VARIATION IN *PEPLIS PORTULA* L.

By D. E. Allen

Introduction.

It has long been known that *Peplis portula* L. varies considerably in the length of the outer calyx teeth. Although there is a general acceptance of the fact that this variation has some geographical significance, little attempt has hitherto been made to discover how far this assumption is justified. The present study was undertaken primarily to plot the distribution of the variation in the British Isles, but in the course of the work a number of interesting features have come to light and are discussed in this paper.

The first notice of the variation in Britain was given by Dunn (1896), who, however, made the surprising assertion that var. *longidentata* Gay, a local race on the Continent, appeared to be the only form occurring in this country. It is difficult to account for this error, for Dunn is known to have been familiar with parts of Surrey and Warwickshire ; his statement would have been understandable had his experience been confined, say, to the Cornish Peninsula. The next mention was by Druce (1911) who, misunderstanding the true nature of var. *longidentata* and misled by only finding specimens that did not display the calyx character to an extreme degree, created a new variety *dentata* for the British plants, which in his opinion formed a passage to the (supposedly) Mediterranean var. *longidentata*. Druce's name was challenged by Thompson (1917), who rightly claimed that perfectly good examples of var. *longidentata* were to be found in Britain and also questioned the value of giving varietal names to " passages." Furthermore, in 1916 W. C. Barton had distributed through the Watson Botanical Exchange Club excellent material from Radnor of both the typical plant and what he correctly named var. *longidentata*. Even so, Druce persisted in using his epithet and the interesting nature of the variation soon relapsed into the oblivion from which it had emerged.

Taxonomy

As reported by Bennett (1917), Gay's type is in the Kew Herbarium, where it is described as follows : " Dentibus calycinis interioribus brevibus, exterioribus longioribus, valde elongatis, filiformibus." The specimens were collected in 1825 near Banyuls-de-mer in Roussillon, close to the Franco-Spanish border, and sent to Gay, who later (1832) published an account of the new variety. Afterwards, he seems to have considered it a distinct species, for he raises to it this rank in his herbarium.

The synonymy is as follows :—

P. PORTULA var. LONGIDENTATA Gay, 1832, *Notic. sur Endress*, 38; 1832, *Ann. Sci. Nat.*, **26**, 226 ; *P. fradini* Pomel, 1860, *Matér. Fl. Atlant.*, 156 ; *P. portula* *[ssp.] *longidentata* (Gay) Boiss. & Reut. ex Nym., 1879, *Consp. Fl. Eur.*, **2**, 252 ; *P. longidentata* (Gay) Batt. 1890, in Batt. & Trab., *Fl. Alg.*, **1**, 320 ; *P. portula* " forme " *P. longidentata* (Gay) Rouy & Camus, 1901, *Fl. Fr.*, **7**, 167 ; *P. portula* proles *longidentata* (Gay) Rouy, 1927, *Consp. Fl. Fr.*, 107.

The outer calyx teeth in Gay's type specimens are 1·5-2 mm. long, and this is the extreme reached in various parts of the plant's range. In var. *portula* the outer teeth are not at all elongated and consequently only attain 0·5 mm. in length at the most. Between these two extremes – the latter always well-marked, the former somewhat less so – every intergradation can be found. The continuity of this variation tends to be obscured by

the very small range (only one millimetre) that is involved. H. Stuart Thompson, in a note in his herbarium, also came to the conclusion that every form occurs between the type and var. *longidentata*, but he failed to realise that this intergradation follows a definite pattern. The manner, in fact, in which one extreme gradually gives way to the other following a broadly recognizable geographical trend suggests that a cline of some kind may be distinguishable.

In the earlier determinations of herbarium material during the present study, the two extremes were treated as subspecies – a view which later had to be abandoned. The case for subspecific rank rests not only on the very distinct geographical range of var. *longidentata*, but also on a number of other characters which various authors have claimed to be associated with the elongation of the calyx teeth. Thus, Knerskon (1874) has asserted that the variety is also characterised by sessile (rather than subsessile) flowers and longer, subherbaceous (rather than scarious) bracteoles. Battandier & Trabut (1890) mention a strongly papillose stigma and sublinear (not ovoid) placentas as additional features. It has not been possible to check these alleged correlations (which would have to be done by a biometric analysis, preferably of fresh material), and it is by no means out of the question for the gene or genes determining the elongated character of the calyx teeth to possess a pleiotropic effect, or even for linkage to be involved. However, since the variation between the two extremes of the calyx character evidently forms a single continuum, the maintenance of two distinct subspecies seems inappropriate.

It should be stressed that while var. *portula*, with almost obsolete calyx teeth, is a well-defined extreme, the boundary between var. *longidentata* and the various intermediate grades is a somewhat arbitrary one. Even so, by studying the variation in an area such as Cornwall, where only two out of the eleven gatherings seen fail to exhibit extreme elongation of the calyx teeth, the limits of var. *longidentata* can be comprehended and defined with reasonable precision. Moreover, there are specimens of the variety in Gay's herbarium which he records having grown from seed in 1845. In the British Isles it is not uncommon to find both var. *portula* and intermediates growing together in abundance without any sign of var. *longidentata* ; I have personally encountered this in populations in Dorset and the Isle of Man, and it is reflected in a number of herbarium gatherings. It was this phenomenon, no doubt, that led Druce to the belief that the true variety of the Iberian Peninsula was not to be found in Britain.

In the meantime, it seems best to treat these two extreme forms as varieties ; those who like to use a name for the medial part of a continuous series might find var. *dentata* Druce convenient for the purpose.

Distribution

A study of the distribution of the variants reveals a fairly well-marked geographical trend : var. *longidentata* is prevalent in the west, but becomes gradually replaced eastwards, first by specimens exhibiting various degrees of intermediacy and then by the well-marked extreme of var. *portula*. It is possible that climate operates effectively in producing a balance between the varieties, and for this reason it is of interest to see how far the isophenes coincide with any particular climatic feature.

In order to assess the degree of oceanicity of the climate, Greig-Smith (1950) has employed Amann's Index of Hygrothermy. This is obtained by dividing the annual precipitation (in centimetres) multiplied by the annual mean temperature by the mean temperature of the coldest month subtracted from that of the hottest month, the values of these last three being expressed in degrees Centigrade. On comparing the values for this index in various parts of the British Isles with the variation in *Peplis portula* as plotted on the map (see fig. 1), there would appear to be some correlation in Great Britain between

the line joining places with a hygrothermic value of about 70 and those areas in which the two varieties are represented in approximately equal proportions ; in Ireland, however, no such correlation is perceptible, though little can be argued from this owing to the small amount of material seen from the eastern part of that country.

It would be premature, in view of the so far scanty evidence adduced, to make too emphatic an assertion about the nature of this geographical trend. It does, however, appear that a cline, albeit a rather ill-defined one, is to some extent recognisable. This cline is remarkable for the fact that one extreme, var. *longidentata*, has a " Lusitanian " type of distribution. The direction of the cline – or topocline, as it should perhaps be more accurately termed – is also interesting. Most topoclines so far recognised in the British Flora seem to extend from north to south. The only other recorded examples of a true east-west cline are apparently those exhibited by *Ulmus stricta* Lindl. (Melville, 1939, 1944, 1948) and by *Orchis fuchsii* Druce subsp. *hebridensis* (Wilmott) Clapham (Harrison, 1949, 1952).

Material from the following herbaria has been examined :

Hb. Univ. Birmingham (B), Hb. Univ. Cambridge (C), Hb. Carlisle Museum (Cl), Hb. Royal Botanic Gardens, Kew (K), Hb. Manchester Museum (M), Hb. British Museum (Natural History) (N), Hb. Univ. Oxford (O), Hb. N. Douglas Simpson, Bournemouth (S), Hb. National Museum of Wales, Cardiff (W).

The extra-British distribution will be considered first.

var. *longidentata* :

FRANCE : Banyuls-de-mer, Roussillon, 1825, *M. Petit* (K).
SPAIN : Manzanares, 1841, *G. F. Reuter* (N).
PORTUGAL : Manteigas, 1881, *J. Daveau* (C) : Gollega, 1886, *A. R. da Cunha* (N) : Near Oporto, 1889, *R. P. Murray* (N).
ALGERIA : near Lake Houbera, La Calle, 1841-4, *J. Gay* (K).
AZORES : Caldera, Fayal, 1842, *H. C. Watson* (C) and 1929, *T. G. Tutin & E. F. Warburg* (C).

Rouy & Camus (1901) record this variety as occurring " here and there " in the departments of France nearest the Pyrenees. In Spain it has been recorded by Knerskon (1874) from Escorial and by Willkomm (1893) from the Sierra de Palma; it is probably more plentiful than the sparsity of the records suggests. Wolley-Dod (1914) noted that it had been recorded from Gibraltar, although his only gathering belonged to var. *portula*. In Algeria (Battandier & Trabut, 1890, 1902) it is said to be " frequent in the east," while Jahandiez & Maire (1931) report it as more frequent than the type in Morocco. In the Azores Trelease (1897) records it on Flores, Fayal, Pico, Terceira and San Miguel. All these authors, however, do not distinguish between the extreme type and the probably equally frequent intermediates. I have seen material of the latter from :—

SPAIN : near Madrid, 1844, *M. Willkomm* (K) : La Granja, Sierra de Guadarrama, 1858, *E. Boissier & G. F. Reuter* as *P. longidentata* (K).
PORTUGAL : Coimbra, 1848, *F. Welwitsch* (C) : near Manteigas, 1881, *J. Daveau* (N).

Var. *portula* is the only form outside Macaronesia, North Africa and the Iberian Peninsula. Material of this has been seen from most of Europe, including Italy, Sicily, Sardinia, Corsica, many parts of France (including La Vendée) and a single gathering from Pico in the Azores.

British Isles

A considerable amount of material lacked ripe capsules and could not be determined satisfactorily. In the far north the species tends to become aquatic and evidently does not fruit readily.

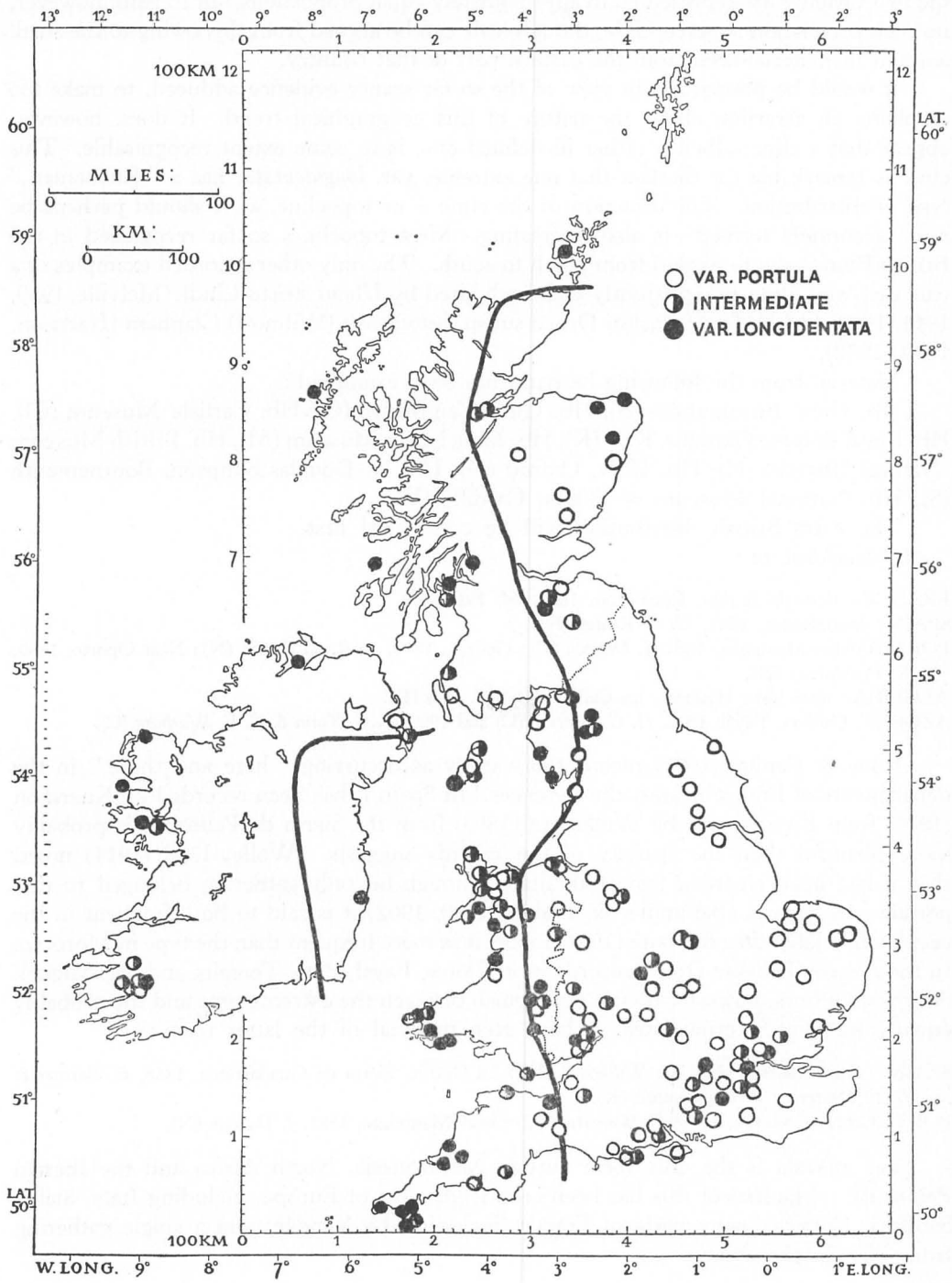

Fig. 1. Distribution of the three forms of *Peplis portula* L. in the British Isles The line indicates the approximate eastern limit of the areas where the values of the hygrothermic index exceed 70 (copied from Greig-Smith, 1950). *Base-map by courtesy of "New Naturalist" Series.*

VAR. LONGIDENTATA :

V.c. 1. W. CORNW. : pond near Looe Pool, Helston 1870, *G. C. Druce* (O): near Penzance, 1875, *E. A. Lomax* (M) and 1880, *H. S. Thompson* (B) : Lizard Head, 1882, *R. P. Murray* (N) and 1887, *C. A. Wright* (N) : Helston, 1891, *F. R. Tennant* (C).

2. E. CORNW. : Boscastle, 1906, *G. C. Druce* (O) : Lank Valley, 1923, *R. Melville* (W) : Egloskerry, near Launceston, 1943, *J. H. Davie* (N).

5. S. SOM. : stream near Quantock, 1890, *H. S. Thompson* (B, N).

17. SURREY : Wimbledon Common, 1860, *H. Trimen* (N) : wealden copse near Witley, 1888, *E. S. Marshall* (C) : Ham Common, 1928, *C. E. Hubbard* (K).

18. S. ESSEX : Woodford Forest, 1839, *J. Freeman* (Cl).

22. BERKS. : Bulmarsh Heath, 1804, *S. Rudge* (N).

35. MON .: Trelleck Bog, 1944, *A. E. Wade* (W).

38. WARW. : Earlswood Reservoir, 1893, *H. S. Thompson* (B).

42. BRECON : The Ystrad, Taffechan, 1900, *A. Ley* (B) : Cae-pandy Wood, near Builth, 1928, *A. E. Wade* (W).

43. RADNOR : wet places on hillside, Llandrindrod, 1890, *W. H. Purchas* (N) and 1916, *W. C. Barton* (various herbaria).

45. PEMB. : Haverfordwest, 1848, *C. C. Babington* (C) : Saundersfoot, 1873 (B) : Dowrog Moor, near St. David's, 1937, *H. A. Hyde & A. E. Wade* (W) : near Llanerch, Gwaen Valley, 1939, *A. E. Wade* (W) : woods near Tenby, 1945, *F. L. Rees* (W).

46. CARD. : cliff-top near Upper Borth, 1930, *H. M. Montford & W. B. Turrill* (K).

48. MER. : Barmouth, 1867, *M. A. Lawson* (O).

49. CAERN. : Criccieth, 1931, *H. Hall* (W).

69. WESTMORL. : Poaka Beck Reservoir, Dalton-in-Furness, 1913, *W. H. Pearsall* (C, O, N, W): marsh, Rough Hill, near Askham, 1925, *L. B. Hall* (S) : moor north of Rough Hill, 1925, *C. E. Salmon* (N).

70. CUMB. : pond near Melmerby, 1919, *C. E. Salmon* (N) : Seascale, 1928, *R. H. Williamson* (Cl).

71. MAN : field near Fleshwick, 1952, *D. E. Allen.*

76. RENFREW : Glen Dam Abbey, 1886, *E. S. Gregory* (N).

78. PEEBLES : near West Linton, 1790, *W. McRitchie* (N).

86 or 99. Loch Lomond, 1868, *J. Storrie* (W).

93. N. ABERD. : Old Meldrum, 1879, *F. C. King* (C, N) : Drowning Pot, Pitsligo, 1888, *J. Fraser* (K).

94. BANFF : Alvah, 1838, *W. A. Stables* (Cl).

98. ARGYLL : Dunloskin Loch, near Dunoon, 1868, *J. C. Hutcheson* (N).

102. S. EBUDES : Isle of Colonsay, *ante* 1916, *M. McNeil* (N) and 1929, *Mrs. Lockhead* (K).

109. CAITHN. : Kirk of Stones, 1905, *D. Douie* (N).

110. HEBRIDES : ditches, west side of North Uist, 1896, *W. A. Shoolbred* (W).

111. ORKNEY : " Orkney," *J. Miers* (N).

H. 1. S. KERRY : Poulgorm Bridge, 1952, *S. M. Walters* (C).

H. 2. N. KERRY : near Finow Bridge, Lough Guitane, 1935, *S. Ross-Craig & al.* (K).

H.16. W. GALWAY : Recess, Connemara, 1900, *J. S. Gamble* (K).

H.20. WICKLOW : Wicklow, *J. Ball* (C).

H.27. W. MAYO : Clare Island, 1903, *R. L. Praeger* (N) : mouth of R. Glenamoy, Lough Feeagh, 1903, *H.H.S.* (W).

H.34. E. DONEGAL : Buncrana, 1894, *H. E. Fox* (O).

INTERMEDIATE :

0. JERSEY : St. Brelade's, 1842, *W. W. Newbould* (C) : Grouville Common, 1900, *L. V. Lester-Garland* (K).

1. W. CORNW. : Goonhilly Downs, 1910, *H. E. Fox* (O).

3. S. DEVON : Holne Chase, near Ashburton, *H. T. Mennell* (N).

4. N. DEVON : Lynton, 1831, *C. C. Babington* (C) : Badgeworthy Valley, 1917, *W. C. Barton* (M).

6. N. SOM. : Melcombe Wood, Wells, 1918, *H. S. Thompson* (B).

9. DORSET : Wareham, 1889, *E. F. Linton* (N) : near Littlesea, Studland, 1911, *H. E. Fox* (O) and 1951, *D. E. Allen & N. D. Simpson.*

11. S. HANTS. : New Forest, 1882, *F. T. Mott* (M) : Brockenhurst, 1885, *R. P. Murray* (N) and 1889, *J. D. Gray* (C) : Petersfield Lake, 1911, *F. Stratton* (D) : Blashford, 1921, *N. D. Simpson* (S).

12. N. HANTS. : Mattingley, 1934, *J. F. G. Chapple* (D, M).

17. SURREY : Abberley Hills, 1840, *H. Newman* (N) : Wandsworth Common, without data (M) : wealden copse near Witley, 1888, *E. S. Marshall* (C) : Ashtead, 1890, *C. B. Clarke* (K): Ham Common, 1928, *A. R. Horwood* (K) and 1928, *C. E. Hubbard* (K) : Lost Pond, Richmond Park, 1933, *H. M. Montford & al.* (K).
19. N. ESSEX : Norton Heath, 1910, *A. J. Wilmott* (N).
20. HERTS. : Hertford Heath, 1910, *J. E. Little* (C).
21. MIDDX. : Hampstead Heath, 1866, *H. E. Fox* (O) : Stanmore Common, 1905, *H. P. Reader* (W).
22. BERKS. : Mortimer Common, 1930, *G. C. Druce* (O).
23. OXON. : Bladon Heath, near Woodstock, 1943, *W. B. Turrill* (K).
34. W. GLOS. : near the Buckstone, Coleford, 1874, *A. Ley* (B).
35. MON. : Trelleck Bog, 1876, *A. Ley* (B, N) and 1944, *A. E. Wade* (W).
36. HEREF. : Lower Pool, Shobdon, 1887, *A. Ley* (B).
37. WORCS. : Great Malvern, 1907, *J. S. Gale* (O).
38. WARW. : Coleshill Pool, 1893, *H. S. Thompson* (B).
39. STAFFS. : Rudyard Reservoir, 1887, *C. Bailey* (M).
41. GLAM. : Pilton, 1903, *H. J. Riddelsdell* (N) : Mynydd-y-Glew, St. Donats, 1907, *E. Vachell* (W) and 1921, *A. E. Wade* (W).
43. RADNOR : Llandeilo Hill, Aberedw, 1927, *A. E. Wade* (W).
45. PEMB. : Dowrog Moor, near St. Davids, 1937, *H. A. Hyde & A. E. Wade* (W) : Llanbed, near Mathry, 1939, *A. F. Wade* (W).
46. CARD. : bog near Llantrissant, 1893, *I. H. Burkill & J. C. Willis* (C).
47. MONT. : between Craig Breidden and Craig Moel-y-Golfa, 1832, *W. A. Leighton* (C).
48. MER. : near Tan-y-bwlch, 1854 (M) : Dolgelly, *Mrs. Berkeley* (N) : near Abercorys, 1875, *A. Ley* (B) : Lake Bala, between Llan-y-Cil and Bala, 1877, *C. Bailey* (M, N) : Barmouth, *G. C. Druce* (O).
49. CAERN. : Caernarvon, 1830, *C. C. Babington* (C) : Criccieth, 1884, *H. C. Levinge* (K) : Pwllheli, 1904, *C. T. & E. Vachell* (W) : Ro Wen, near Conway, 1931, *A. Wilson* (W).
52. ANGL. : Llyn Pwmp, Llangefni, 1884, *J. E. Griffith* (W) : near Cemmaes Bay, 1931, *A. Wilson* (W).
55. LEICS. : Ulverscroft, 1896, *F. T. Mott* (M) : Cropstone Reservoir, 1913, *W. Wade* (W).
58. CHES. : Mere mere, 1870, *J. L. Warren* (N) : Irby, 1876, *J. H. Lewis* (D).
69. WESTMORL. : Cliburn Moss, 1905, *T. J. Foggitt* (N): Poaka Beck Reservoir, Dalton-in-Furness, 1913, *W. H. Pearsall* (C, M, W).
70. CUMB. : Cronkley Fell, 1873, *H. E. Fox* (O) : Melmerby, 1920, *W. W. Mason* (O) : Moorhouse, near Carlisle, 1949, *C. W. Muirhead* (Cl).
71. MAN : Gat-y-Whing, Andreas, 1921, *C. I. Paton* (Hb. Manx Mus., Douglas) : Smeale ; Clypse Reservoir, 1951 ; near Fleshwick, 1952, *D. E. Allen.*

73 or 74. " Galloway," 1836, *R. K. Greville* (C).

75. AYR : Currarie Glen, Ballantrae, 1902, *A. Somerville* (N).
79. SELK. : near Caddonfoot, 1872, *A. Brotherston* (M).
83. EDINB. : Harlaw Reservoir, 1878, *W. Horton-Smith* (M).
93. N. ABERD. : Drowning Pot, Pitsligo, 1888, *J. Fraser* (K).
100. CLYDE IS. : Bute, 1823 (K).
106. E. ROSS. : Loch Ussie, Strathpeffer, 1877, *Thomson* (D) : near Achilty Inn, 1909, *W. A. Shoolbred* (C, N, W).

H.1. S. KERRY : Gap of Dunloe, 1901, *G. C. Druce* (D).

H.2. N. KERRY : Killarney, 1858, *C. C. Babington* (C), 1901, *H. J. Riddelsdell* (N) and 1908, *C. Bucknall* (K) : ditches, Dicksgrove, 1895, *R. M. Middleton* (N) : near Finow Bridge, Lough Guitane ; between Ross Island and mouth of R. Flesk, Killarney, both 1935, *S. Ross-Craig et al.* (K).

H.16. W. GALW. : ditches near Maam, 1885, *C. Bailey* (B, D, M, W).

H.38. DOWN : Kircubbin, 1918, *C. H. Waddell* (N).

Material of var. *portula* is too numerous to cite individually ; it has been seen from the following vice-counties : 0, 2, 4-6, 9-24, 26-29, 32-36, 38-43, 45, 46, 48-50, 54, 55, 58, 60-63, 69-71, 73, 74, 80, 83, 90, 92, 96, H1, H38, H40. It should be noted that from the Channel Isles five gatherings of var. *portula* have been seen, two of the intermediates, but none of var. *longidentata*.

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