The **Zygodon**-dominated species-po bryophyte flora of the Isles of Scilly

Jeff Duckett attributes unusual features of the epiphytic bryophyte flora of the Scilly Isles to the effects of salt spray and prolific lichens

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ryological pilgrimages to the Isles of Scilly almost invariably centre on Riccia crystallina, Sphaerocarpos, Phaeoceros and Anthoceros in the bulb fields and the spread of the exotics found initially in the Tresco Abbey gardens in the 1950s and 1960s. Whereas Calyptrochaeta apiculata (Paton, 1968) remains restricted to a few colonies on Tresco, it is now very difficult not to tread on Lophocolea semiteres (Paton, 1965) as it covers just about every footpath on the archipelago. On wall tops it grows alongside L. bispinosa (Paton, 1974) whilst Telaranea murphyae (Paton, 1965) is now abundant on damp banks across Tresco, has spread to St Mary's and, during a visit in 2018, I also found it for the first time on St Martins. Sematophyllum substrumulosum, described as new to Britain in the Isles of Scilly in 1995 (Holyoak, 1996), has subsequently been found on four of the five major islands (St Agnes, St Martin's, St Mary's and Tresco, but not Bryer), and two additional islets.

 \triangle The Great Pool, Tresco, fringed by lichen-festooned willows (see Fig. 6).

During my visit in April 2018, as well as catching up on these bryological delights, which Jean Paton first showed me in 1967, I was most surprised to observe a remarkable lack of epiphytic bryophytes on both native and exotic trees and particularly in sheltered locations where elsewhere in the U.K. the same tree species support diverse taxa. Thus this account, highlighting the unique nature of the Scillies epiphyte flora, comes with a clear warning: if you are interested in epiphytic bryophytes the Isles of Scilly are probably not the place for you.

The occurrence of epiphytic bryophytes on Scilly from the literature (Holyoak, 2016), the BBS data base and my own observations in 2018 is summarized in Table 1. These represent approximately half the 45 or so mosses found as epiphytes on mainland Cornwall and twothirds of the 15 liverworts. Of the 26 mosses and 9 liverworts listed in Table 1, only 14 and 5 respectively are found as epiphytes on all five





major islands, three species (*Orthotrichum affine, Ulota bruchii* and *U. crispa*) are, to date, restricted to St Mary's and four (*Metzgeria violacea, Radula complanata, Dicranoweisia cirrata* and *Zygodon conoideus*) to Tresco.

The only two species forming extensive patches on both the trunks and bases of deciduous sycamores and native elms are Zygodon viridissimus (Fig. 1) and Hypnum resupinatum with smaller amounts of H. andoi and Rhynchostegium confertum. Zygodon viridissimus is also one of the dominant mosses on wall surfaces (Fig. 2) and in crevices (Fig. 3), usually associated with Frullania microphylla or F. fragilifolia across the islands. Inclusion of conifers (Pinus and Cupressus) which have likewise dominant Zygodon (Figs. 4, 5) adds Sematophyllum substrumulosum to the epiphyte list whilst the bases of willows near to water (Fig. 6) are covered with Amblystegium serpens, Leptodictyum riparium and less frequently Brachythecium rutabulum and Calliergonella cuspidata. Otherwise branches and twigs of willows are festooned with lichens but no bryophytes (Fig. 6) and the same is true for the trunks of Cordyline (Fig. 7), palms and other exotics. Many bryophyte species are largely restricted to the tree bases whilst most mosses on the trunks usually occur as small cushions and the liverworts as small patches less than 2-3 cm in diameter. Small and scattered epiphyte colonies of Bryum capillare, Dicranum scoparium, Orthotrichum diaphanum and Ulota phyllantha stand in marked contrast to the extensive swelling patches of these mosses on rocks and walls on the Scillies. Notably rare as epiphytes are Metzgeria violacea, Radula complanata, Cryphaea heteromalla (Fig. 8), Dicranoweisia cirrata, also unknown as a saxicole on the Scillies, Orthotrichum affine, Ulota bruchii and U. crispa. Microscopic examination of over 30 epiphytic Zygodon colonies revealed that only one of these was Z. conoideus and not viridissimus whilst Z.

▽Fig. 1. Ulmus trunk with pure Zygodon viridissimus.





△Fig. 2. Granite wall 50 m from the sea, New Grimsby, Tresco, with *Zygodon viridissimus* surrounded by *Frullania microphylla*.

stirtonii appears to be exclusively saxicolous on the Scillies and *Z. rupestris* has not been recorded. In view of the absence of previous records for the Scillies the presence of epiphytic *Metzgeria consanguinea* (Fig. 9) on three of the major islands was unexpected as was its frequent occurrence on shaded walls.

The present findings on the Isles of Scilly are very much in line with David Holyoak's authoritative account (Holyoak, 2016) of coastal influences on bryophytes based on extensive fieldwork and tetrad analysis. Though clearly demonstrating that coastal tetrads have reduced

numbers of bryophyte species, Holyoak does not single out epiphytes per se or note the abundance of Zygodon viridissimus described in this account. But, as found here, he specifically mentions that Metzgeria furcata, Orthotrichum diaphanum and Ulota phyllantha are common within 1 km of coasts. Of three species classified as having low or moderate coast tolerance Syntrichia laevipila occurs as notably smaller colonies in the Scillies than on inland trees, there is but a single recent record for Dicranoweisia cirrata and Grimmia pulvinata is absent as an epiphyte. The rarity of Cryphaea heteromalla, Microlejeunea ulicina and Zygodon conoideus is in line with these as species intolerant of coasts whereas Leptodictyum riparium and Neckera complanata (Fig. 10), which are also in this category, are commoner than might be expected.

The highly coast-intolerant species *Metzgeria* violacea, Neckera pumila, Orthotrichum affine, Ulota bruchii and U. crispa are only represented by single records whilst notable absentees in this category from the islands are *Homalia* trichomanoides, Orthotrichum pulchellum and O. tenellum.

Holyoak points out that many environmental factors are likely to affect bryophytes whose







△Fig. 4. *Cupressus macrocarpa* trunk with pure *Zygodon viridissimus* on the trunk.

distributions vary in relation to distance from the coast. These include higher windspeeds, humidity, higher insolation, higher temperatures, fewer frosts and lower rainfall plus exposure to salt as probably significant variables. Whilst

▽Fig. 6. Salix carr by the Great Pool, Tresco showing bryophyte-free twigs and branches covered with lichens.





△Fig. 5. Extensive Zygodon viridissimus growing with Hypnum resupinatum on the base of Cupressus macrocarpa.

differential tolerance to salt spray may have a direct effect on the composition of some epiphytic communities on the Scillies, for example the reduced tuft sizes in many species, another indirect factor, namely prolific lichen growth, may be equally if not more important. It is most likely that absence of bryophytes from many trees on the Scillies, for example *Cordyline*

⊽Fig. 7. Lichen-covered bryophyte-free Cordyline australis with the New Zealand strangler Metrosideros growing on it.



australis, many palms and particularly willows, is not because they cannot grow here but that, due to salt deposition, they are outcompeted by lichens where halophytic species can be literally numbered in the hundreds (Delmail *et al.*, 2013) compared to just one obligate halophyte moss *Schistidium maritimum* and one strongly halophytic species *Tortella flavovirens*.

In the absence of actual data on salt tolerance the possible reasons for the abundance of *Zygodon viridissimus* on the Scillies are at present matters for speculation. However, one possible factor, readily amenable to experimentation, may be the survival and germination of its thick-walled gemmae in the presence of sea salt. Looking at asexual propagule production by the Scilly epiphytes, their continuous production not just by *Zygodon* but also by *Sematophyllum* (Matcham *et al.*, 2005) and the highly salt tolerant *Ulota phyllantha* is most striking in this context.

Reflecting their much larger size, the Channel Islands have a much more diverse epiphyte flora including many species absent from the Scillies: *Lejeunea cavifolia, L. lamacerina, Leucodon sciuroides, Orthotrichum lyellii, O. pulchellum, O. striatum, O. tenellum* and *Syntrichia papillosa* plus a greater abundance of *Metzgeria violacea*

▽Fig. 9. Metzgeria consanguinea on Bryher.



△Fig. 8. Cryphaea heteromalla on Ulmus branch.

and *Orthotrichum affine*. In terms of numbers, the 35 epiphytes recorded from the Scillies are in line with the 41 recorded from 617 trees in East Anglian orchards (Stevenson *et al.*, 2017) and the 35 from over 400 trees along major roads in London in 2018 (Duckett & Pressel, unpublished data). Whereas the latter are certainly increasing due to nitrogen deposition (Duckett & Pressel, 2016) there is no obvious evidence for any significant changes in the Scillies epiphytes over the 47 years between Paton's (1969) and Holyoak's (2016) floras.

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▽Fig. 10. Neckera complanata on an Ulmus trunk.



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Jeffrey G. Duckett e j.g.duckett@qmul.ac.uk

abla The Tresco Abbey Gardens with diverse exotic trees supporting very few epiphytic bryophytes.



excuueu 11011 1118 analysis. Geninita 10us; Spor, sporadic.	Salt tolerance		Highly tolerant	Low to moderate tolerance	Highly tolerant	Low to moderate tolerance	Highly tolerant	, Intolerant	Low to moderate tolerance	Highly tolerant	Highly tolerant	ind Low to moderate tolerance	in's Low to moderate tolerance	Highly tolerant	Highly tolerant	Highly tolerant) Intolerant	Intolerant
07) is indicated by Cont, continu	Comments		Mainly on bases of willows	Mainly on bases of willows	Occasional cushions	Mainly on bases of willows	Occasional cushions	One record on St Mary's pre 1992 Ulmus on Tresco 2018	One record pre 1992, on <i>Phoenix</i> palm 2018	Occasional cushions	Around bases of trunks	Trunks and bases; new to Bryher a St Agnes 2018	Trunks and bases; new to St Marti 2018	Trunks and bases	Around bases of trunks	Around bases of trunks	Mainly on bases of willows next to water	Mainly on trunks
10110005; Pressel <i>et al.</i> , 20	Islands as an epiphyte		All 5	All 5	All 5	St Mary's, Tresco	All 5	St Mary's, Tresco	Tresco	All 5	All 5	All 5	All 5	All 5	All 5	All 5	St Mary's, Tresco	St Mary's, Tresco
ham <i>et al.</i> ,	Frequency as an epiphyte		ц	0	0	0	0	R	R	0	0	Н	Н	А	0	0	0	0
O, occasional; N, Iare. 3a Duckett <i>et al.</i> , 2001; Matc	Species	Mosses	Amblystegium serpens	Brachythecium rutabulum	Bryum capillare	Calliergonella cuspidata	Campylopus introflexus	Cryphaea heteromalla	Dicranoweisia cirrata	Dicranum scoparium	Homalothecium sericeum	Hypnum andoi	H. cupressiforme	H. resupinatum	Isothecium myosuroides	Kindbergia praelonga	Leptodictyum riparium	Neckera complanata

Table 1. Epiphytic bryophytes of the five major islands of the Scillies. Frequency as an epiphyte is indicated by A, abundant; C, common; F, frequent; O occasional: R rare Salt rolerance follows Holvook (2016) with N/A indicating aliens evoluted from his analysis Gemma production (after

Highly intolerant	attered on trunks Low to moderate tolerance	Low to moderate tolerance	<i>Pinus</i> or <i>Cupressus.</i> it Agnes and St N/A	s Low to moderate tolerance	in sheltered <i>Salix</i> Highly intolerant	in sheltered Salix Highly intolerant	attered on trunks Highly tolerant	us in Abbey Gardens Intolerant	hyte on trunks and Highly tolerant		ks Highly tolerant	trunks Highly tolerant	runks Low to moderate tolerance	runks N/A	o the Scillies Intolerant	Highly tolerant	Highly intolerant	Intolerant	
A single record	Small cushions sca	Around tree bases	Almost always on ssco Only on soil on St Martin's	ssco Scattered cushions	Only one record i carr	Only one record i carr	Small cushions sca	Restricted to Ulm	Dominant bryoph tree bases		Frequent on trunk	Small patches on t	Around bases of ti	Around bases of ti	co On trunks, new to	On trunks	On trees	On trunks	
St Mary's	All 5	All 5	St Mary's, Tre	St Mary's, Tre	St Mary's	St Mary's		Tresco	All 5		All 5	All 5	All 5	All 5	Bryher, St Martin's, Tres	All 5	Tresco	St Mary's, Tresco	
R	C	U	ц	0	Я	R	С	R	А		ц	0	R	Ц	ц	ц	R	0	
otrichum affine	iaphanum	ıchostegium confertum	atophyllum trumulosum	richia laevipila	a bruchii	rispa	hyllantha	odon conoideus	iridissimus	erworts	llejeunea minutissima	llania dilatata	bocolea beterophylla	miteres	zgeria consanguinea	urcata	violacea	rolejeunea ulicina	