

An update on the moss flora of the Maltese Islands

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(Received 12 September 2011, accepted 16 March 2012)

Abstract – A revised list of mosses and their distribution in Malta up till 2011 is presented. Ten species and one variety are new, but six previous records are considered questionable and five have been rejected. Nineteen species have not been found again since 1915. Over 50% of the species listed belong to Pottiaceae, reflecting the prevailing arid climate of the Maltese island. The semi/natural habitats host the greatest diversity and need to be protected.

Mosses / Bryophyta / Malta / Gozo / Comino

INTRODUCTION

An updated list of Maltese mosses is compiled from publications and new records from recent collections, in preparation for a larger project encompassing the mosses of the Mediterranean basin (Ros *et al.* in preparation).

Each taxon is listed alphabetically according to nomenclature used mainly in Hill *et al.* (2006) and Holyoak & Pedersen (2007), but several other recent publications have been considered. All the synonyms that have been used in Maltese literature are placed in square brackets.

Each taxon includes a list of all the known localities, to indicate both distribution and frequency in Malta, Gozo, Comino and St. Paul's islands. The distribution records were published in Brizi (1890), Baur (1891), Bottini (1907), Sommier & Caruana Gatto (1915), Gradstein (1972), Lanfranco (1989) and Frahm & Lüth (2008). Unpublished distribution data are also included from collections by *Edwin Lanfranco* (1960-1990) and *Georgina Borg* (1990-1993), listed in Ms. Borg's B.Educ. Dissertation (Borg, 1993).

The list also includes records of new taxa, and new distribution data, from collections by the author (*Mifsud*) from 2000 to 2011, and by *David T. Holyoak* (*Holyoak*) during a short visit to Malta in 2005. The author's collections were mostly determined by David T. Holyoak (Bryaceae), Lars Hedenäs (Brachytheciaceae), Ida Bruggeman Nanenga (Fissidentaceae) and Rosa María Ros (all other families). These specimens are kept in private herbaria (owned by Edwin Lanfranco, David T. Holyoak and the author). Records of new taxa are marked with the symbol * and comments are included where appropriate.

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LIST OF TAXA

Acaulon muticum (Hedw.) Müll. Hal. [*Sphaerangium muticum* (Schreb. ex Hedw.) Schimp.]

MALTA: Valletta (Baur, 1891).

Acaulon triquetrum (Spruce) Müll. Hal. [*Sphaerangium triquetrum* (Spruce) Schimp.]

MALTA: Valletta (Baur, 1891).

Aloina aloides (Koch ex Schultz) Kindb. [*Barbula aloides* (Koch ex Schultz) Bruch]

MALTA: Valletta (Baur, 1891), Wied il-Faham (Borg 1993). Also found by *Holyoak* (2005) in Fomm ir-Rih on moist, compact, exposed soil.

Aloina ambigua (Bruch et Schimp.) Limpr. [*Barbula ambigua* Bruch et Schimp.]

MALTA: Qormi, Valletta (Baur, 1891); St Paul's Bay, Hagar Qim, Attard, Addolorata, Floriana, Wied Incita, Wied Babu and Marsa (Sommier & Caruana Gatto, 1915).

Aloina rigida (Hedw.) Limpr.

MALTA: Gebel Ciantar (Borg, 1993); Mellieha (Frahm & Lüth, 2008). Also found in Kalkara on exposed, chalky soil (35°53'09"N, 14°31'34"E, 22m a.s.l., Jan 2011, *Mifsud*).

Barbula bolleana (Müll. Hal.) Broth. [*Trichostomum ehrenbergii* Lorentz, *Barbula ehrenbergii* (Lorentz) M. Fleisch.]

MALTA: Mtahleb (Bottini, 1907). A single record noted by Bottini (1907) as "bellissima specie mediterranea sporadica e rara" and found "nel fosso", in a humid place. An extensive search for it at Mtahleb in 2011 was unsuccessful.

Barbula unguiculata Hedw. [*Barbula unguiculata* var. *apiculata* (Hedw.) Bruch et Schimp.]

MALTA: Ta' Baldu (Sommier & Caruana Gatto, 1915); Rabat, Mistra, Wied Ghomor, Girgenti, Tal-Qroqq, Ghar Hasan and Bahrija (Borg, 1993); Mellieha and Wied Qirda (Frahm & Lüth, 2008). Recent finds in Malta at Ghajn Tuffieha, Buskett, Dingli, Wardija, Wied Luq, Kalkara indicate that it is common on rocks, walls & stony soil. Also present on most of the smaller islands such as Gozo: Ghajnsielem (Borg, 1993), COMINO (Sommier & Caruana Gatto, 1915), ST PAUL'S ISLANDS (Borg, 1993).

****Brachytheciastrum velutinum*** (Hedw.) Ignatov et Huttunen

MALTA: Buskett, 35°51'23"N, 14°23'59"E, 205 m a.s.l., on semi shaded, limestone stones, 15 Jan 2009, *Mifsud*. A specimen in Edwin Lanfranco's herbarium, collected by *Georgina Borg* from Wied Babu (Malta) in 1992 also corresponds to this species.

Brachythecium rutabulum (Hedw.) Schimp.

GOZO: Xlendi (Sommier & Caruana Gatto, 1915); Wied Lunzjata (Gradstein, 1972). MALTA: Wied Babu (Borg, 1993); Sabtan and Bingemma (Frahm & Lüth, 2008).

Bryum argenteum Hedw.

Bryum argenteum var. *hirtellum* De Not. has been reported near Valletta, on walls with *Tortula muralis* var. *aestiva*, by Brizi (1890). However the identity of this taxon has not been studied recently. Frahm & Lüth (2008) consider it to be a possible synonym of *Bryum lanatum* (P. Beauv.) Brid., that according to Hill *et al.* (2006) is a synonym of *B. argenteum*.

Bryum argenteum grows in urban areas of Malta: Collected by the author from Hamrun on numerous occasions between 2001-2011, in spots where air conditioning condensate keeps the ground and concrete pavements moist even in summer.

Bryum dichotomum Hedw. [*B. atropurpureum* Bruch et Schimp, *B. atropurpureum* var. *dolioloides* Solms., *B. barnesii* J.B.Wood ex Schimp., *B. dunense* A.J.E. Sm. et H. Whitehouse, *B. bicolor* Dicks.]

Common in Malta and Gozo (Sommier & Caruana Gatto, 1915); St. Andrews, Wied Xaghri and Fgura (Borg, 1993); Mellieha, Xemxija and Wied Qirda (Frahm & Lüth, 2008). Recent records in Malta (Ghajn Tuffieha, Wied Gerzuma, Buskett, Bahrija, Hamrun, Ballut and Rabat) by *Holyoak* and *Mifsud* indicate that it is a common species on shady humid soil, roadsides, roofs, and rocks.

****Bryum gemmiparum*** De Not.

MALTA: Chadwick lakes, 35°53'33"N, 14°23'27"E, 120m a.s.l., a hygrophilous species colonising steps on dams in the flood zone, 25.1.2007, *Mifsud*.

Bryum moravicum Podp. [*Bryum capillare* var. *flaccidum* (Brid.) Bruch. et Schimp., *Bryum laevifilum* Syed., *Bryum subelegans* Kindb.]

MALTA: Zurrieq; in gardens (Sommier & Caruana Gatto, 1915). A northern moss possibly introduced with garden plants. Not recorded in decades.

Bryum radiculosum Brid. [*Bryum murale* (Hedw.) With.]

MALTA: Girgenti, Addolorata, ta' Braxia and Ghaxaq (Bottini, 1907). GOZO: San Blas (Sommier & Caruana Gatto, 1915). Recent collections in Malta such as at Ghajn Tuffieha, Rduim Dikkiena, Buskett as well as in Gozo such as in Victoria, Wied il-Lunzjata indicate that this is a frequent species in both islands. It forms dark green cushions on rubble walls, pavements and compacted soil.

Bryum torquescens Bruch ex De Not. [*Bryum obconicum* auct. non Hornsch. ex Bruch et Schimp]

MALTA: Mdina, Ta' Baldu, Wied Qliegħa, Wied Incita and Addolorata (Sommier & Caruana Gatto, 1915); Verdala, Wied Incita, Wied Xaghri and Buskett (Borg, 1993); Xemxija (Frahm & Lüth, 2008). Also collected by *Holyoak* in Malta at Buskett and Ghajn Tuffieha in 2005 on exposed/lightly shaded rocks and dry soil.

Calliergonella cuspidata (Hedw.) Loeske [*Hypnum cuspidatum* Hedw.]

GOZO: 'Going from Marsalforn to Zebbug' (Sommier & Caruana Gatto, 1915).

Recent searches for this hygrophilic species in the same valley have been unsuccessful.

Crossidium crassinerve De Not. [*Tortula chloronotos* Brid., *Barbula chloronotos* (Brid.) Brid., *Crossidium chloronotos* (Brid.) Limpr.]

MALTA: Valletta and Floriana (Baur, 1891).

Dicranella howei Renauld et Cardot

MALTA: Ghar Hassan, San Pawl tat-targa, Ta' Baldu and Wied il-Għasel (Borg, 1993); Mellieha (Frahm & Lüth, 2008). Frequent in natural areas and gardens in Buskett, Girgenti, Attard, Kalkara (all in Malta), and Marsalforn (Gozo). On shaded or exposed moist clayey soil.

Dicranella varia (Hedw.) Schimp.

MALTA: Marsascalea (Baur, 1891); Mdina, Addolorata and Zebbug (Sommier & Caruana Gatto, 1915); Wied id-Dis and Wied Incita (Borg 1993). GOZO: Ta' Cenc (Sommier & Caruana Gatto, 1915). Also found in Malta at Ghajn Tuffieha (*Holyoak*) and Wied Luq (*Mifsud*), on moist shaded soil.

Didymodon acutus (Brid.) K.Saito [*Barbula gracilis* Schumach., *B. gracilis* var. *viridis* (Hook. et Grev.) Brid.]

MALTA: Adolorata, Minsija, Fiddien, Imtahleb, Zurrieq, ta' Braxia, Wied Qliegħa and Wied Babu (Sommier & Caruana Gatto, 1915); Rabat, Wied Xaghri and Mosta (Borg, 1993).

Didymodon fallax (Hedw.) R.H. Zander

MALTA: Mistra, Wied Incita and Wied Hanzir (Borg, 1993). Also found in Ghajn Tuffieħa, Buskett and Dingli, sometimes associated with *Barbula unguiculata*, on soil and rocks, in garigue and partly shaded rocky slopes.

Didymodon insulanus (De Not.) M.O. Hill

GOZO: Without locality data and specimen not available (Lanfranco, 1989).

Didymodon luridus Hornsch. [*Didymodon trifarius* (Hedw.) Röhl.]

MALTA: Wied Incita, Addolorata, Ballut, Ta' Baldu and Girgenti (Sommier & Caruana Gatto, 1915); Tal-Qroqq, Wied Xaghri and Ta' Baldu (Borg, 1993). Ghadira and Wied Qirda (Frahm & Lüth, 2008). GOZO: Ggantija temple (Gradstein, 1972); Ghajnsielem (Borg, 1993). Found on unshaded stone blocks in flood zone such in the valleys of Wied Incita and Wied Ghollieqa (Herb. *Mifsud*).

Didymodon rigidulus Hedw [*D. rigidulus* var. *densus* (Bruch et Schimp.) Paris]

MALTA: Wied Incita (Sommier & Caruana Gatto, 1915).

Didymodon tophaceus (Brid.) Lisa [*D. tophaceus* f. *elatus* (Boulay) Artaria in E. Bauer]

MALTA: Fiddien, Girgenti and Imtahleb (Sommier & Caruana Gatto, 1915); Wied Qirda (Frahm & Lüth, 2008). *D. tophaceus* f. *elatus* is frequent in the Buskett-Girgenti valley system growing along shaded streams, frequently partly inundated.

Didymodon vinealis (Brid.) R.H. Zander [*Barbula vinealis* Brid.]

MALTA: Valletta (Baur, 1891); St Julians, Attard, San Anton (Sommier & Caruana Gatto, 1915); Wied Qirda and Xemxija (Frahm & Lüth, 2008). Recently found in Wied Qliegħa on a concrete dam subject to inundation, on boundary walls in Attard, on moist soil in Kalkara (all in Malta), and in GOZO (Rabat) on a garden wall.

Entosthodon attenuatus (Dicks.) Bryhn

MALTA: Maqluba (Borg, 1993).

Entosthodon convexus (Spruce) Brugués [*Funaria convexa* Spruce]

MALTA: Marsaxlokk, Wied Incita and Fiddien (Sommier & Caruana Gatto, 1915).

GOZO: Wied Lunzjata (Sommier & Caruana Gatto, 1915).

Entosthodon durieui Mont. [*Entostodon pallescens* Jur.]

GOZO: Xlendi (Sommier & Caruana Gatto, 1915); Dwejra valley (Frahm & Lüth, 2008).

Entosthodon fascicularis (Hedw.) Müll. Hal.

MALTA: B'Kara (Baur, 1891).

****Entosthodon longicolle*** (Trab.) Ros & M.J.Cano

MALTA: Ta' Qali, 35°53'56"N, 14°25'41"E, 90 m a.s.l., in and around a garden center, on stone benches holding garden plants, 10 April 2008, *Mifsud*.

Entosthodon muhlenbergii (Turner) Fife [*Funaria calcarea* Wahlb., *F. calcarea* var. *flaccida* (Bruch et Schimp.) Schimp., *F. mediterranea* Lindb., *F. mediterranea* var. *patula* (Bruch et Schimp.) Limpr., *F. muhlenbergii* Turn.]

MALTA: Marsascala and Marsa Valley (Baur, 1891); San Martin, Girgenti, Gnejna and Ta' Baldu, (Sommier & Caruana Gatto, 1915).

Entosthodon pulchellus (H.Philib.) Brugués [*Funaria pulchella* H. Philib.]

MALTA: Wied Babu, Wied Harq Hammiem, Wied Ghasel and Wied Qirda (Borg, 1993); Qasam Barrani and Dingli cliffs (Frahm & Lüth, 2008).

Eucladium verticillatum Bruch et Schimp. [*E. verticillatum* var. *crispatum* Röll]

MALTA: Ghar Hassan (Baur, 1891); humid places in Girgenti, Wied Babu, Balluta, Gnejna, Ta' Baldu, Argotti and Mtahleb (Sommier & Caruana Gatto, 1915); Ta' Kandja, S. Pawl tat-Targa, Bahrija and Selmun (Borg, 1993); Buskett and Wied Qirda (Frahm & Lüth, 2008). Recently found on shaded wet rocks/caves/tunnels near dripping water in Paradise bay, Bormla tunnel, Qammieh, Gharghur (all in Malta), as well as GOZO (Dwejra) (Sommier & Caruana Gatto, 1915). *Eucladium verticillatum* var. *angustifolium* Jur. nom. illeg., has been reported for Malta but its identity is unknown.

Fissidens bryoides Hedw.

MALTA: Mellieha (Frahm & Lüth, 2008).

Fissidens crispus Mont [*Fissidens cyprius* Jur., *Fissidens limbatus* Sull.]

MALTA: Msida valley, Wied Balluta and Marsa (Baur, 1891); Verdala and Sliema (Borg, 1993); Mellieha and Wied Qirda (Frahm & Lüth, 2008).

Fissidens gracilifolius Brugg.-Nann. et Nyholm

MALTA: Bingemma (Frahm & Lüth, 2008).

Fissidens pusillus (Wilson) Milde

MALTA: Girgenti and San Anton (Sommier & Caruana Gatto, 1915); Selmun and Mgarr (Borg, 1993). GOZO: Xlendi (Sommier & Caruana Gatto, 1915). Recently collected by the author on shaded rocks in streams splashed with running water and on humid soil banks such as in Wied Qliegħa, Buskett (Malta), and in Ramla l-Hamra (Gozo) (Herb. *Mifsud*).

Fissidens taxifolius Hedw.

MALTA: Girgenti on a moist shaded wall (Borg, 1993). A single record in an area full of introduced species.

Fissidens viridulus (Sw. ex anon.) Wahlenb. var. ***incurvus*** (Starke ex Röhl.) Waldh. [*F. incurvus* Starke ex Röhl., *F. tamarindifolius* (Turner) Brid., *F. incurvus* var. *tamarindifolius* (Turner) Braithw.]

MALTA: Gnejna, Valletta ditches, Ta' Baldu, Hagar Qim, Wied Incita and Wied Babu (Sommier & Caruana Gatto, 1915); Bahrija and San Pawl tat-Targa (Borg, 1993). GOZO: Xlendi (Sommier & Caruana Gatto, 1915). Also found frequently on shady, moist or dry soil banks in Ghajn Tuffieħa (*Holyoak*), Wied il-Ghasel, Chadwick lakes, Wied Znuber, Bahrija, Wied Qirda, Mtahleb (all in Malta) and Marsalforn (Gozo) (*Mifsud*).

Fissidens viridulus (Sw. ex anon.) Wahlenb. var. ***viridulus*** [*F. viridulus* (Sw. ex anon.), *F. limbatus* var. *bambergeri* (Milde) Waldh.]

MALTA: Maqluba (Gradstein, 1972); Verdala, Sliema, Argotti, Wied Zenqa, Wied Harq Hammiem and Wied Kbir (Borg, 1993); Bingemma (Frahm & Lüth, 2008). Also found on shaded, humid rock and soil in Ghajn Tuffieħa, Buskett (*Holyoak*), Girgenti, Wardija, Pembroke and Wied Mejxu (*Mifsud*) (all in Malta).

Funaria hygrometrica Hedw. [*F. hygrometrica* var. *calvescens* (Schwägr.) Mont.]

MALTA: Floriana, Hamrun, Attard, Imghieret, Mosta, Wied Incita and Mdina (Bottini, 1907); Wied Hanzir, Sabtan, Wied Incita, Wied Speranza, Wied Ghomor, Ta' Giorni, Wied Ghasel and Tal-Virtu (Borg, 1993). GOZO: Mgarr (Sommier & Caruana Gatto, 1915). Also found in Malta on eutrophic soil such as in

greenhouses in Rabat and on burnt ground in valleys at Wied Babu and Wied Qirda (*Mifsud*).

Funariella curviseta (Schwägr.) Sérgio [*Entosthodon curvisetus* (Schwägr.) Müll. Hal., *Funaria curviseta* (Schwägr.) Milde]

MALTA: Marsascala, Siggiewi and Qormi (Baur, 1891); Wied Incita, Mtahleb, Fiddien and Mdina (Sommier & Caruana Gatto, 1915); Maqluba (Gradstein, 1972); Mellieha (Frahm & Lüth, 2008). GOZO: Xlendi (Sommier & Caruana Gatto, 1915).

Gymnostomum calcareum Nees & Hornsch.

MALTA: Wied Balluta, Siggiewi and Marsa (Baur, 1891). Notabile, Ta' Baldu, Wied Qirda, Girgenti, Wied Incita, Gnejna, Fort Manuel, Addolorata and Hawli (Sommier & Caruana Gatto, 1915); Ta' Baldu (Borg, 1993); Bingemma, Paradise bay (Frahm & Lüth, 2008). Also found on semishaded calcareous gravel, rock, and pockets of soil in rock in Buskett and Mtahleb (*Mifsud*). GOZO: Ta' Cenc, Xlendi (Sommier & Caruana Gatto, 1915); Mgarr (Gradstein, 1972); San Lawrence (Frahm & Lüth, 2008).

Gyroweisia reflexa (Brid.) Schimp.

MALTA: Wied Qliegħa (Sommier & Caruana Gatto, 1915).

Gyroweisia tenuis (Hedw.) Schimp.

GOZO: Without locality data (Lanfranco, 1989).

****Hygroamblystegium humile*** (P. Beauv.) Vanderp., Goffinet *et* Hedenäs

MALTA: Qormi, 35°53'01"N, 14°28'37"E, 25m a.s.l., on an artificial waterfall of a garden centre, July 2002, *Mifsud*. Probably introduced with imported plants.

Imbriobryum mildeanum (Jur.) J.R. Spence [*Bryum mildeanum* Jur.]

MALTA: Wied Ghomor (Sommier & Caruana Gatto, 1915). A single record of this northern species unlikely to grow extensively in Malta.

Kindbergia praelonga (Hedw.) Ochyra [*Eurhynchium praelongum* (Hedw.) Schimp.]

MALTA: Sliema (Borg, 1993). Found in an urban private garden. Probably introduced with imported pot plants.

Leptobarbula berica (De Not.) Schimp.

MALTA: Wied Incita, Attard, San Anton, Imgieret and Addolorata (Sommier & Caruana Gatto, 1915); Mellieha and Bingemma (Frahm & Lüth, 2008). Recently collected on humid limestone blocks, thin soil and pavement in several Maltese localities such as Rđum Dikkiena, Buskett (*Holyoak*), Wied Qirda, San Anton, Wied Babu and Verdala (*Mifsud*).

Microbryum curvicolle (Hedw.) R.H. Zander [*Phascum curvicolle* Hedw.]

MALTA: Qormi (Baur, 1891).

Microbryum davallianum (Sm.) R.H. Zander [*Pottia minutula* var. *conica* (Schleich. ex Schwägr.) Bruch *et* Schimp., *Pottia commutata* Limpr., *Pottia davalliana* (Sm.) C.E.O. Jensen var. *conica* (Schleich. ex Schwägr.) Podp.]

MALTA: Qormi, Corradino, Sliema, Ghaxaq, Marsascala, Wied Balluta and Valletta (Baur, 1891); Porte Bombe, Ta' Baldu and Girgenti (Sommier & Caruana Gatto, 1915); Wied Incita (Borg, 1993); Mellieha (Frahm & Lüth, 2008). Also found in Wied Gerzuma, Ghajn Tuffieħa, Wied Luq, Girgenti and Kalkara on shaded soil paths and open soil. GOZO: Ggantija (Frahm & Lüth, 2008).

Microbryum rectum (With.) R.H. Zander [*Phascum rectum* With., *Pottia recta* (With.) Mitt.]

MALTA: Qormi, Marsaxlokk, Valletta and Ghaxaq (Baur, 1891); Wied Incita, Porte Bombe and Gnejna (Sommier & Caruana Gatto, 1915); Verdala (Borg, 1993).

Microbryum starckeanum (Hedw.) R.H. Zander [*Pottia starckeanum* var. *brachyodus* (Bruch et Schimp.) Müll. Hal., *Pottia mutica* Vent.]

MALTA: Senglea, Msida, Wied Balluta, Marsa, Sliema, Ghaxaq and Marsascala (Baur, 1891); Wied Incita, Porte Bombe, Ingieret, Wied Babu, Senglea and Mdina (Sommier & Caruana Gatto, 1915); Wied Faham and tal-Qroqq (Borg, 1993); Mellieha (Frahm & Lüth, 2008). COMINO: No precise location is listed, but most of the island is too small for place names (Borg, 1993). The combination *Pottia davalliana* var. *brachyoda* listed for Malta (Dia *et al.*, 1987) is not valid.

Orthotrichum diaphanum Schrad. ex Brid.

MALTA: Buskett and San Anton (Sommier & Caruana Gatto, 1915).

Oxyrrhynchium hians (Hedw.) Loeske [*Eurhynchium swartzii* (Turn.) Curn., *Eurhynchium hians* (Hedw.) Sande Lac.]

MALTA: Argotti and Imtahleb (Sommier & Caruana Gatto, 1915). Recently also found in Bahrija and Girgenti (Herb. *Mifsud*), on wet dripping rocks and in water channels.

Oxyrrhynchium schleicheri (R. Hedw.) Röhl. [*Eurhynchium schleicheri* (R. Hedw.) Milde]

MALTA: Gnejna, Ghajn Tuffieha and Balluta (Sommier & Caruana Gatto, 1915).

****Oxyrrhynchium speciosum*** (Brid.) Warnst. [*Eurhynchium speciosum* (Bridel) Jur.]

MALTA: Gnejna, 35°55'03"N 14°21'30"E, 60 m a.s.l., on a dripping crag and submerged in a cave-well, 5 Dec 2010, *Mifsud*. The previous Maltese specimens labelled *Eurhynchium speciosum* collected by Lanfranco in Buskett and Girgenti, and listed in Borg (1993) were recently respectively checked as *Rhynchostegiella curviseta* and *O. hians*.

Plasteurhynchium striatulum (Spruce) M. Fleisch. [*Eurhynchium striatulum* (Spruce) Schimp., *Isothecium striatulum* (Spruce) Kindb.]

MALTA: Qormi and Wied Balluta (Baur, 1891); Bingemma and Wied Qirda (Frahm & Lüth, 2008).

Pohlia melanodon (Brid.) A.J. Shaw [*Webera carnea* Schimp.]

MALTA: Imtahleb, Fiddien, Gnejna and Wied Bingemma (Sommier & Caruana Gatto, 1915). Recently found by the author on long term wet substrates, such as along streams in Buskett, Girgenti, Bahrija, Wied Ghasel and in urban areas such as the Marsa Power station and Bormla tunnel. GOZO: Wied Rihan and Ta' Cenc (Sommier & Caruana Gatto, 1915).

Pseudocrossidium hornschuchianum (Schultz) R.H. Zander [*Barbula hornschuchiana* Shultz]

MALTA: Imtahleb, Fiddien and Mdina (Sommier & Caruana Gatto, 1915); Tal-Qroqq (Borg, 1993); also in Buskett 35°51'23"N, 14°23'59"E, 210m a.s.l., on thin soil, 12 March 2005, *Holyoak*. GOZO: Xlendi (Sommier & Caruana Gatto, 1915).

Pseudocrossidium revolutum (Brid.) R.H. Zander [*Barbula revoluta* Brid.]

MALTA: Addolorata, Fiddien, Mgieret, Marsaxlokk and Zejtun (Sommier & Caruana Gatto, 1915).

Ptychostomum capillare (Hedw.) D.T. Holyoak *et* N. Pedersen [*Bryum capillare* Hedw., *B. capillare* var. *meridionale* Schimp.]

MALTA: San Anton, Addolorata, Ta' Bria, Fort Manuel, Girgenti, Fiddien, Gnejna and Birzebbugia (Sommier & Caruana Gatto, 1915); Wied Xaghri, Maqluba, Wied Dis, Chadwick Lakes and Manoel Island (Borg, 1993); also found recently in Wied Ghasel, Buskett and Wied Qirda on humid soil and rock in semi shade. GOZO: Mgarr and Xlendi (Sommier & Caruana Gatto, 1915); Wied Xlendi (Borg 1993). COMINO: Santa Maria (Borg, 1993).

Ptychostomum donianum (Grev.) D.T. Holyoak *et* N. Pedersen [*Bryum donii* Grev. *orthogr. pro B. donianum* Grev., *Bryum donianum* Grev.]

MALTA: Wied Balluta (Baur, 1891). Luqa, Hagar Qim, Wied Babu, Valletta, Mgieret, Wied Ghasel, Wied Incita and Ta' Baldu (Sommier & Caruana Gatto, 1915); Mellieha, Wied Saptan and Wied Babu (Frahm & Lüth, 2008); also collected at GhajnTuffieha and Buskett by Holyoak in 2005. GOZO: Mgarr (Gradstein, 1972).

Ptychostomum imbricatulum (Müll. Hal.) D.T. Holyoak *et* N. Pedersen [*Bryum caespiticum* Hedw.]

MALTA: Wied Incita, Ta' Baldu, Girgenti, Buskett, Zurrieq, Gnejna and Addolorata (Sommier & Caruana Gatto, 1915); Wied Ghomor, Verdala, Wied Babu, Chadwick Lakes and Wied Zurrieq (Borg, 1993). Dingli (Frahm & Lüth, 2008); GOZO: Wied Qorrot (Sommier & Caruana Gatto, 1915). A typical moss of shallow soil in open garigue, also collected in Wied Ghasel, Wied Saptan, Wardija, Wied Ghollieqa, Buskett (all in Malta) by the author and from Xlendi (Gozo) by Holyoak.

Ptychostomum pseudotriquetrum* var. *bimum (Schreb.) D.T. Holyoak *et* N. Pedersen [*Bryum bimum* (Schreb.) Turner, *Bryum pseudotriquetrum* var. *bimum* (Schreb.) Lilj.]

MALTA: Wied Balluta (Baur, 1891). A single record from a valley that has been highly urbanised and degraded.

****Ptychostomum rubens*** (Mitt.) D.T. Holyoak *et* N. Pedersen

MALTA: Ghajn tuffieha, 35°55'50"N, 14°20'42"E, 20m a.s.l., on thin soil between boulders, cliff, March 2005, Holyoak. Also found by Mifsud in Bormla, Wied Ghasel, St. Martin and Wied Ghollieqa near streams and seepages.

Records of *Bryum erythrocarpum* Schwäg. (Zejtun, Marsa) and its variety *minor* Baur (M'Scala) in Baur (1891) may refer to *Ptychostomum rubens* and *Bryum radiculosum*, as other members of the *Bryum erythrocarpum* complex have not subsequently been recorded in Malta. *Bryum blindii* Bruch *et* Schimp (listed in Borg 1993) has been used in Malta as a modern synonym of *Bryum erythrocarpum* Schwäg. (Borg, 1993), but it has not been recorded.

Rhynchostegiella curviseta (Brid.) Lindb. [*Rhynchostegium curvisetum* (Brid.) Schimp.]

MALTA: Gnejna (Sommier & Caruana Gatto, 1915). Collected on numerous occasions from 2001 to 2011 by Holyoak and Mifsud at various points in the Wied Luq-Girgenti valley system; attached to shaded limestone and roots, reservoirs, streams and channels, partly or wholly submerged in cascading water.

****Rhynchostegiella litorea*** (De Not.) Limpr.

MALTA: Wied Babu, 35°49'35"N, 14°27'43"E, 75 m, on stones and tree stems, 20 March 2011, Mifsud. Found growing on shaded rocks, stones and tree bark in Maqluba, Buskett, Gharghur, Lunzjata and Wardija.

All recent finds of "*R. tenella*" corresponded with the description of *R. litorea* implying that previous records of *R. tenella* probably included *R. litorea*.

Rhynchostegiella tenella (Dicks.) Limpr. [*Hypnum tenellum* Dicks., *Rhynchostegium algerianum* (Brid. ex P. Beauv.) Lindb., *Rhynchostegium tenellum* (Dicks.) Schimp.]

MALTA: Maqluba, Wied Qirda and Wied Balluta (Baur, 1891). “Common in all valleys” (Sommier & Caruana Gatto, 1915); Wied Xaghri (Borg, 1993); Mellieha, Wied Babu and Bingemma (Frahm & Lüth, 2008). GOZO: Mgarr (Gradstein, 1972).

Rhynchostegium megapolitanum (Blandow ex F.Weber et D.Mohr) Schimp. [*R. megapolitanum* var. *meridionale* Schimp.]

MALTA: Marsaxlokk, San Martin, Imghieret, Zurrieq and Ghajn Tuffieha (Sommier & Caruana Gatto, 1915); Mgiebah, Wied Xaghri and Wied Ghasel (Borg, 1993); Bingemma, Wied Babu and Wied Saptan (Frahm & Lüth, 2008). Also recently found by the author in Buskett, Wied Ghomor, S.Pawl tat-Targa, Wardija and Dingli on rocks and leaf litter in *Pinus* stands, garigue and shaded cliffs. GOZO: San Blas, Xlendi (Sommier & Caruana Gatto, 1915).

Scleropodium touretti (Brid.) L.F.Koch [*Scleropodium illecebrum* Schimp.]

MALTA: Wied Qirda (Baur, 1891); Wied Incita, Girgenti, Wied Qliegħa, Wied Ghomor and Wied Ghasel (Sommier & Caruana Gatto, 1915); Wied Hanzir, Buskett, Wied Dalam and Wied Babu (Borg, 1993); Wied Saptan (Frahm & Lüth, 2008). Also recently found by the author in San Pawl tat-Targa and Verdala on rocks and in debris along the roadside. GOZO: Mgarr, Xlendi (Sommier & Caruana Gatto, 1915).

Scorpiurium circinatum (Bruch) M.Fleisch. et Loeske [*Eurhynchium circinatum* (Brid.) Schimp., *Hypnum circinatum* f. *attenuatum* Boulay, *Thamnium cossyrense* var. *melitense* Bott.,]

Common in all valleys in Malta and Gozo. Numerous collections listed in all literature including Sommier & Caruana Gatto (1915), Borg (1993), Gradstein (1972) and Frahm & Lüth (2008). It grows on soil, rock and tree bases as well as epiphytically on tree branches at Maqluba, Wied Babu and even submerged in periodically dry reservoir at Girgenti. A number of forms exist in Malta: with short branches in well lit situations to a form with long stems and infrequent branches in submerged conditions. A sub-dendroid form was even mistaken for a *Thamnobryum* by Bottini (Mastracci, 2001).

Timmiella barbuloidea (Brid.) Mönk. [*Trichostomum barbula* Schwäg., *Timmiella barbula* Limpr.]

MALTA: Wied Qirda (Baur, 1891); Marsa, Fort Manoel, Buskett and Wied Incita (Sommier & Caruana Gatto, 1915); San Pawl tat-Targa (Borg, 1993); Wied Saptan and Dwejra (Frahm & Lüth, 2008). Also recently found by the author in Wied ta' B'Kara, Addolorata and Wied Babu on shaded rocks. GOZO: Ggantija temple (Gradstein, 1972).

Tortella flavovirens (Bruch) Broth. [*Trichostomum flavovirens* Bruch]

MALTA: Maqluba (Gradstein, 1972); San Pawl tat-Targa, Selmun, Fawwara, Wied Babu, Wied Incita, Wied Bahrija, Qammiegh, Verdala, Wied Ghasel, Wied Dis, Wied Qliegħa, Wied Kbir (Borg, 1993). Bugibba, Paradise Bay (Frahm & Lüth, 2008). Also found on shaded rocks at Ghajn Hadid, Wied Gerzuma, Ghajn Tuffieha (Herb. *Holyoak*), Buskett and Wardija (Herb. *Mifsud*). GOZO: Munxar, Xlendi, Marsalforn, Zebbug (Sommier & Caruana Gatto, 1915); Ggantija (Frahm & Lüth, 2008). Also found on the smaller islands such as GOZO (Dwejra) (Borg, 1993).

**Tortella flavovirens* var. *papillosissima* Sérgio et Casas

MALTA: Buskett, 35°51'19"N, 14°23'57"E, 210m a.s.l., on shaded rubble wall, 15 January 2009, *Mifsud*.

Tortella inclinata (R.Hedw.) Limpr.

GOZO: Without locality data (Lanfranco, 1989).

Tortella inflexa (Bruch) Broth. [*Trichostomum inflexum* Bruch.]

MALTA: Maqluba and Wied Balluta (Baur, 1891); Addolorata, Hagar Qim, Wied Babu, Ta' Baldu, Gnejna, M'Xlokk and Zurrieq (Sommier & Caruana Gatto, 1915); St. Paul's bay, on rocks and crevices (Gradstein, 1972); Wied Ghasel, Wied Xaghri, Wied Harq Hammiem, Verdala and Wied Mejxu (Borg 1993). Also recently found by the author in Girgenti, Wied Ghollieqa, Buskett forming light green carpets on rocks and stones in semi-shade. As noted by Gradstein (1972); "This rare Mediterranean moss appears to be common in Malta". GOZO: Wied Hanzira (Gradstein, 1972); Xlendi (Borg, 1993).

Tortella nitida (Lindb.) Broth.

MALTA: Ta' Baldu, M'Xlokk, Wied Ghomor and Minsija (Sommier & Caruana Gatto, 1915); Rdum Madonna, S.Pawl tat-Targa, Gebel Ciantar and Wied Zurrieq (Borg, 1993). GOZO: Xlendi (Sommier & Caruana Gatto, 1915); Mgarr and Il-Prajjet (Gradstein, 1972). Also found in GOZO at Qrolla Safra, Rabat, Zebbug on rocks and walls in shade or sun and on COMINO (Borg, 1993).

The names *Trichostomum nitidum* var. *obtusum* (Boulay) Zodda and *Tortella nitida* var. *obtusum* (Boulay) Jelenc. have been used for Malta but the identity of the variety is unknown.

Tortella tortuosa (Hedw.) Limpr.

MALTA: Wied Babu, Verdala and Wied Hanzir (Borg, 1993). COMINO: Without locality name (Borg, 1993).

Tortula acaulon (With.) R.H. Zander [*Phascum cuspidatum* Hedw.]

MALTA: Valletta (Baur, 1891). GOZO: Dwejra (Frahm & Lüth, 2008).

Tortula acaulon var. *pilifera* (Hedw.) R.H. Zander [*Phascum cuspidatum* var. *piliferum* (Hedw.) Hook. et Taylor]

GOZO: Ggantija Temple (Frahm & Lüth, 2008).

Tortula caucasica Broth [*Pottia truncata* var. *major* (F. Weber et D. Mohr) Bruch et Schimp., *Pottia intermedia*, (Turner) Fürnr.]

MALTA: Senglea and St.Paul's Bay (Baur, 1891); Valletta, Marsaxlokk and Mgieret (Sommier & Caruana Gatto, 1915); Wied Incita (Borg, 1993).

**Tortula freibergii* Dixon et Loeske

MALTA: Girgenti, 35°51'21"N, 14°24'54"E, 125 m a.s.l., on a dam wall in spray zone associated with *Didymodon tophaceus*, 4 March 2011, *Mifsud*.

Tortula marginata (Bruch et Schimp.) Spruce [*Barbula marginata* Bruch et Schimp.]

MALTA: Msida and Wied Balluta (Baur, 1891). "Common everywhere" (Sommier & Caruana Gatto, 1915). Wied Mejxu and Wied Babu (Borg, 1993); Mellieha, Xemxija and Buskett (Frahm & Lüth, 2008). GOZO: Mgarr (Gradstein, 1972); Cittadella (Borg, 1993). Also recorded by the author as common on shaded rocks and walls, in urban and rural habitats such as Wied Qliegha, Wied Incita, Wied Kbir, Hamrun, Wied Luq, Girgenti (Malta) and Rabat, Marsalforn (Gozo).

Tortula muralis Hedw. var. *muralis* [*Barbula muralis* (Hedw.) Crome., *T. muralis* var. *incana* Bruch et Schimp.]

MALTA: Gharghur and Wied Balluta (Baur, 1891); Wied Incita, M'Xlokk, Valletta and Girgenti (Sommier & Caruana Gatto, 1915); Wied Dis, Verdala,

Wied Saptan, Fawwara, tal-Qroqq, Chadwick lakes, Wied Ghasel, Wied Babu, Wied Kbir and St.Elmo (Borg, 1993). GOZO: Xlendi and Wied Qorrot (Sommier & Caruana Gatto, 1915); Xaghra and Ghajnsielem (Borg, 1993). Very common on exposed rocks, walls and buildings in all localities.

Tortula muralis var. *aestiva* Brid. ex Hedw., [*Barbula muralis* var. *aestiva* (Brid. ex Hedw.) Röhl., *Tortula aestiva* (Brid. ex Hedw.) P. Beauv.]

MALTA: Valletta (Sommier & Caruana Gatto, 1915); Buskett and Mellieha (Frahm & Lüth, 2008). Recently found on shaded limestone walls, even in urban areas such as Hamrun and Paola.

Tortula pallida (Lindb.) R.H. Zander [*Pottia venusta* Jur.]

MALTA: Corradino and Marsascalea (Baur, 1891); Port Bombi (Sommier & Caruana Gatto, 1915); Ghallis rock (Frahm & Lüth, 2008). GOZO: Dwejra, Ggantija (Frahm & Lüth, 2008).

Tortula solmsii (Schimp.) Limpr.

MALTA: Mdina (Sommier & Caruana Gatto, 1915). Also found in Wied Qliegha 35°53'19"N, 14°22'50"E, 130m a.s.l., on limestone along stream, 6 April 2006, *Mifsud*.

Tortula truncata (Hedw.) Mitt. [*Pottia truncata* (Hedw.) Bruch et Schimp., *Pottia truncatula* (With.) Büse nom. illeg.]

MALTA: Corradino (Baur, 1891); Selmun (Borg, 1993).

****Tortula vahliana*** (Schultz) Mont.

MALTA: Kalkara, 35°53'09"N, 14°31'34"E, 21m a.s.l., on shaded rock, 20 April 2011, *Mifsud*.

Trichostomum brachydontium Bruch [*Trichostomum mutabile* Bruch]

MALTA: Wied Balluta (Baur, 1891); Hagar Qim, Wied Babu, Wied Incita and M'Xlokk (Sommier & Caruana Gatto, 1915); Selmun, Wied Xaghri, Torri l-Abjad, S.Pawl tat-Targa, Wied Zurrieq, Wied Babu and Gebel Ciantar (Borg, 1993); Qasam Barrani (Frahm & Lüth, 2008). Recently also found on open rocky soil in Ghajn Tuffieha and Buskett. GOZO: Ghajnsielem and Xlendi (Borg, 1993).

Trichostomum crispulum Bruch [*Trichostomum crispulum* var. *elatum* Schimp.]

MALTA: Mdina, Wied Incita, Girgenti, Ballut, Ta' Baldu and Minsija (Sommier & Caruana Gatto, 1915); Wied Saptan, Fawwara, Rdum Madonna, Misrah Ghonoq, S.Pawl tat-Targa, Wied Babu, Mtahleb (Borg, 1993); Qasam Barrani, Wied Qirda (Frahm & Lüth, 2008). Recently found forming yellow green patches in semi-shaded gravel in Buskett. GOZO: Xlendi, Marsalforn and Xlendi (Sommier & Caruana Gatto, 1915).

Weissia brachycarpa (Nees et Hornsch.) Jur.

MALTA: Xemxija (Frahm & Lüth, 2008).

Weissia condensa (Voit) Lindb. [*Gymnostomum tortile* Schwägr., *Hymenostomum tortile* (Schwägr.) Bruch et Schimp.]

MALTA: Wied Qirda, Chircop and Siggiewi (Baur, 1891); Ghajn tuffieha, 35°55'50"N, 14°20'42"E, 20m a.s.l., thin soil between boulders at base of cliff, 9 March 2005, *Holyoak*.

Weissia controversa Hedw. [*Weissia viridula* Hedw. ex Brid.]

MALTA: Mdina, Wied Incita, Ta' Baldu and Wied Qorrot (Sommier & Caruana Gatto, 1915).

Weissia controversa var. *crispata* (Nees et Hornsch.) Nyholm [*Weissia fallax* Sehm.]

MALTA: Mellieha (Frahm & Lüth, 2008).

****Weissia longifolia* Mitt.**

MALTA: Ghajn Tuffieha, 35°55'46"N, 14°20'51"E, 70 m a.s.l., rocks on slope, 9 March 2005, *Holyoak*.

Only var. *angustifolia* (Baumgartner) Crundw. & Nyholm has been reported, although it is not accepted in Hill *et al.* (2006).

Doubtful Records

Barbula convoluta Hedw.

GOZO: Mgarr (Borg, 1993). The illustration of leaf raises doubt. No other record of the species has been published for Malta, and the original specimen is not available for confirmation.

Bryum intermedium Ludw. (Brid.) var. *subcylindricum* Limpr.

MALTA: Wied il-Qliegħa (Sommier & Caruana Gatto, 1915). A northern/mountainous species unlikely to grow in Malta. The variety *subcylindricum* Limpr. requires further investigation.

Ptychostomum pallescens (Schleich. ex Schwägr.) J. R. Spence [*Bryum obconicum* Hornsch., *Bryum pallescens* Schleich. et Schwägr.]

Bryum obconicum was recorded in Gnejna by Sommier & Caruana Gatto (1915). The type specimen of this species was synonymised with *P. pallescens*, a northern species unlikely to be found in Malta. However many gatherings of *B. obconicum* have been found to be *B. torquescens* (Smith, 1978), a more likely identity also for the Maltese specimen.

Scorpiurium deflexifolium var. *myosuroideum* (Bott.) Podp. [*Eurhynchium circinatum* var. *myosuroideum*]

A single record by Sommier & Caruana Gatto (1915), growing on tree trunks at Wied Babu. However all epiphytic *Scorpiurium* collected at Wied Babu in 2011 were identified as *Scorpiurium circinatum* by Lars Hedenäs, even though not of typical form.

Tortella squarrosa (Brid.) Limpr. [*Pleurochaete squarrosa* (Brid.) Lindb.]

This is one of the few specimens collected by Caruana Gatto near Valletta that was determined by Brizi, who described it as 'forma *minor, sterilis, flavescens, rigidula*' (Brizi 1890). Even though common elsewhere in the Mediterranean this distinctive species has not been recorded in Malta since the 1800's.

Weissia wimmeriana var. *muralis* (Spruce) Breidl.

Recorded in Malta between San Gwann and St Julians by Sommier & Caruana Gatto (1915). *Weissia wimmeriana* is a mountainous species unlikely to be found in Malta. This variety *muralis*, listed by Bottini, may refer to a different species.

Rejected Records

Distichium inclinatum (Hedw.) Bruch et Schimp.

Gulia (1858-1859) mentioned *Grimmia inclinata* without author, locality and confirmation by a contemporary bryologist. Sommier and Caruana Gatto (1915) left it out of their main checklist. Although this name is at present accepted as a synonym of *Distichium inclinatum* it is not clear that the author referred to this species which is therefore rejected from the Maltese bryoflora.

Pohlia elongata Hedw.

Borg (1993) lists *P. elongata*, however the original specimen is a *Bryum* sp.

Pohlia wahlenbergii (F. Weber et D. Mohr) A.L. Andrews [*Mniobryum wahlenbergii* (F. Weber et D. Mohr) Jenn.]

Lanfranco (1989) lists this for Malta at Bahrija. However the original specimen is a typical *Pohlia melanodon*.

Scorpiurium sendtneri (Schimp.) M.Fleisch.

Sommier (1916) reported *Thamnum cossyrense* Bott. from Malta without indication of variety. After the taxonomical study of Mastracci (2001) of both names, *T. cossyrense* is identical with *Scorpiurium sendtneri* and *T. cossyrense* var. *melitense* with *Scorpiurium circinatum*. However the 1916 publication by Sommier made reference to earlier collections by Caruana Gatto which had already been identified as *T. cossyrense* var. *melitense*. It is apparent that the 1916 report was not based on new records from Malta and so *S. sendtneri* should not be included in the Maltese list.

Vesicularia galerulata (Duby) Broth. [*Vesicularia sphaerocarpa* (A. Jaeger) Broth.]

Reported from Malta by Reimers (1934) on the basis of a 19th century collection by Schweinfurth. This was excluded from the European checklist by Hill *et al.* (2006).

DISCUSSION

Each publication of moss records in Malta, starting from Nyman (1844), has added to the list of known taxa. Ten species and one variety are recorded here for the first time. Species that have not been found in decades and are listed in the Red Data Book (Lanfranco 1989), such as *Tortula solmsii* and *Rhynchostegiella curviseta* have also been found again. However many others have still not been recorded since the early 1900's.

A number of other species are regularly imported unintentionally, growing on the surface of potted soil. Their spread is generally limited by their requirements for low pH, low temperature or high humidity and have not been included in the list (eg. *Rhizomnium punctatum* (Hedw.) T.J. Kop., reported once from a pot in a garden in Sliema (Borg, 1993)). Some mosses are imported intentionally for use with "Bonsai" (e.g. *Leptobryum pyriforme* (Hedw.) Wilson, *Polytrichum* sp. pl.) as well as for the aquarium hobby (e.g. *Vesicularia montagnei* (Schimp.) Broth. and *Fontinalis antipyretica* Hedw.) and grow outside in a few private gardens. They are however limited in their ability to colonise other Maltese habitats and have also been omitted from the list.

The long history of human habitation in Malta and its extensive alteration in the Maltese landscape have favoured the selection of facultative synanthropic species. Humans have had a significant role in the introduction and dispersal of mosses, the removal of competing angiosperms in ploughed soil, gardens, country paths, etc and in the creation of suitable habitats such as rubble walls, fort ditches, cemeteries, etc. Recently, condensate from cooling equipment has even allowed mosses such as *Bryum argenteum* and *Pohlia melanodon* to grow in the dry summer months. Many of the recorded species have benefited to some degree from human activities. Even those associated with the rare fresh water

habitats have colonised reservoirs, water channels and dams. Nonetheless it is important to conserve both the natural and semi-natural areas which host the rarest species such as *Tortula freibergii* and *Oxyrrhynchium speciosum*.

Acknowledgements. I would like to thank everyone who helped me in this project including Edwin Lanfranco (University of Malta), David Holyoak (Cabeçudo, Portugal), Lars Hedenäs (Natural History Museum, Sweden), Maria Giovanna Dia (University of Palermo, Italy), Ida Bruggeman-Nanenga (Zeist, The Netherlands), Stephan Robbert Gradstein (Paris, France) and especially Rosa María Ros (University of Murcia, Spain) to whom I am greatly indebted.

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