)	0.5–1.7 [IB]; 0.7–1.5 [FE]	Slender [FE]; 0.5–1.0 (1.3) [FI]; 0.5–1.6 [IB]	0.8 [FI]; 0.3–0.8 [FE]	0.5–1.0 (1.3) [FI]; 0.6–1.0 [FE]	0.9–1.5 [FE]	0.8–1.1 [FE]	(0.5–) 0.7–2.0 [IB, FE]; 1.0–1.5 [FI]
<b>Leaf cross section</b>	Oval (rarely subterete)	Data unavailable	Data unavailable	Terate/cylindrical [FI]	Ovate/semicylindrical [FI, IB]	Data unavailable	Data unavailable	Oval, semicylindrical [FI]
<b>Bract length (mm)</b>	9–12	8–14(–17) [IB]; 10–22 [FE]	(8–) 10–20(–25) [IB]	12–17 mm [?]	8–12 mm [IB]; 6–13 [FE]	13–23 [FE]	8–14 [FE]	10–20 [IB, FE]; 10–15 [FI]
<b>Bracteole length</b>	9–12	Subequal (or slightly shorter) [IB]	Subequal (or slightly shorter)	Subequal (or slightly shorter)	Subequal (or slightly shorter) [IB]	Data unavailable	Data unavailable	Subequal [IB, FE]
<b>Bract texture</b>	Herbaceous with a thin membranous margin	Totally herbaceous [IB, FE] or with a thin hyaline margin [IB]	Totally herbaceous or with a thin hyaline margin [IB]	Totally herbaceous or with a thin hyaline margin [IB]	Totally herbaceous [FI, IB] or with a thin hyaline margin [IB, FE]	Totally herbaceous with a thin hyaline margin [FE]	Herbaceous with a thin membranous margin. [FE, FI]	Herbaceous with a thin membranous margin. [IB, FI]
<b>Bracteole texture</b>	Wide hyaline margin. Hyaline margin is half to two thirds the bracteole width leaving a central herbaceous keel. Membranous border folded and covered within the bract.	Totally herbaceous or with a thin hyaline margin [IB, FE]	Wide hyaline margin [FE, IB] or entirely herbaceous [IB]	Wide hyaline margin [FI], sometimes completely hyaline [?]	Wide hyaline margin, sometime leaving only a narrow herbaceous band [IB, FI] or almost entirely hyaline [FE]	Wide hyaline margin, sometime leaving only a narrow herbaceous band or completely hyaline [FE]	Wide hyaline margin [FI, FE] with reddish brown spots [FE]	Totally herbaceous or with a narrow herbaceous keel. [IB, FI]
<b>Perianth colour</b>	Variable between lilac to vivid dark purple	Purple/lilac–blue [IB, FE]	Lilac to pink [FE];	White to Lilac [FI]	Lilac or white [FI, IB, FE] (Assumed that yellow in FI should read white)	Violet–Purple [FE]; Dark violet [FI]	Pale Purple [FI]	White, lilac or rarely pale violet ending with darker purple tips. [FI]

(Continued)

## Appendix 1. (Continued).

Character	<i>R. varicolor</i> [1]	<i>R. melitensis</i> (Beguinot protologue description & type)	<i>R. ramiflora</i> subsp. <i>ramiflora</i>	<i>R. ramiflora</i> subsp. <i>gaditana</i>	<i>R. rollii</i>	<i>R. columnae</i>	<i>R. linarestii</i>	<i>R. revelieri</i>	<i>R. bulbocodium</i>
<b>Colour of abaxial side of external tepals (aka 'undertepal')</b>	Extremely variable, ranging from completely ash-grey with a green keel to completely dark violet. Most specimens have intermediate patterns of these two forms	Data unavailable	Yellowish green becoming greenish blue when drying [IB]	Green with lemon-yellow central vein, and purplish lateral veins [IB]; Green [FE]	Green, with a purple veins which can be found widespread to the tepal margin. [1]	Yellow-green [IB]	Data unavailable	Data unavailable	Violet streaks and yellowish base [1]
<b>Tepal length or perianth Ø (mm)</b>	(14-)15-21(-22) Specimens that are stunted or in poor soils may have smaller flowers and excluded from this measurement (2.5-)3.0-4.5	13	14-25(-35) Ø [IB]; 10-30 Ø [FE]	(16-) 20-30 Ø [IB]	15-22 Ø [FI]	10-12 Ø [FI]; 8-13 (-19*)Ø [IB, FI]	20-26 Ø [FE]; 10-20 Ø [FI]	c. 12 Ø [FI]; 12-16 Ø [FE]	13-28 (-30) Ø [IB]; (10)20-35(55) Ø [FE]
<b>Tepal Width (mm)</b>		1.0-1.5	(2.5-) 3-4 (-5) [IB]	(4-)4.5-8 [IB]	Data unavailable	1.5-2.0 [IB]	Data unavailable	3.5 [FE]	2.5-5.5 (-6) [IB]; 15-50 [FI]
<b>Throat Colour</b>	White to pale green, rarely with a slight yellowish hue.	Yellow with violet veins	Yellowish [FE]; Yellow or whitish [IB]	Yellowish [FE]; Yellow [IB]	Pale yellow [FI]	Yellow [FI]	Concolorous with perianth, (=Violet)	Whitish [FE]	Pale Yellow [IB, FI]
<b>Throat pilosity</b>	Glabrous or sometimes subglabrous	Data unavailable	Hairy (FI)	Data unavailable	Pubescent [FI]	Glabrous [FI]	Data unavailable	Glabrous [FI]	Pubescent [FI]
<b>Veins on perianth</b>	Moderately to conspicuously darker (depending flower colour)	Data unavailable	Darker esp. median vein [IB]	Darker [IB]	Slightly darker veins [FI]	Darker veins or streaks [FI]	Data unavailable	Dark veins present [FE]	Not conspicuous [FI]
<b>Filament texture</b>	Short hair restricted at the basal 1/3 of the filament.	Data unavailable	Pubescent at the basal half [IB]	Pubescent at the basal half [IB]	Pubescent [FI, FE]	Glabrous [FE]	Hairy at the base [FE]	Hairy below [FE]	Hairy at the base [IB, FE]
<b>Length of stamens : length of tepals</b>	Half the tepal length	Half the tepal length	Two thirds the length of tepals [FE]	Data unavailable	Half length of tepals [FI]	Half length of tepals [FI, FE]	1/2 to 2/3 length of tepals [FE]	1/2 to 2/3 length of tepals [FE]	1/2 the length of tepals [FE]
<b>Style length : anther length</b>	More or less same level	More or less same level	Never longer than the stamens [IB]	Slightly exceeding stamens [FE, IB];	More or less same level	Same Level [IB] or shorter [IB, FI, FE]	Below top of anthers [FI]	Same Level [FI, FE] or just above [FE]	Well above the stamens [IB, FI, FE]
<b>Pollen Colour</b>	Yellow	Data unavailable	Yellow [^]	Yellow	Yellow	Yellow [IB]	Data unavailable	Data unavailable	Yellow [FI]
<b>Fruit capsule length (mm)</b>	6-15 mm (with 18-30seeds)	Data unavailable	8-15 [IB]	8-13 [IB]	Data unavailable	5-12 mm [IB]	Data unavailable	Data unavailable	7-13 [IB]
<b>Seeds</b>	1.8-2.0 mm, spherical, (pale) brown, smooth	Data unavailable	1.8-2.0 mm, spherical, smooth [IB]	1.8-2.0 mm, Spherical, smooth [IB]	Data unavailable	1.0-1.4(-1.7)mm, spherical, smooth. [IB]	Data unavailable	Data unavailable	1.5-1.7 mm, spherical, smooth [IB]
<b>Endemism</b>	Mainly in the Maltese Islands, but also in the south coast of Sicily	Maltese Islands	No	W. & S. parts of Iberian peninsula [FE]; Esp.: Ca H Sc. Port.: Ag [IB]	No	No	Sicily	Corsica and Sardegna	No

## Appendix 3. Population study datasheet.

Example of a datasheet to record diagnostic characters of many specimens within a population. 420 specimens in 23 different populations in Malta and Sicily have been examined.

Population study of <i>Romulea varicolor</i> from Tal-Ghallis, Bahar ic-Caghaq, Malta (10-mar-2014).															
Specimen No.	Leaf Curvature	Leaf Erectness	Leaf Length (mm)	Bract length (mm)	Bracteole length (mm)	Bracteole Type	Peduncle Length (mm)	Tepal Length (mm)	Tepal Width (mm)	Corolla Colour	Throat colour	Undertepal colour code	Undertepal Violet index	Undertepal Green index	Remarks
329	1	2	98	11	10	2	13	15	3.5	5	0	B	2	3	
330	2	2	101	11	10.5	2	14	19.5	4	4	1	B	1	3	
331	2	2	71	9	9	2	15	14	3.5	4	1	B	2	3	
332	2	2	86	10.5	10.5	3	4	18	4	2	0	B	3	3	
333	1	2	85	12	11	2	7	14.5	4	5	0	B	1	3	
334	3	2	148	12	12	2	5	19	4	3	0	B	3	1	
335	3	3	95	10.5	10.5	3	8	18	3.5	3	1	B	2	2	
336	3	3	100	10	10	2	16	13	3	4	0	C	3	0	var. <i>martynii</i>
337	2	1	150	14	13.5	2	40	20	4.5	2	1	B	2	1	
338	2	2	120	11	10.5	2	36	20	4	2	1	A	0	3	
339	3	3	92	11	10	2	9	16.5	4	4	1	B	3	3	
340	3	3	53	10	13.5	2	8	14.5	3.5	3	0	B	1	2	
341	2	3	110	11.5	11	3	12	20	4.5	2	1	B	1	3	
342	2	3	98	11	10.5	2	17	21	3.5	3	0	B	3	1	
343	3	3	90	11.5	11	2	4	19	4	1	1	B	2	1	
344	3	2	96	11	11	2	7	16	4	4	1	A	0	3	
345	1	1	155	12.5	12	2	42	22	4	2	1	B	1	3	
346	2	3	100	9.5	9.5	2	17	14.5	3	4	0	B	3	1	
347	3	2	120	11	11	2	14	19.5	5	3	1	C	3	0	var. <i>martynii</i>
348	1	3	95	10.5	10.5	3	17	15	4	2	1	C	3	0	var. <i>martynii</i>
349	2	3	145	11.5	11.5	2	20	17	3.5	2	0	B	1	3	
350	3	3	104	10	10	3	8	15	3	3	0	C	3	0	var. <i>martynii</i>
351	3	3	101	10	9.5	3	7	16.5	4	2	0	B	1	3	
352	2	2	88	12	12	2	15	16	3.5	5	0	B	3	1	
353	3	2	102	11	10.5	3	10	15	3.5	3	0	B	3	1	
354	1	2	79	10	9.5	3	6	13	2.5	4	0	B	3	1	
355	2	2	98	9.5	9.5	2	6	17	4	2	0	B	3	2	
356	2	2	85	11	11	3	9	14.5	3.5	4	1	B	3	3	
357	3	2	90	11	11	2	17	17	4	3	1	B	3	1	
358	1	2	81	9.5	9.5	3	14	13	3	4	0	C	3	0	var. <i>martynii</i>



**Appendix 4. Character record sheet for field observations**

<b>Date</b>	06-Feb-14
<b>Locality</b>	Mellieha
<b>Area</b>	Garigue over Paradise Bay
<b>Sample Number</b>	<b>C206b</b>
<b>DNA Collection</b>	Yes: TB-04
<b>Leaf Microscopy</b>	Yes
<b>Photo Set</b>	IMG 3315 - 3327
<b>Further Notes on Location and/or Population</b>	Exposed garigue, stoney, with scattered low labiate shrubs or low-growing garigue plants, windy location.
<b>No. aerial leaves</b>	5
<b>Length × Width of longest leaf (mm)</b>	65 × 1.2
<b>Leaf Shape / Position</b>	Prostrate and moderately curved
<b>Leaf Cross section</b>	Flattened cylindrical
<b>Number of flowers / buds</b>	2
<b>Pedicle length at flowering</b>	16 mm
<b>Bract: Length (mm) &amp; morphology</b>	11.0 mm; [Type A]
<b>Bracteole: Length (mm) &amp; morph.</b>	10.5 mm; [Type B]
<b>Further Notes</b>	
<b>Flower Colour</b>	Light violet [2/5]
<b>Tepal Size (LxW)</b>	17 × 3.5 [fused at lower 4 mm]
<b>Throat Colour</b>	White
<b>Veins</b>	3 dark veins, mid vein more conspicuous and large
<b>Colour of abaxial side of outer tepals</b>	Dark violet without green hues [Type C]
<b>Filaments colour</b>	Pale greenish-yellow
<b>Filaments pilosity</b>	Sub-glabrous at basal 1/4
<b>Length of stamens compared to tepals</b>	Half length of tepals
<b>Position of styles compared to anthers</b>	Same level
<b>Length of Filament hair</b>	321 µm
<b>Pollen size</b>	50.3 × 42.4 (Q=1.2)
<b>Pollen Colour</b>	Yellow
<b>Further Notes</b>	images 3479-3482: filament hair at ×100; images 3483-3486: pollen at ×400;

Appendix 5. Protologue of *Romulea melitensis* Bég. (1907).

Diagnoses Romulearum novarum vel minus cognitarum.

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Exsicc. SCHIMPER, It. abyss. sect. II. n. 550, ap. Un. It. 1842, sub *Ixia Bulbocodium*; id. in Pl. Abyss. ed. R. J. HOHENACKER n. 550, sub *R. Linaresii*.

Habitat. Abyssinia, in monte Bachit (SEMEN): SCHIMPER in exs. s. cit.; Abyssinia: SCHIMP. in Hb. Ces. (Rom.); Abyssinia 1855: SCHIMP. in Hb. Boiss.

4. *Romulea Battandieri* Bég. n. sp.

R. cormo parvo, ovato, tunicis coriaceis castaneis tecto; scapo unifloro; foliis cylindraco-compressis, latiusculis, basi late vaginantibus, flexuosis, plerumque solo adpressis, flaccidis, scapum superantibus; spathis foliolo inferiore herbaceo angustissime marginato, superiore omnino membranaceo et fusco-punctulato, ad 15 mm longo; perigonio spathis parum longiore, 15—20 mm longo, tubo longiusculo (5—8 mm), laciniis oblongo-lanceolatis, subobtusis, 3—4 mm latis, albidis, tribus venis intense purpureis et ramulosis percursis, fauce dealbata, tubo externe violaceo; staminibus perigonii dimidiam partem attingentibus, antheris filamentis longioribus saepe atrophicis; stilo exserto, rarius inter antheras incluso; capsulam maturam non vidi.

Syn. *Romulea Linaresii* Batt. Not. s. quelq. pl. d'Alg. nouv. ou peu conn. in «Bull. Soc. Bot. Franç.» XXXII (1885) p. 343; BATT. e TRAB. Fl. de l'Alg. II (1895) p. 37.

Habitat. Algeria, in cacumine montis Haïzer (Kabylia), ad nives deliquescentes: BATTANDIER in Hb. sub *R. Linaresii* Parl.?

Observ. Habitu et perigonii fabrica *R. Linaresii* Parl. refert, a qua et ab omnibus speciebus mediterraneis colore florum diversa. An constans species?

5. *Romulea melitensis* Bég. n. sp.

R. cormo mediocri tunicis debilibus tecto; scapo debili, unifloro, 3—5 cm longo; foliis paucis cylindrico-filiformibus, parum compressis, erecto-patentibus et plus minusve contortis, nervis validis in sicco percursis et ideo rigidiusculis, scapum parum superantibus; spathis subaequalibus ovato-lanceolatis 10 mm circ. longis, foliolo inferiore herbaceo angustissime marginato, superiore latiuscule hyalino-membranaceo; perigonio mediocri spathis duplo longiore 13 mm longo, tubo angusto  $\frac{1}{3}$  circ. perigonii brevioris, laciniis linearibus obtusiusculis  $4-\frac{1}{2}$  mm latis, intense violaceis tubo luteo venisque violaceis percursis; staminibus perigonio dimidiam partem aequantibus, antheris filamentis brevioribus; stylo incluso.

Habitat. Insula Melita (Malta) ad ripas maris, prope Fort Fiqué: SICKENBERGER in «Herborisations du Levant» 14. II. 1876, in Hb. Barbey-Boissier.