

TABLE 18 (Continued).

22. 1886, Sept. Glanafon, Glamorgan.
One caught by H. W. Vivian (R. M. Richardson, *Ent. mon. Mag.* 50 : 249). In 1914 in Nat. Mus. Wales, Cardiff.
23. 1886, Sept. or Oct. Housel Bay, Lizard, Cornwall.
One seen by A. H. Jenkin (*Entomologist* 19 : 276).
24. 1886, Oct. 2. St. Peters Port, Guernsey, Channel Is.
One caught by A. H. Collings (W. A. Luff, *Entomologist* 19 : 278).
25. 1886, —. Shanklin, Isle of Wight.
One caught by J. A. Billings (*Entomologist* 20 : 39, quoting a newspaper).
26. 1886, —. Cornwall.
Specimen in Nat. Mus. Wales at Cardiff with this data, from coll. H. W. Vivian, according to N. M. Richardson (1914, *Ent. mon. Mag.* 50 : 249). In the minutes of the meeting of the Entomological Society held on 6th October 1886 there is a statement that Mr. F. F. Freeman reported the capture of a specimen of *D. plexippus* in Cornwall. This record does not appear in the published *Proceedings* of the meeting. The specimen referred to may be that now at Cardiff.
27. 1887, Sept. 14. Worthing, Sussex.
One caught by F. H. Stewart (*Entomologist* 21 : 321).
28. 1887, Sept. 15. Worthing, Sussex.
One seen by F. H. Stewart (*Entomologist* 21 : 321).
29. 1888, —. Penarth Dock, Glamorgan.
One caught (Hallett, 1917, *Trans. Cardiff Nat. Hist. Soc.* 50 : 48).
30. 1890, Oct. 2. Eastbourne, Sussex.
One seen by A. H. Clarke (*Ent. mon. Mag.* 26 : 327); flew out to sea.
31. 1894, Aug. Brighton, Sussex.
One seen by W. E. Blackiston, from his diary and "contemporary newspaper" (T. Dannreuther, 1935, *Entomologist* 68 : 136).
32. (1894.) Aylesbury, Buckinghamshire.
One seen about this year by W. Crouch (F. W. Frohawk, 1915, *Entomologist* 48 : 266).
33. (1895.) Shanklin, Isle of Wight.
One captured by a visitor (Poole, in Morley's *Guide to Nat. Hist. of Isle of Wight* : 398).
34. 1896, May 28. Lymington, Hants.
One seen by E. G. B. Meade-Waldo (6.v.1896, *The Field* 87 : 856; also *Entomologist* 29 : 216). Recorded as *chrysiptus* but editorial says probably *plexippus*.
35. 1896, June 12. Newlands Corner, Surrey.
One seen by a friend (W. J. Lucas, *Entomologist* 30 : 18), recorded as *menippe*.
36. 1896, Aug. Newchurch, Isle of Wight.
One seen by W. S. Worsley-Benison (*Ent. mon. Mag.* 38 : 113).
37. 1896, Sept. Lizard, Cornwall.
One seen by Miss Jenkin (A. P. Jenkin, *Entomologist* 29 : 365).
38. 1899, —. Weymouth, Dorset.
One caught by G. and J. Joliffe. Wings found in a curiosity shop and purchased by N. M. Richardson (*Ent. mon. Mag.* 50 : 249).
39. 1906, Sept. 29. Felixstowe, Suffolk.
One seen by T. Barrett (1906, *Country Side* : 275, see also T. S. Barrett, *Trans. Suffolk N.H. Soc.* 1 : 30).
40. 1908, —. North Oxford.
One caught by a gardener and brought to Rev. M. Merry (J. J. Walker, *Ent. mon. Mag.* 64 : 90).
41. 1908, Sept. 13. Culver Cliffs, Isle of Wight.
One found lying dead on grass, but not yet stiff, by G. H. Heath (*Ent. Rec.* 20 : 237).
42. 1910, Autumn. North Oxford.
One male captured by a young lady (J. J. Walker, *Ent. mon. Mag.* 64 : 90). Now in Hope Dept. Oxford. Male of N. American type.
43. 1916, Oct. 20. Castle Townsend, Co. Cork, Ireland.
One caught by H. Chevasse (4.xi.1916, *The Field* 128 : 714; see also F. W. Frohawk, *Entomologist* 49 : 285). Now in coll. F. W. Frohawk. Female, figured in Frohawk's *Natural History Brit. Butterflies*.
44. 1917, Sept. 17. Kirkheaton Tip, nr. Huddersfield, Yorks.
One caught by C. Cameron (B. Morley, *Naturalist* 1928 : 47). In Huddersfield Museum.

TABLE 18 (Continued).

45. 1917, Oct. 1. Instow, Devon.
One seen by G. F. Mathew (*Entomologist* 54 : 211).
46. 1918, Aug. 19. Porthcurno, Cornwall.
One female caught by M. L. Wandle (J. G. Wandle, 21.ix.1918, *The Field* 132 : 263; see also F. W. Frohawk, *Entomologist* 51 : 256).
- 47-48. 1920, —. Tilbury, Essex.
Two specimens said by F. W. Buxton, purser of a steamer, to have come over on the boat from Norfolk, Virginia, and to have flown away on reaching Tilbury (F. W. Frohawk, *Entomologist* 54 : 145).
49. 1923, Aug. 28. Selmeston, nr. Berwick, Sussex.
One male captured, ? by J. C. Tunnard (20.ix.1923, *The Field* 142 : 427). Seen by F. W. Frohawk (*Entomologist* 56 : 258).
- 50-51. 1923, Sept. Portslade, Sussex.
One caught and one seen by Mrs. Brown and given to A. H. Griffith (Griffith, *Entomologist* 58 : 97). Now in Nat. Mus. Wales at Cardiff.
52. 1926, Sept. Cockerton, nr. Darlington, Durham.
One captured, ? by E. O. D. Sibson (*Entomologist* 60 : 82). Now in Darlington Museum.
53. 1926, Sept. Headlington Hill, Oxford.
One seen almost daily for a fortnight by E. W. Gordon (L. Dawes, *Ent. mon. Mag.* 64 : 90).
54. 1926, Sept. 8. Nr. Countisbury, Devon.
One seen by S. Morris (C. Nicholson, *Entomologist* 71 : 220).
55. 1928, Sept. 5. Llanmadoc, Gower, Glamorgan.
One seen by H. E. David (*Entomologist* 61 : 250).
56. 1929, Aug. 12. Kimmeridge, Dorset.
One believed to have been seen by H. L. Andrewes (*Entomologist* 63 : 87) : identification not very certain.
57. 1929, Oct. 12. Niton, Isle of Wight.
One seen by R. Prendergast (16.x.28, *Times*; see also *Ent. mon. Mag.* 65 : 261).
58. 1930. Ruan Minor, Cornwall.
One seen by A. L. Crossman (26.x.33, *Western Morning News*; see Nicholson, *Entomologist* 68 : 248).
- [1930, Aug. P20. Upper Clapton, N.E. London.
According to C. W. V. Gane a small boy captured two Monarchs which were taken to the Natural History Museum and identified by N. D. Riley as the Indian Monarch *Danaus genutiae* (C. Nicholson, *Entomologist* 71 : 218).]
59. 1931, June? Framlingham, Suffolk.
One seen by C. H. S. Vinter (1933, *Trans. Suffolk N.H. Soc.* 2 : 104).
60. 1931, Oct. 3. Modbury, Devon.
One seen by H. E. Hooppell (8.v.1933, *Western Morning News*; see also C. Nicholson, *Entomologist* 68 : 248).
- 61-64. 1932, end Aug. and Sept. Tresco Abbey, Scillies.
Two seen by a clerk at end August, one seen by a "man" and another by A. A. D. Smith in September (Smith, 1933, *Entomologist* 66 : 6).
65. 1932, Sept. 15. Llanbadarn Fawr, nr. Aberystwyth, Cardigan.
One seen by J. H. Saltern (1932, *N. West. Naturalist* 7 : 315).
66. 1932, Sept. 16. Burton Bradstock, nr. Bridport, Dorset.
One seen by K. Trenchard Cox (1.x.1932, *Times*; see also Williams, 1933a : 7).
67. 1932, Sept. 20? Fossebridge, Gloucester.
One seen by C. F. Parks (C. Nicholson, *Entomologist* 71 : 220).
68. 1932 (Sept. 21). Bognor, Sussex.
One seen by E. H. Hewett (5.x.1932, *Times*; also *Ent. Rec.* 45 : 45). Date not in original.
69. 1932, Sept. 26. New Milton, Hants.
One caught by Mr. Sturmev (F. W. Frohawk, *Entomologist* 66 : 27). Now in coll. of Sir B. Whitehouse of Birmingham.
70. 1932, Oct. 1. Abbotsbury, Dorset.
One seen by E. H. Smyth (*Entomologist* 65 : 284).
71. 1932, Oct. (20). Porthcurno, Cornwall.
One caught by A. J. Gardiner (C. Bartlett, *Entomologist* 67 : 248). Now in collection of A. J. Gardiner.
72. 1932, Oct. 22. Corbally, Limerick, Ireland.
One seen by N. H. Wilson (C. Nicholson, *Entomologist* 68 : 249).

TABLE 18 (Continued).

73. 1933, June 14-18. Nelson, Lancs.
One seen by J. Wensley, verified by W. G. Clutter (T. Dannreuther, *Entomologist* 67 : 11).
74. 1933, July 4 or 5. Corfe Castle, Dorset.
One seen by D. C. Thomas (T. Dannreuther, *Entomologist* 67 : 209).
- 75-79. 1933, July 14. Off Seacombe Cliffs, Dorset.
Five seen three miles out at sea by Mr. Bower (F. W. Frohawk, *Entomologist* 66 : 250).
80. 1933, Aug. 11. Nr. Ditchling Beacon, Sussex.
One seen by G. T. St. J. Steadman (C. Nicholson, *Entomologist* 71 : 220).
81. 1933, Aug. 16. Off Seacombe Cliffs, Dorset.
One seen about 3½ miles out at sea by Mr. Bower (F. W. Frohawk, *Entomologist* 66 : 250).
82. 1933, Sept. Off Margam, Glamorgan.
One seen by H. David (C. Nicholson, *Entomologist* 68 : 249).
83. 1933, Sept. Hawthorne Dene, Durham.
One captured by a student [Miss Farmer]. Seen by J. D. H. Harrison (T. Dannreuther, *Entomologist* 67 : 164.) [Specimen now destroyed. C.B.W.]
- [1933, Sept. 2. Bude, N. Cornwall.
See under Sept. 12, which is correct date.]
84. 1933, Sept. 2. Lelant, Cornwall.
One male caught by Miss Briant (F. W. Frohawk, *Entomologist* 67 : 134). Now in collection of Sir B. Whitehouse of Birmingham.
85. 1933, Sept. 3. Salcey Forest, Northants.
One seen by R. D. Pendered (T. Dannreuther, *Entomologist* 67 : 164).
86. 1933, Sept. 4-6. Howth Promontory, Dublin.
One seen by G. Hemphill (1933, *Irish Nat.* : 244; see also T. Dannreuther, *Entomologist* 66 : 254).
87. 1933, Sept. 5. Budleigh Salterton, Devon.
One caught by M. Wood (6.x.1933, *Times*; see also F. W. Frohawk, *Entomologist* 66 : 250). Now in collection of Mrs. M. Wood of Westbury, Wilts.
88. 1933, Sept. 9. Penhale Pt., Cornwall.
One seen by D. O. Boyd (*Entomologist* 66 : 234).
89. 1933, Sept. 10. Battle, Sussex.
One seen by Mrs. Arnold (28.vii.1934, *Times*; see T. Dannreuther, *Entomologist* 67 : 209).
90. 1933, Sept. 12. Bude, Cornwall.
One captured by B. J. Leader (*Entomologist* 66 : 225), date given as Sept. 2 in original by mistake.
91. 1933, Sept. 18. Bexhill, Sussex.
One seen by K. Jackson (T. Dannreuther, *Entomologist* 68 : 254).
92. 1933, Sept. 19. Boreham Street, Sussex.
One seen by K. Jackson (T. Dannreuther, *Entomologist* 68 : 254), possibly the same individual as the previous record.
93. 1933, Sept. (20). Church Cove, Lizard, Cornwall.
One seen by P. H. Dean (T. Dannreuther, *Entomologist* 66 : 254).
94. 1933, Sept. 20. Lyminster, Hants.
One seen by J. Nickell (T. Dannreuther, *Entomologist* 66 : 254).
95. 1933, Sept. 21. Tenby, Pembrokeshire.
One female caught by H. Mathias (T. Dannreuther, *Entomologist* 68 : 254).
Now in National Collection at Tring. Typical N. American form.
96. 1933, Sept. 21. Bognor, Sussex.
One seen by R. J. Hodgson (4.x.1933, *Times*; see T. Dannreuther, *Entomologist* 66 : 254).
97. 1933, Sept. 26. Eastbourne, Sussex.
One female caught by a schoolboy (R. Adkin, *Entomologist* 66 : 250).
98. 1933, Sept. 26. Little Common, Bexhill, Sussex.
One seen by H. G. McLeod (*Entomologist* 69 : 42; see also T. Dannreuther, *Entomologist* 66 : 254). Seen from only a few feet away.
99. 1933, Sept. 26. Bexhill, Sussex.
One seen by W. A. Elder (T. Dannreuther, *Entomologist* 66 : 254). Possibly the same individual as the previous record.
100. 1933, Sept. 27. West Cove, near Cahirdaniel, Co. Kerry, Ireland.
One male caught by M. M. Green (S. Kemp, *Entomologist* 66 : 241).

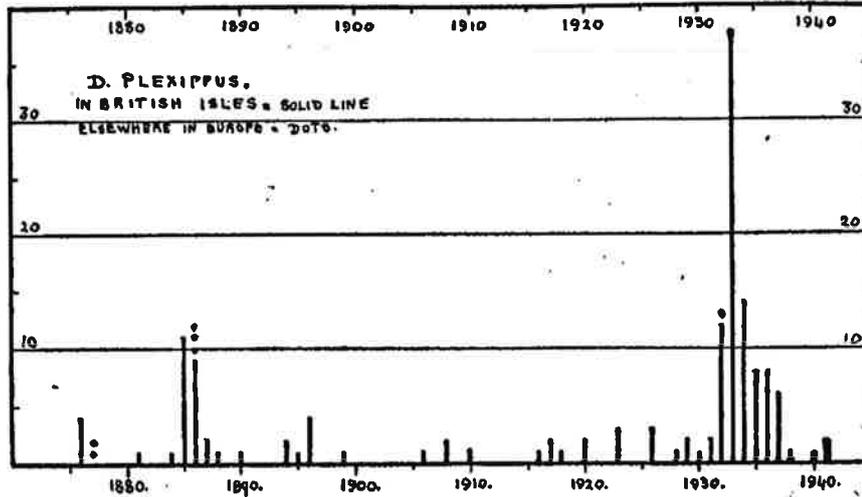
TABLE 18 (Continued).

101. 1933, Sept. 27. Housel Bay, Lizard, Cornwall.
One seen by P. H. Dean (T. Dannreuther, *Entomologist* 66 : 254).
102. 1933, Sept. 29. Housel Bay, Lizard, Cornwall.
One seen by P. H. Dean (T. Dannreuther, *Entomologist* 66 : 254), possibly the same as the previous record.
103. 1933, Sept. 30. Mawnan Smith, Cornwall.
One seen by R. B. Goodden (T. Dannreuther, *Entomologist* 67 : 209).
104. 1933, Oct. 1. St. Mawes, Cornwall.
One captured by W. C. May (14.x.1933, *Western Morning News*; C. Nicholson, *Ent. Rec.* 46 : 20). Now in collection W. E. May.
105. 1933, Oct. 1. Exmouth, Devon.
One seen by S. D. Gibbard (3.x.1933, *Western Morning News*; also T. Dannreuther, *Entomologist* 66 : 254).
106. 1933, Oct. 2. Hastings, Sussex.
One seen by A. M. Elliott (*Entomologist* 66 : 279), inspected closely for several minutes and said to be a male as scent spots on hind-wing were noticed (*Entomologist* 67 : 11).
107. 1933, Oct. 12. Blagdon, Somerset.
One seen by G. S. Griggs (T. Dannreuther, *Entomologist* 66 : 254).
108. 1933, Oct. 15. Ruan Minor, Cornwall.
One seen by A. L. Crossman (T. Dannreuther, *Entomologist* 67 : 12).
109. 1933, Oct. 29. Nr. St. Ives, Cornwall.
One male captured by F. A. Turk.
110. (1933). Lanarth, St. Keverne, Cornwall.
One seen by Lady Seaton (C. Nicholson, *Entomologist* 71 : 218).
111. 1934, July 15. Ringwold, Kent.
One seen by H. C. Gunton (1.viii.1934, *Times*; also T. Dannreuther, *Entomologist* 67 : 213).
- 112-113. 1934, Aug., 2nd week. Off Beer Regis, Devon.
Two seen by Miss Mercer (C. Nicholson, *Entomologist* 71 : 220).
114. 1934, Aug. 25. Oxford.
One seen by B. M. Hobby (C. Nicholson, *Entomologist* 71 : 220). Large butterfly, identification not quite certain.
115. 1934, Aug. 29. Dudbridge, nr. Stroud, Gloucester.
One seen by Miss Wright (C. Nicholson, *Entomologist* 71 : 217).
116. 1934, Sept. 19. Denham, Bucks.
One seen by G. B. Oliver (*Entomologist* 67 : 248).
117. 1934, Sept. 20. Coombe Martin, Devon.
One seen by Mrs. Miall (F. W. Frohawk, *Entomologist* 67 : 248).
118. 1934, Sept. 25. Minehead, Somerset.
One caught by — Bentley, Jr. (R. C. Bentley, *Entomologist* 67 : 248). Now in collection of R. C. Bentley.
119. 1934, Sept. 27. Bideford, Devon.
One seen by W. M. Littlewood (3.x.1934, *Times*; see also F. W. Frohawk, *Entomologist* 67 : 248). Said to be a female but not captured.
120. 1934, Sept. 27. Northiam, Sussex.
One female seen by A. Townsend (T. Dannreuther, *Entomologist* 68 : 136).
121. 1934, Oct. 2. Bolton Abbey, Yorks.
One caught by a farm boy (F. G. Britton, *Entomologist* 67 : 248). Now in collection of F. G. Britton.
122. 1934, Oct. 5. Milford Haven, Pembroke.
One seen by A. V. W. Stokes (20.x.1934, *Field* 164 : 930; also T. Dannreuther, *Entomologist* 68 : 8).
123. 1934, Oct. 11. Lymington, Hants.
One seen by P. E. G. Harding (20.x.1934, *Field* 164 : 930; also T. Dannreuther, *Entomologist* 68 : 8).
124. 1934, Oct. 22. Dunster, Somerset.
One caught ? by R. C. Bentley (*Entomologist* 67 : 248). Now in collection of R. C. Bentley.
125. 1935, March 21. Brighton, Sussex.
One seen by J. Brazenor (T. Dannreuther, *Entomologist* 68 : 109).
126. 1935, April 21. Lulworth Cove, Dorset.
One seen by a lady (H. G. Harris, *Entomologist* 68 : 136).

TABLE 18 (Continued).

127. 1935, July 17. Ashley, New Milton, Hants.
One seen by L. F. Burt (W. P. Curtis, *J. Soc. Brit. Ent.* 1 (5) : 121).
128. 1935, early Sept. Aberystwyth, Cardigan.
Seen coming in from sea. Captured but escaped again. A. G. Walker (Williams, *Entomologist* 73 : 173).
129. 1935, Sept. 25. Coverack, Cornwall.
One seen by A. T. Cummings (F. Pennington, *Entomologist* 69 : 94).
130. 1935, Sept. —. Bourton-on-the-Water, Gloucester.
One seen by Miss Donovan (C. Nicholson, *Entomologist* 71 : 217).
131. 1935, Oct. 4. South Huish, Devon.
One caught by Mr. Halahan and given to Mr. J. O. N. Wood (Wood, *Entomologist* 69 : 230). Now in collection of J. O. N. Wood.
132. 1935, Oct. 13. Penally, Pembroke.
One caught by G. Scott-Brown (23.xi.1935, *Field* 166 : 1242; see also T. Dannreuther, *Entomologist* 69 : 5).
133. 1936, Aug. 8. Sowley, Lymington, Hants.
One seen by Mr. Harding (22.viii.1936, *Field* 168 : 464; see also T. Dannreuther, *Entomologist* 69 : 226).
134. 1936, Aug. 11. Start Point, Devon.
One seen by A. W. Godfrey (T. Dannreuther, *Entomologist* 69 : 226).
135. 1936, Aug. 18. Meonstoke, Petersfield, Hants.
One seen by Mr. Rawlins (T. Dannreuther, *Entomologist* 69 : 259; and C. Nicholson, *Entomologist* 71 : 221).
136. 1936, Aug. 22. Burley, Hants.
One seen by F. H. Hargreaves (12.xi.1936, *Field* 168 : 630; also T. Dannreuther, *Entomologist* 69 : 226).
137. 1936, Aug. 25. West Meon, Hants.
One seen by G. B. Wood (12.ix.1936, *Field* 168 : 620; also T. Dannreuther, *Entomologist* 69 : 226).
138. 1936, Sept. 4. Leanwater, Lizard, Cornwall.
One seen by H. C. Griffith (18.ix.1936, *Western Morning News*; also T. Dannreuther, *Entomologist* 70 : 8).
139. 1936, Sept. 8. Oakhanger Pond, Selborne, Hants.
One caught by I. P. Russell (T. Dannreuther, *Entomologist* 70 : 8).
140. 1936, Sept. 16. Salcombe, Devon.
One seen by Mrs. Besant (22.ix.1936, *Western Morning News*; also T. Dannreuther, *Entomologist* 69 : 259).
141. 1937, Aug. 6. Rushmore Hall, Ipswich, Suffolk.
One caught by Miss R. M. King (1937, *Trans. Suffolk N.H. Soc.* 11 : 104).
142. 1937, Sept. 8. Selsey Bill, Sussex.
One female caught by T. Trought (1937, *Entomologist* 70 : 285). Now in collection of T. Trought.
143. 1937, Sept. 28. Slapton, S. Devon.
One seen by H. O. Mills (T. Dannreuther, *Entomologist* 70 : 253). Identification not very certain.
144. 1937, Sept. 28. Stoke Fleming, Devon.
One seen by H. M. Churchward (T. Dannreuther, *Entomologist* 70 : 253).
145. 1937, Oct. 2. Harrow, Middlesex.
One seen by K. Clarke (E. W. Classey, *Entomologist* 70 : 246).
146. 1937, Oct. 2. Lydney, Gloucester.
One male caught by H. Angel (C. G. Clutterbuck, *Entomologist* 70 : 249). Now in Gloucester Museum.
147. 1938, Aug. 15. Porth Conger, St. Agnes, Scillies.
One seen by E. B. King (*Entomologist* 71 : 236).
148. 1938, Aug. late. Fernhurst, Sussex.
One seen by Dr. B. Barnes (*in litt.*).
149. 1940, Nov. 4. Putsborough, N. Devon.
One female captured by W. R. C. Mathews and kept alive for two weeks (C. W. Bracken, *Entomologist* 74 : 42).
150. 1941, Aug. 30. Kynance, Lizard, S. Cornwall.
One female captured 6.20 p.m. in perfect condition by E. B. Ford (*Entomologist* 74 : 220).
151. 1941, Sept. 14. Sandsting, W. Shetland.
One captured by G. Johnston.

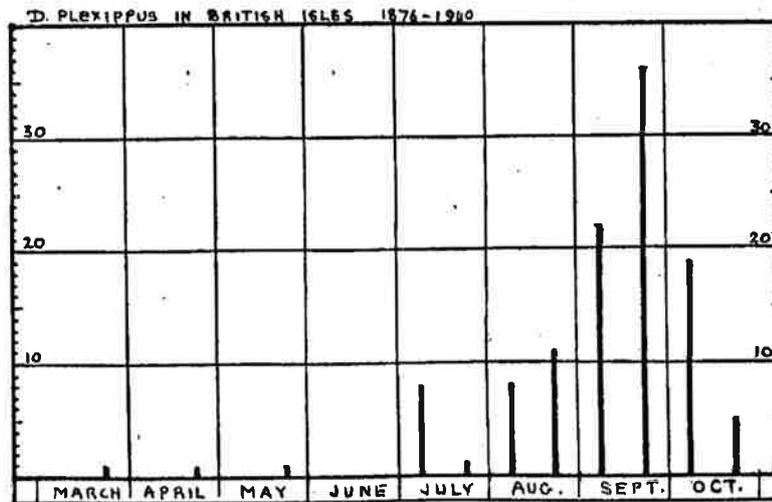
in fig. 23, from which it will be seen that the earliest peak years were 1876, 1885-6, 1896, and then a quite unusual series of captures from 1932-1937 with a peak of 38 records for 1933. Part of the numbers of this last peak must, however, be put down to the greatly increased interest taken in the problem of immigration.



23

FIG. 23.—Diagram of the annual records of *D. plexippus* in the British Isles since 1876.

Fig. 24 shows the distribution throughout the year of the British records in half-monthly periods. Only three specimens (one each in March, April and May) have been recorded before the end of June: none of these were captured. After that there are records to the beginning of November with a very definite peak in the second half of September.



24

FIG. 24.—Records of *D. plexippus* in the British Isles arranged according to the date of observation.

The proportion of sexes in the captures is as follows:—Males: 9 captured + 1 only seen; females: 18 captured + 2 only seen. The sex of the specimens which were only seen is of course open to doubt. Efforts have been made to trace and examine, or to have examined, as many as possible of the British-caught individuals. The results are shown in Table 19.

TABLE 19.

Present location and geographical race of specimens of *D. plexippus* captured in the British Isles.

- 1 (1) 1876, Sept. 6, at Neath. Now in British Museum, seen by C. B. Williams; typical N. American female.
- 9 (2) 1885, Sept. 17, Lizard. Now in Truro Museum, Devon (see below).
- 12-13 (3)-(4) 1885, Sept. 24, Housel Bay. Now in Truro Museum.
- The three specimens above were examined in October 1940 by Mr. F. A. Turk, who reports that they are together in a case which states that all three were taken on 17th September, 1885. All three are females. Two are typical North American type and the third "definitely approaching the Central American form having the spots perfectly white and only two slight traces of the red brown areas in the black tip of the fore wing."
- 18 (5) 1886, Aug. 14, Lyme Regis. Now in Hope Department, Oxford, seen by C. B. Williams; typical N. American female, but faded and spots very pale.
- 22 (6) 1886, Sept., Glanafon. Said in 1914 to be in Nat. Museum of Wales at Cardiff, not possible to verify at present owing to collections being stored for protection.
- 26 (7) 1886, "Cornwall." Said in 1914 to be in "Vivien collection," Nat. Mus. Wales, Cardiff (see no. 6).
- 42 (8) 1910, Oxford. Now in Hope Department, Oxford, seen by C. B. Williams; almost typical N. American male perhaps slightly less brown in outer portion of wing.
- 43 (9) 1916, Co. Cork. Now in collection of F. W. Frohawk, figured by Frohawk as typical N. American female.
- 44 (10) 1917, Sept., Kirkheaton. In Huddersfield Museum. Examined in Sept. 1940 by Mr. W. Anbrook, who reports it to be a typical N. American male.
- 50 (11) 1923, Sept., Portslade. In Nat. Mus. Wales, Cardiff, seen by G. F. Cockbill; typical N. American, spots buff.
- 52 (12) 1926, Sept., Darlington. Now in Darlington Town Museum. Examined carefully by Mr. J. E. Nowers in March 1940, who reports it as a typical N. American male.
- 69 (13) 1932, Sept. 26, New Milton. In 1939 in collection of Sir Beckwith Whitehouse. Examined by him in 1939 and reported to be a typical N. American female.
- 71 (14) 1932, Oct. 20, Porthcurno. In 1939 in collection of Mr. A. J. Gardiner.
- 84 (15) 1933, Sept. 2, Lelant, Cornwall. In 1939 in collection of Sir Beckwith Whitehouse, who reports "typical N. American male."
- 87 (16) 1933, Sept. 5, Salterton. In collection of Mrs. M. Wood, The Garth, Westbury, Wilts., who examined it in July 1940 and reports that it is a female somewhat intermediate between the N. and C. American forms. The spots are white with buff areas present. Possibly the spots are faded.
- 90 (17) 1933, Sept. 12, Bude, Cornwall. Now in collection of Mr. C. W. Whitworth-Hulse, who examined it in August 1941 and reports that it is a female of the typical North American form, with buff spots on the fore-wing.
- 95 (18) 1933, Sept. 21, Tenby. Now at Tring. Seen in 1939 by C. B. Williams. Typical N. American female.
- 104 (19) 1933, Oct. 1, St. Mawes. Now in collection of W. C. May, Council School, St. Mawes.
- 109 (20) 1933, Oct. 29, nr. St. Ives, Cornwall. In Sept. 1940 in collection of Mr. F. A. Turk, who reports that it is a typical N. American male. Since presented to National Collection at Tring.
- 118 (21) 1934, Sept. 25, Minehead. In 1939 in collection of R. C. Bentley, Minehead.
- 121 (22) 1934, Oct. 2, Bolton Abbey. In 1939 in collection of Rev. F. G. Britton, Springfield Manse, Addington, Ilkley, who examined it in July 1940 and reports "typical North American female."

TABLE 19 (Continued).

124	(23)	1934, Oct. 22, Dunster. In 1939 in collection of R. C. Bentley, Minehead.
131	(24)	1935, Oct. 4, South Huish, Devon. In 1939 in collection of J. O. N. Wood, 144 Tulse Hill, London, S.W. 2.
132	(25)	1935, Oct. 13, Penally, Pembroke. Said to be in collection of Mr. A. N. Winnell, Lydstep House, Penally, but I cannot trace Mr. Winnell at this address.
142	(26)	1937, Sept. 8, Selsey. In 1939 in collection of T. Trought, who examined it and reports a female of typical N. American form.
146	(27)	1937, Oct. 2, Lydney, Glos. In Gloucester Museum. Examined in July 1940 by the curator Mr. C. Green, who reports it to be a typical N. American male.
149	(28)	1940, Nov. 2. Putsborough, N. Devon. In National Museum at Tring. Typical N. American female.
150	(29)	1941, Aug. 30, Kynance, Cornwall. In September 1941 in collection of E. B. Ford, who reports that it is a typical N. American female.
151	(30)	1941, Sept. 14, Shetland. Presented to R. Scottish Museum, Edinburgh. Examined by G. R. Waterston, who reports it to be a female of N. American type.

In addition to the above two further specimens have been followed up but are now known to have been destroyed. These are:—

- 1933, Sept., Hawthorndene, Durham.
- 1936, Sept., Selborne, Hants.

Thirty specimens have been located and of 22 examined all except one are of the typical North American type. The exception is one caught by A. H. Jenkin in 1885, and now in the Truro Museum, which is reported on examination by Mr. Turk to be definitely approaching the Central American form, having the spots perfectly white and only two slight traces of the red-brown areas in the black tip of the front wing.

Table 20 gives all the records traced of the appearance of *D. plexippus* in the Continent of Europe. Excluding the very doubtful records, they are:— 2 in France, 4 in Spain and Portugal, and 1 in Holland. In addition there is the unique record of several specimens captured on a steamer outward bound from Glasgow, about 1880, when about 200–300 miles from the British shores. This record is the most definite piece of evidence in support of the idea that the insects fly across the Atlantic, but unfortunately there is no exact date and the specimens cannot now be traced.

TABLE 20.

D. plexippus captured or seen in the European area, excluding the British Isles.

[1842, Sept. Schloss Seehof, Bavaria.

A drawing of a Monarch butterfly was found with this date and locality (Forman, 1927, *Entomologist* 60 : 103). It is very doubtful evidence.]

1877, Sept., early. La Vendée, W. France.

One captured early in September and a second seen about 8 days later by M. Grassal (Baret, *Pel. Nouv. Ent.* 2 : 253–4).

1880 (about). Atlantic, Off. N. Ireland.

Several specimens of the N. American type given to Mr. J. F. X. King by an officer of a steamer outward bound from Glasgow. Butterflies caught playing round rigging about 200–300 miles from British shores. (C. G. Barratt, 1893, *Ent. mon. Mag.* 29 : 163). Enquiries were made in 1937, but no specimens could be found in J. F. X. King collection now at Glasgow University.

1886, Oct. The Hague, Holland.

One captured by J. E. Muschait (Snellen, 1887, *Tijdsch. v. Ent.* 30 : c–ci). G. A. Bentinck (1937, *Ent. Berich.* 9 : 258) says caught in a greenhouse. Specimen now lost.

1886, Oct. 29. Gibraltar.

One male of average size and N. American type captured by Lt. Comm. Cochran and seen by J. J. Walker two days later (Walker, 1886, *Ent. mon. Mag.* 23 : 162).

TABLE 20 (Continued).

1886, Sept. 29. Oporto, Portugal.

One female caught by G. D. Tait in his garden (H. Goss, 1887, *Entomologist* 20 : 106).
Some years before 1893. Off Cape St. Vincent, Portugal.

One caught at sea 60 miles from Cape St. Vincent, "some years ago." Then in coll. of G. A. Harker (1893, *Ent. mon. Mag.* 29 : 86).

1897, Nov. 8. Grecian Archipelago.

G. Mathew (1903, *Ent. Rec.* 15 : 162) says that a *D. plexippus* "flapped slowly over the steamer." (I feel sure that this is a misidentification for *D. chrysippus*. C.B.W.)

1932, Oct. 2. Near Oporto, Portugal.

One captured by Mr. Stock and given to Mr. M. A. de Silva Cruz. Another said to have been seen about the same time a little to the north. (Letter to T. Dannreuther from J. T. Wattison, Dec. 16, 1935.)

It does not seem possible at present to reach a final decision as to whether the British records relate to individuals which have flown across or have been brought across in the holds of ships. It is quite possible that both explanations may be true. The subject has been discussed recently by Nicholson (1935 and 1938). He inclines to the idea that they have all been brought over in ships, but the record just quoted seems impossible to fit into this theory.

(2) *Phoebis eubule* L. (= *Catopsilia sennae*).

In 1938 I published a brief summary (Williams 1938b) of the information available relating to the migrations of this butterfly in the United States. Since then a number of new records have come in relating to this country, including the continuous observations made by Mr. and Mrs. Hodges in Florida already discussed on p. 151. There are also several records for Central America and the West Indies which have not yet been published.

Records relating to flights in the U.S.A.

Alabama. The eighteen years' observations by Mr. P. Smyth which were discussed in my last summary (Williams 1938b) have been also referred to very briefly by Mr. Smyth in a short note (Smyth 1938).

The regularity of movements in this State is confirmed by Mr. J. S. Mason, from Montgomery, who writes: "For many years since 1882 I have noticed the migration of yellow butterflies. In the autumn months they appear in numbers flying to the south-east. They fly in a leisurely manner." Mr. W. A. Ruffin has also observed flights "in a southerly direction."

Arkansas. Mr. A. M. Merrill of Rogers, Ark., writes that the butterflies congregate there in great numbers all at once and "As their wings are not worn I believe they migrate here and stop on their way south. It is almost impossible to find larvae here during the summer."

Mr. Easton saw a large flight to the east in September and October 1933 which is described more fully below under "Louisiana."

New Mexico. Mr. P. R. Gleason writes from Denning, N. Mexico, that the species is rare there but that he saw a few during July and August 1939, becoming more frequent in early September. One pair was seen mating on the 8th September but by the end of the month all had gone. In 1940 the first reappearance was on the 18th March, when two were seen flying steadily to the east.

Florida. In addition to the observations of Mr. and Mrs. Hodges (see p. 151), Mr. W. F. Smith writes that the butterfly occurred commonly at Englewood during December 1937. Twenty were seen on the 30th December, but it became gradually rarer until only two were noted in the last two weeks of March.

Mr. T. K. Cooper states that, at Cape St. George Island, in the north-west of Florida, in 1937 only very few were seen before the end of October but that it then became fairly numerous.

Georgia. Mr. P. M. Gilmer writes (November 1937), "The movement here [Tifton], while somewhat more southerly than in Louisiana, is still distinctly easterly. Tifton is 130 miles from the coast and 60 miles from the Florida line so the movement should be south rather than east if the insects were turning south into Florida. I believe, however, it is rather easterly than southerly even here, although close to S.E. A S.E. movement from here would strike the Atlantic coast only a few miles south of Jacksonville, which is only about 50 miles south of the border. I have only one observation near the coast, in late August 1937, when I saw two specimens flying S.E. disappear out to sea at Sea Island Beach, Brunswick, Ga. They were flying steadily 4-5 feet above the water. From this I am inclined to believe that the movement does not turn south but continues to the S.E. until the death of the insects either by drowning at sea or by natural causes inland." (See below for records of flights out at sea in the Bahama Islands.)

Mr. L. Harris writes that in September 1926, at Decatur and Atlanta, Georgia (both well inland), he saw a movement to the S.E. for several days. Not more than one or two were in sight at one time, usually 2-6 feet from the ground, rising over obstacles and immediately descending to the ground again.

Iowa. Mr. C. W. Thorwald sent three specimens from Chariton, Iowa, in October 1937, with the information that they had appeared within the past three months but were not common in Iowa.

Louisiana. Mr. H. D. Easton writes that in September and October 1933 he observed a very distinct migration of *P. eubule* flying to the East or E.S.E. in Louisiana and Arkansas. The migration was most dense from 15th September to 15th October and then thinner. It was observed from Noel, just over the border from Arkansas into Missouri, to Alexandria and De Ridder in Southern Louisiana, over a front of approximately 400 miles. He estimates the number of butterflies in the flight as "billions."

Again in the autumn of 1937 Mr. Easton noted a very much thinner flight in exactly the same direction over a large part of the State of Louisiana.

Mr. P. Glick writes that he saw movements of *P. eubule* to the east in the autumn almost every year that he was at Tallulah, La. The flights lasted for about three weeks and the insects flew all day singly rather than in groups.

Mr. P. M. Gillmer, who also lived at Tallulah, La., says that the flights often reached a density of one insect per 100 feet. They flew individually near the ground, rarely higher than 3-6 feet. In crossing a depression at Tallulah about 30 feet deep and 50-100 yards wide they went down to the bottom and not straight across. The general direction was a little E. of S.E.

Mississippi. Mr. R. S. Smith reports, in continuation of records already published (Williams 1938b), that in 1937 the flight to the east at Biloxi Bay was first distinct on 4th July, and not 1st July as previously stated. The air was filled with butterflies.

In 1938 the flight started about 14th August and was almost at its end on 13th October. It was in the usual direction and of normal numbers.

Mr. C. Lyle reports that about 1923 at the end of October or beginning of November he saw large numbers of *P. eubule* flying to the east at Bay St. Louis, Miss.

Missouri. Shannon (1935, map p. 157) indicates an annual flight to the south at Independence, near Kansas City, Missouri.

North Carolina. Mr. R. M. Dayton reports that he saw a definite movement of *P. eubule* to the south at Carolina Beach, near Wilmington, North Carolina, at the beginning of October 1935. The weather was hot, many days about 90° F. "While the Monarchs drifted round and stopped here and there, the 'Cloudless Sulphurs' went right through, flying strong and fresh usually about 10 feet up." They were very difficult to catch but he managed to get two. Usually two or three were always visible at one time. The flight lasted through October to the beginning of November.

Tennessee. Mr. C. McR. Plummer has made observations on the movements of *P. eubule* in the neighbourhood of Bolivar, Tenn., in three successive years.

In September 1937 he noted, while driving between Bolivar and Nashville, several individuals all going to the S.E. which was "the usual direction."

In 1938 the flight was observed from August 18th until the end of the month and continued in September. In August about 40 per hour were seen, all flying to the S.E. about six feet above the ground or any obstacle in their path. He writes, "On one occasion we noticed a butterfly stray from the path of its predecessors and go into the woods, but it came out again a few hundred feet farther on and resumed flight along the regular path. We were amazed when the next butterfly exactly duplicated this performance though it was not in sight of the former. The next one which came along, however, resumed the direct path of the normal migration."

Mr. Plummer also writes, "I have noticed that when we have a cold snap, the numbers of the insects are almost doubled. The Sulphurs are flying today (24th September 1938) at about 70 per hour which is compared with the 40 per hour of the warm August days. Today is not frosty, but cool enough for a jacket." And again, "The wind seems to have no effect on the numbers, and little effect on the speed of the flight. When the wind is favourable, i.e., tail-wind, the insects seem to fly with less deviation and less 'fluttering,' but my pure guesswork doesn't indicate that they move much faster than when the wind is across or opposite to the direction of flight."

In 1939 Mr. Plummer reported that the flight began very early and before the end of June a few individuals had been seen moving fast to the E.N.E.

Texas. Mr. B. Struck writes that he has noticed a southerly movement of this species, together with *P. agarithe*, in the fall in the district round San Antonio Bay and Corpus Christi, Texas.

Mr. R. J. Watson observed a flight from 8th to 10th August 1941 in Rusk County, E. Texas, flying about 4 miles per hour about 6 feet above the ground. The width of the territory observed was about 24 miles. About 500 per hour were passing within sight between 11 a.m. and noon. The wind was very light from S.W. Temperature 95° F. Flight from west to east.

America (outside U.S.A.).

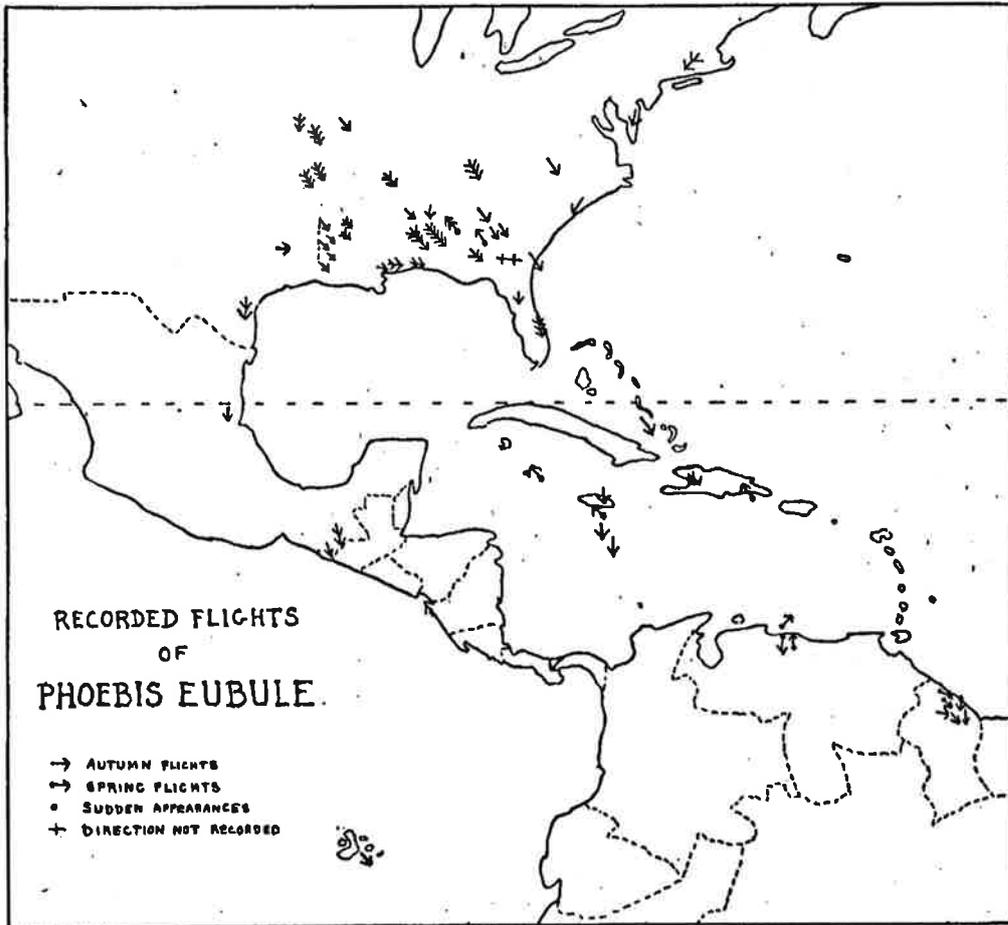
Mexico. Dr. C. W. Sabrosky informs me that on 3rd August 1933 he saw numbers of *P. eubule* flying to the south at Guerrerio, State of San Luiz Potosi, Mexico, about 60 miles west of Tampico.

Guatemala. According to Mr. A. F. Novella, this species emigrates southward from Mexico into Guatemala in August, arriving about the middle of the month.

Mr. M. Y. Fuentes reports a large flight, 800 metres wide, 4 kilometres long and 2-12 metres above the ground, in the first week in August 1938 at Ocos, Guatemala towards the S.E. This locality is on the Pacific coast near the Mexican border.

Panama. Miss C. Longfield has recorded (Poulton 1932a) a flight of this species at Colon, Panama, on 9th June 1924, when hundreds were flying to the S.W.

Jamaica and at sea south of Jamaica. Dr. E. Murray-Aaron informs me that in the autumn of 1889 he saw a flight of scattered groups of this butterfly going almost directly south at about 6000 feet elevation in the Upper Garden, Blue Mountains, Jamaica. A few days later Captain Morris of S.S. *Ailsa* reported



25

FIG. 25.—Recorded flights of *Phoebis eubule* in North and South America and the West Indies.

that he had seen them for at least two days “well over” the Caribbean Sea and heading towards Venezuela.

Haiti. Mrs. B. C. Scott informs me that in June 1920 there was a flight for at least one hour towards the S.E. near Port au Prince, Haiti; and on several subsequent occasions she has seen similar flights in the same direction. The butterflies are locally known as “Papillon St. Jean” and their wanderings have become the subject of a native song (see p. 104).

Caribbean Sea. Dr. E. Murray-Aaron sends me the two following accounts of flights of *C. eubule* in the Caribbean Sea. It is curious that there are no more recent records.

(a) In 1891 Mr. F. Herzog, an entomologist from Frankfort-on-Main, returning from Panama, showed him specimens of *C. eubule* which were part of large numbers seen flying to the south over the sea about 100 miles south of Jamaica. Some of them had settled on the ship's deck. The captain of the steamer had told Mr. Herzog that this was a common thing "about hurricane time." This is about mid-August to mid-October in these waters.

(b) Dr. Aaron gives in a boys' story-book a popular account (Murray-Aaron 1894) of a flight of *C. eubule* over the sea in the neighbourhood of the Bahamas. He tells me that this account is substantially correct. The flight was observed on 12th or 13th October 1889, moving towards the south-east at the north end of Fortune Island Passage in the Bahamas off the east shore of Rum Cay. Many hundreds of butterflies were in sight at one time flying in parallel columns. They were seen at daybreak and had been noted passing over Watlings Island on the previous day.

The map (fig. 25) shows all the known information on the distribution of the flights of *P. eubule*. By far the most striking feature is the south-easterly movement in the autumn in the south-eastern part of the U.S.A., which seems to extend to some of the Northern West Indian Islands and possibly over the Caribbean Sea.

There are north-westerly flights in the spring recorded in Haiti, Jamaica, the Cayman Islands and in Alabama.

The most important records that do not fit into the scheme are the observations of Mr. and Mrs. Hodges in Florida (see p. 151), who noted southerly flights throughout the whole year.

(3) *Eunica monima* (Cramer).

In my summary (Williams 1930b) only one record of the migration of this species was available in which it was said to be taking part in a mixed flight towards the south with *A. maerula* and *C. sennae* (*eubule*) near Caracas, Venezuela, on 25th-26th June 1926 (Box 1930).

Since then Mr. D. B. Legters, of Yucatan, Mexico, has sent me particulars of two large flights. The locality was the village of Xocemplich in the East Central portion of the Yucatan Peninsula in S.E. Mexico.

The first migration started on 20th May 1939 and the insects were flying from S.E. to N.W., the majority just over the tops of the trees, though some possibly 100 feet or more in the air. Fully 100 passed over one square yard per minute. The following day the flight shifted to the west and continued for a week in this direction, every day from about noon till dark. "No matter which direction the wind there was always a definite heading into the west." The flight was suddenly brought to an end by heavy rain on the 30th May (Williams 1939e).

In 1940 the flight was again observed on 22nd June. "Heavy migration heading due south, continued all afternoon, sweeping over and through the tree tops." On 30th June "the heaviest migration of all; the sky is a solid mass of moving pin points, the majority flying high about 100 feet above ground." The flights were, as in the previous year, towards the south and the speed of flight about 4-5 m.p.h.

On the 22nd June, the day of the thinner flight, Mr. Legters took a photograph of the flight with the camera pointing towards the sky. This is reproduced on plate 3. According to his description, the photograph covers an area of

about 80 square feet at 30 feet high. It was taken with 1/200 second exposure at F/11. On the original print which was sent about 475 insects can be seen. One can scarcely identify the species of butterfly from it, but it may help to give some idea of the density of the flight to those who have had no opportunity to see such an occurrence.

(4) *Pieris brassicae*.

The Large Cabbage White Butterfly is a regular migrant in Europe. In 1930 I dealt with it in my book (Williams 1930b) and in 1939 I gave a summary of the available information with particular reference to its movements on the continent of Europe up to 1937. In the latter a full list of recent flight records on the continent was given, but the records for Great Britain were only briefly referred to. A very early record for the year 1508 is discussed on p. 103.

The following are a few records up to 1937 omitted from these summaries.

Between 1850 and 1860. Geldebee, nr. Prensburg. To S.

Swarm about a mile broad passing for several days. Schmidt (Sajo 1897, p. 261).

1882, July 18. Nr. Leighton Buzzard, England.

Road between Leighton Buzzard and Gt. Gaddesden blocked by great swarm of butterflies. Proctor (Littleboy 1892).

1885, end July or beginning Aug. Off S.W. coast Sweden. To S.

Two miles off Trelleborg and Falsterbo, air filled with butterflies. Several seen to alight and rise from water (Alsen 1891).

1891, end July. Sweden.

Mass flight, but locality and direction not given (Wahlgren 1912).

1913, Aug. 15. Loch Dan, Wicklow, Ireland. To S.

Mass of butterflies went off suddenly to S. in late afternoon. Evans (Williams 1936a).

1925, Aug. 28. Verona and Mantua, Italy.

Clouds of white butterflies suddenly appeared, filled streets, business at a standstill; all gone after four hours. Newspaper report (Butterfield 1925).

1931, July 28. Weimar, Thuringia, Germany. To S.

Great swarm passing at level of house tops. Janblitzen (Seitz 1931).

1931, July 29. Hochtör Pass: Heiligenblut, S. Austria. To S.

Constant stream of both sexes drifting over snow with north wind. Up to 10 per minute in sight; 20-30 feet in air (Welch 1933).

1932, July 25. Faeborg, Faen Is., Denmark. To S.

Several hundreds visible 1-5 metres over water for two hours. Sunny, no wind. C. Stapel (ms.).

1932, July 30. Middelkerke, Belgium. To S.W.

Big flight (Severin 1932).

Migrations on the continent of Europe 1937-1939.

In 1937 there were extensive migrations, often accompanied by *Pieris rapae* and rarely *P. napi*, in Central Europe. Nineteen references to such flights have already been published (Williams 1939a). Since then the following additional ones have been traced.

1937, May. Schleswig-Holstein. To S. and S.W.

Large swarm near Flensburg and Kreis-Sudtöndern (Warnecke 1937).

1937, July. Langenbielau, Silesia. To E.

Migrating for a week quickly and without stopping; mostly 2-3 metres from the ground. Seen also at Snadenfrei in Silesia. Possibly results of unusual heat (30-35° C.) in May (Specht 1937).

1937, July 8. Waldenburger Bergland, Saxony. To W.

Great thick swarm, 10 kilometres broad seen from Fellhammer to Friedland (Hentschel 1937).

1937, July 10. Usedom Is., Baltic coast, Germany. To S.E.

Hatch out of 2nd generation adults at beginning of July. Common everywhere; on 10th great masses started to move to S.E. Urbahn (Wenzel 1937).

- 1937, July 15. Kefermarkt, Upper Austria. To S.
Hundreds of thousands, fields white. Continued on following days but not so thick (Foltin 1938).
- 1937, July 15. Schwarzbrennkopfe, Gablonz, Bohemia. To S.
Masses seen, 875 m. above sea-level. R. Wunsch (Wenzel 1937).
- 1937, mid-July. Fehmarn, Schleswig-Holstein. To N.
Flight about 4 kilometres long (Warnecke 1937).
- 1937, mid-July. Kiel.
Very abundant for about a week (Warnecke 1937).
- 1937, mid-July. Schleswig-Holstein. To S.W.
Great flight 300 metres broad seen near Pelzerhaken in East Holstein, across Neustadter Bay (Warnecke 1937).
- 1937, July 21. Between Hamburg and Kiel. To W.
Numbers all the way, always 10-15 in sight, apparently mostly females (Warnecke 1937).
- 1937, July 21. Mardorf, Hanover. To W., S.W., and S.
Flying all afternoon, chief flight 2.30-4.30, when 250-300 passed per minute on 30 metre front. Majority flying over margin of Lake Steinhuder in belt about 70 metres broad. Cloudless, temperature 24-28° C. Calm at first, then about 5 p.m. light W. wind but no change in direction of butterflies (Barth 1938).
- 1937, July 23. Vöcklabruch, Upper Austria. To S.
Flight seen (Foltin 1938).
- 1937, July 31. Keller See, nr. Eutin, Oldenburg. To S.
Flight seen on east bank by H. Sick (Wenzel 1937).
- 1937, Aug. 1. Between Ponitz and Ahrenstock, Oldenburg. To S.W.
Seen by H. Sick in "Middle-Kreis, Eutin" (Wenzel 1937).
- 1937, beginning August. Reichenau Is., Lake Constance.
Flew one after the other in great numbers; direction not stated. Rethingen (Wenzel 1937).
- 1937, Aug. 4. The Brocken, Germany. To S.
Flying in groups of 3-8 about 6-10 metres from the ground. Three times as many females as males; about 850 metres above sea-level. Wind very light N. Temperature about 20° C. (Wenzel 1937).
- 1937, Aug. 24. Kemtauer, Chemnitz. To S.
All three Pierids flying round; then suddenly, about 3 p.m., went off to south for about 20 minutes; then heavy rain. Ground level up to 10 metres, both sexes equally common. Friedemann (Wenzel 1937).
- 1937, —. Gratz, S.E. Austria. To W.
Commoner than at any time for ten years. Kraut (Wenzel 1937).
- 1937, —. Switzerland.
Great damage by caterpillars at Mürren and near Lake Constance (Wenzel 1937).
- 1937, —. Schilthorn, Switzerland.
A swarm like a snowstorm seen at height of 2600 metres. Hopf (Wenzel 1937).
- 1937, —. Bad Freienwalde a. Oder, Brandenburg. To S.
Flight reported by Haase (Wenzel 1937).
- 1937, —. Stuttgart. To S.
Swarm observed by A. Koelsch (Wenzel 1937).
- 1937, —. Jungbuch, Bohemia. To S.W.
Flight reported by Haase (Wenzel 1937).

In 1938 there were no extensive migrations recorded in Central Europe but one record of unusual interest from Sweden which extends the known migration area considerably farther north.

1938, June 20. Straits of Messina. ? To N.N.W.
Thin migration 10.30 a.m. to 1 p.m. Two captured: almost calm. Robertson (Williams 1939a).

1938, Aug. 21. Southern Sweden. To S.
On 320-mile railway journey from Trölleborg to Stockholm large numbers seen; up to 23 visible at one moment; both *P. brassicae* and *P. rapae*. Hodson (Williams 1939a).

In 1939 there was a very extensive invasion in England in August (see p. 193) but only a few records on the Continent and none is available from Central Europe.

1939, July 29. Dieppe, France.

Flight "literally like snow" right up to above the houses, weather fine and clear, wind offshore. Flight seen from train, so direction uncertain. Andrews (ms.).

1939, Aug. 2. Elsinore, Denmark. To S.W.

Mass migration seen "like a snowstorm." "No abnormal numbers at Copenhagen side of ferry 20 miles from Elsinore." J. Smith (ms.).

TABLE 21.

Records of directional flights of *P. brassicae* in the British Isles, 1931-1938.

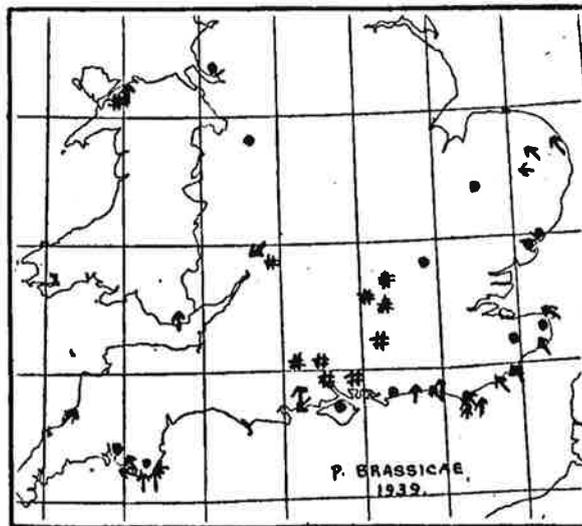
1931, June 4	Sark, Channel Is.	W.	Droves	Newman 1931
1931, mid-June	E. Dudgeon Light-Vessel, off Norfolk	W.	30 per hour	Sharman
1931, 1st week Aug.	Broadstairs, Kent	—	Great numbers	Newman 1932
1932, July 3	E. Dudgeon Light-Vessel, off Norfolk	W. and W.S.W.	Thin flight	Sharman
1932, Aug. 2	Hove, Sussex	N.	Swarms	V. E. August
1932, Aug. 8	Eastbourne, Sussex	N.W.	Many	R. Adkin
1932, Aug. 8-19	Harpenden, Herts	W.	Thin movement	C. B. Williams (1933a)
1932, Aug. 11	Eastbourne, Sussex	—	Town invaded	Chartres
1932, Aug. 14	Dunwich, Suffolk	W.	Large number	M. B. Ellis (Williams 1933a)
1933, May 12	Broadstairs, Kent	W.	Many	Frohawk
1933, May 21-June 6	Alston, Cumberland	N.	Large numbers	Bolam 1933
1933, May 21-22	Reading, Berks	N.	Small numbers	Hodson
1933, May 21 and 22	Catcleugh, Northumberland	W.	A flight	Craigs
1933, May 22	Droitwich, Worcester	N.	Thin flight	A. B. Williams
1933, June 2	Between Dover and Ostend	N.W.	Hundreds	Gilbert
1933, June 3-5	Scolt Head, Norfolk	W. and S.W.	Considerable immigration	(Turner, <i>Ent. Rec.</i> 45: 127)
1933, June 3-6	Jack Sound, Skomer Is., Pembroke	W.	Thin stream	Lockley
1933, July 20	East Coast, Norfolk	W. and S.W.	Large numbers	Ellis
1933, July 23-30	Nr. Gorleston, Norfolk	W. and S.W.	Hundreds	(<i>Entomologist</i> 66: 210)
1933, July end	Harpenden, Herts	W.	Small numbers	C. B. Williams
1933, Aug. 2	Outer Dowsing Light-Vessel, off Lincoln	E.	20	J. W. Reeve
1933, Aug. 2	E. Dudgeon Light-Vessel, off Norfolk	S.S.E.	Swarm	J. Audley
1933, Aug. 4	Gorleston, Norfolk	N.	Many	E. A. Ellis
1933, Aug. 5	Barrow on Soar, Leicester	W.	Hundreds	C. J. Tatham
1933, Oct. 1	E. Dudgeon Light-Vessel, off Norfolk	E.	Nine	Fuller
1934, July 26	Start Point, Devon	N.	Dozens	A. W. Godfrey
1935, June 9	Scolt Head, Norfolk	S.W.	Dozens	E. A. Ellis
1935, Aug. 5	Start Point, Devon	N.	Dozens	A. W. Godfrey
1936, Aug. 7	Lizard, Cornwall	N.W.	Hundreds	B. A. Cooper
1936, Aug. 17-29	At sea, off Maplethorpe, Lincs	W.	Hundreds	W. R. Withers
1936, Aug. 23	At sea, off Bexhill, Sussex	S.	Dozens	H. G. MacLeod
1936, Aug. 25-26	Harpenden, Herts	S.E.	Dozens	K. Grant
1937, May 24-30	Harpenden, and St. Albans, Herts	N.	Hundreds	K. Grant (1938)
1937, May 24-27	N. Foreland Lighthouse, Kent	W. and W.N.W.	Dozens	H. W. Bowling
1937, May 24	Norwich, Norfolk	N.	Large numbers	E. A. Ellis
1937, May 24 and 25	Blakeney Pt., Norfolk	S.E.	Like a snow-storm	W. Eales
1937, May 27	St. Nicholas Light-Vessel, off Norfolk	W.	A hundred or more	S. G. Sharman
1937, May 30	Gorleston, Norfolk	W.	Many hundreds	M. B. Ellis

TABLE 21 (Continued).

1937, May 30	N.W. Norfolk	W.	Large numbers	S. H. Long
1937, June 5-9	Blakeney Pt., Norfolk	S.E.	Thousands.	W. Eales
1937, June 6	Nr. Scott Island, Norfolk	S.W.	Thousands	R. True (3.vii.37, Field)
1937, June 6	Burnham-over-Staithe, Norfolk	S.W.	Millions	D. Carruthers
1937, June 6	Sheringham, Norfolk	1 S.	Thousands	B. C. Perowne
1937, July 1	Bamburgh Castle, North- umberland	S. and W.	Hundreds	W. Wannop
1937, July 28	Owers Light-Vessel, Sus- sex	S.W. and W.N.W.	Hundreds	W. F. Willgress
1937, July 29	Harpenden, Herts	W.-S.W.	Thin flight	C. B. Williams
1937, July 29	Dover, Kent	N.	Hundreds	B. Embry
1937, July 31- Aug. 7	At sea between Isle of Wight and Chichester	N.W.	Hundreds *	C. J. P. Cave
1937, Aug. 1-7	Nr. Hastings, Sussex	N.N.W.	Several hundred	H. Eves
1937, Aug. 3	Nr. Porchester, Hants	S.	Many	A. W. Cother
1937, Aug. 4	Beachy Head, Sussex	N.	About 50	H. C. Gunton
1937, Aug. 14-27	Barmouth, Merioneth	S.	Thin movement	C. B. Williams
1937, Oct. 3	Tynemouth, Northumber- land	W.	20-30 from sea	G. L. Drury
1938, May 18-22	Brighton, Sussex	N. and N.E.	Hundreds	H. Blackiston
1938, Sept. 25	Dolgelly, Merioneth	S.	Small numbers	G. van Zuylen

Records in England 1931-1940.

Table 21 gives the records of directional flights observed in England in 1931-1938. Most of them have already been discussed in Williams 1939a. They are summarised in fig. 30. It will be seen that the flights were most extensive in 1933 and 1937, with relatively few in the intervening years. In 1937 there



26

FIG. 26.—Recorded flights, and unusual abundance of adults (dot), and larvae (cross hatch) of *Pieris brassicae* in England in 1939.

were (see above) many flights observed on the Continent, but in 1933 only very few.

In 1939 there is little doubt that an extensive immigration occurred, particularly along the south coast. The records are shown in Table 22 and the map (fig. 26), which also shows several reports of unusual abundance and damage by larvae which are not listed in the table.

TABLE 22.

Records of directional flights of *P. brassicae* in the British Isles in 1939.

1939, July 11	Royal Sovereign Light-Vessel, Sussex	N.	A few	W. F. Willgress
1939, July 27	Eastbourne, Sussex	N.	Dozens	G. J. T. Jose
1939, July 27	Start Point, S. Devon	W.	Very common	T. C. Abell
1939, July 27	Beachy Head, Sussex	N.	Hundreds	H. G. Adkin
1939, July 28	Bournemouth, Hants	S.W.	Scores	F. C. Fraser
1939, July 29-Aug. 2	North Foreland, Kent	N.W.	Very common	J. W. Bowling
1939, Aug. 1-6	Mid-Norfolk	W.	Large numbers	E. A. Ellis
1939, Aug. 4-8	Eastbourne, Sussex	N.	A thousand	H. G. MacLeod
1939, Aug. 5	Dungeness, Kent	From sea	Hundreds	E. M. Cawkell
1939, Aug. 4-29	Brighton district, Sussex	N. and N.W.	Thousands	H. Blackiston
1939, Aug. 5 and 6	Start Point, Devon	N.	Great number	R. L. Sheppard
1939, Aug. 6	Bexhill, Sussex	N.	Hundreds	H. J. Sargent
1939, Aug. 7-17	Bangor, Carnarvon	N.	General movement	— Jacob
1939, Aug. 8	Hastings, Sussex	N.W.	Hundreds	D. Brightmore
1939, Aug. 8	Alnmouth, Northumberland	—	Suddenly appeared	F. C. Garrett
1939, Aug. 13	Start Point, Devon	N.	Very common	C. H. R. Edwards
1939, Aug. 10-13	Stoke Bay, S. Devon	W. and N.W.	Hundreds	C. B. Williams
1939, Aug. 13	Salcombe, S. Devon	N.	Very common	— Rodick
1939, Aug. 14	Inistrahull Lighthouse, N. Donegal	N.E.	Very common	D. J. Sullivan
1939, Aug. 19	Barry, Glamorgan	N.N.E.	Hundreds	L. R. White
1939, Aug. 20 and 24	Inistrahull Lighthouse, N. Donegal	N.W.	Large numbers	D. J. Sullivan
1939, Aug. 25	Bournemouth, Hants	N.	Hundreds	F. C. Fraser
1939, Aug. 27	Cheltenham, Glos.	S.W.	Over a thousand	F. B. Welch

The main flight started about the 27th July and was at its height in the first half of August. My own observations were made on the South Devon coast at Stoke, where there was a thin flight towards the west for over a week with a peak about the 10th-13th August.

The record of numbers flying towards the north-east at the Inistrahull Lighthouse off the north coast of Ireland is not marked on the map, but is of considerable interest in being the first record of migration from this part of the country. There were also reports of unusual abundance in Perthshire and in Northumberland.

In 1940 there occurred one of the most extensive outbreaks of *Pieris brassicae*, together with smaller numbers of *P. rapae* and *P. napi*, that had been observed for many years in the British Isles. There is little doubt that it was connected with the extensive immigration in 1939, and may have been in part at least the results of a general absence of parasites in the autumn of that year.

It is worthy of note that the winter of 1939-1940 was one of the most severe experienced for many years with minimum temperatures frequently below 10° F. and the ground in many parts frozen or snowbound for from four to six weeks.

The spring started with records of unusual numbers of white butterflies in many parts of the country, including Kent, North Wales, Buckinghamshire and Gloucester, but only three directional flights were recorded, all in the north, as follows:—

1940, May 18. Morecambe, Lancs. Approximately to S.E.

Procession of butterflies coming in from the sea down the old pier; flying against a moderate land breeze at 3 p.m. All keeping the same course down one side of the pier. Flying in twos and threes, many hundreds passed in 45 minutes' observation. Sea very calm but hazy sky. H. W. Slater.

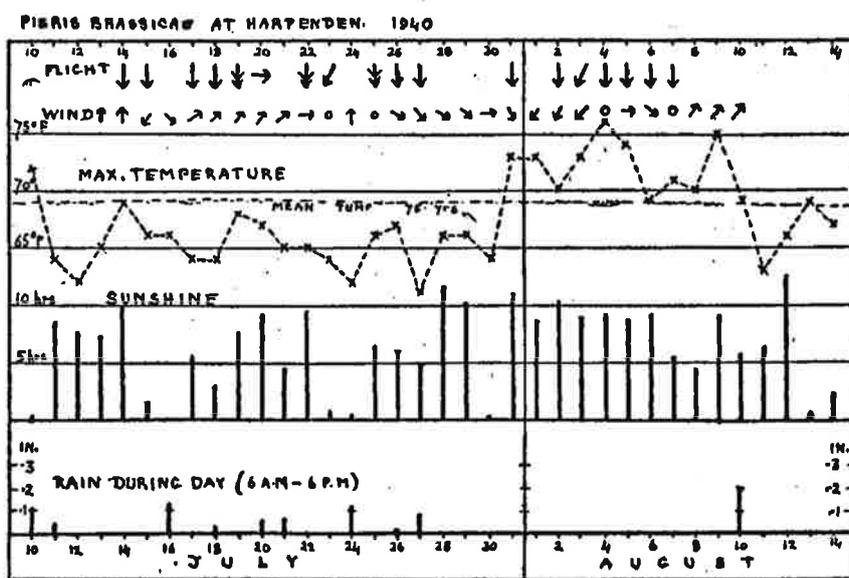
1940, May 21. Hilbre Is., Cheshire. To E.N.E.

Thousands passing in late afternoon and early evening in calm weather. Flying across the mouth of the River Dee from the Welsh coast; not settling; a hundred every few minutes. H. Blackler (1940).

1940, May 26. Catcleugh, Northumberland. To S.W.

Definite migration seen over eight miles of Hawick Road between Catcleugh and Carters Bar. R. Craigs.

During June and July there were numerous reports of damage by caterpillars to various cruciferous crops, including severe damage to swedes in North Wales and North-east England. In the former area J. Thomas reported that several fields were so damaged that they had to be ploughed up. In the latter area R. A. Harper-Gray reported the worst damage since 1925.



27

FIG. 27.—Summary of observations on a flight of *P. brassicae* at Harpenden in July and August 1940.

The second generation of butterflies began to hatch out about the second week in July, and the first movement was reported at Harpenden on Sunday 14th July. On this date Dr. Henderson-Smith observed a considerable movement of white butterflies to the south over the golf links at mid-day. Forty and fifty were in sight at once and many hundreds passed. The flight was sufficiently obvious to attract the attention of the general public. On the same day C. G. Butler reported them moving to the south in very large numbers for several miles between Royston and Cambridge. This is about 25–30 miles north-east of Harpenden. Thousands were seen and many were dead along the roadside killed by passing traffic. Four of these brought back were 2 males and 2 females of *P. brassicae*. Counts of the numbers crossing the main road within view in five successive minutes gave 76, 121, 102, 85 and 97 respectively.

Movements were also reported on this day from Norfolk, Monmouth and Sussex.

Observations at Harpenden.

From this date until the movement ceased a regular watch was kept at Harpenden, and observations and counts were made at frequent intervals on

TABLE 23.

Observations on migrating *P. brassicae* at Harpenden in July and August 1940.
For description of localities A, B and C see text.

Date	Time : G.M.T.	Loc.	Min.	Flight		Number to S. per 5 min. per 100 yd.	Group density
				S.	N.		
July 15	1.07	A	20	16	5	4	1
	1.27	A	20	11	2	3	1
July 17	1.15	A	20	55	5	12	2
	3.00	A	10	11	2	5	1
July 18	3.15	B	10	59	14	30	2
	3.10	B	10	17	9	9	1
July 19	8.55	B	25	77	18	16	2
	11.25	B	5	118	18	130	3
	11.30	B	5	89	5	98	3
	1.27	B	10	36	8	20	2
	2.10	B	5	49	2	55	3
	3.36	B	5	8	3	9	1
July 22	9.12	B	5	43	1	48	2
	9.18	A	5	22	1	20	2
	9.23	A	5	62	1	56	3
	9.27	B	5	152	2	167	3
	11.10	C	5	189	4	170	3
	2.30	B	5	48	4	52	3
	2.35	A	5	28	1	25	2
	10.55	A	5	27	4	24	2
July 25	11.00	B	5	44	8	48	2
	11.15	A	5	25	4	23	2
	11.20	B	5	47	5	51	3
	11.35	B	5	35	6	39	2
July 26	11.10	B	5	20	1	22	2
July 27	1.30	B	5	15	5	17	2
	1.25	A	5	22	5	20	2
Aug. 2	1.30	B	5	18	2	20	2
	5.30	A	5	17	2	15	2
Aug. 4	1.45	B	10	31	9	17	2
Aug. 5	1.55	B	10	51	21	27	2
	2.05	A	10	13	4	6	1
Aug. 6	11.40	B	10	55	15	30	2
	1.35	B	10	34	18	19	2
Aug. 7	10.00	B	5	23	3	25	2
	10.05	B	5	14	12	15	2
	1.55	B	5	23	15	25	2
	2.00	B	5	23	14	25	2
Total to date			300	1628	258		
Aug. 9	10.25	B	5	24	24	No evidence of movement. First observations with more to N.	
	10.30	B	5	19	27		
Aug. 12	4.21	B	5	1	5		
	10.00	B	10	29	14		

each fine day. A summary of the weather conditions during the flight will be found in fig. 27 and a summary of the observations on flight directions in Table 23.

Observations were made chiefly at two points. The first was (Table 23A and fig. 28) on an open cricket ground on Harpenden Common just in front of the Rothamsted Laboratories. The area observed was about 120 yards square. On this field the compass direction (8 points) of each individual was noted.

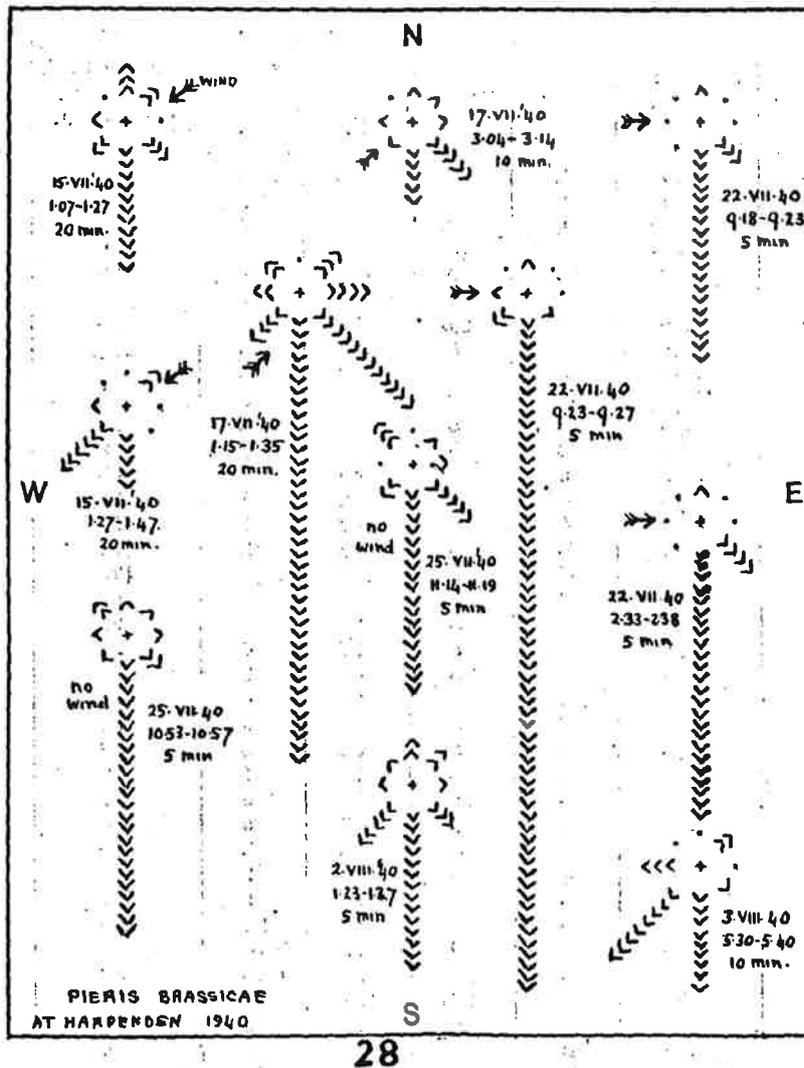


FIG. 28.—Observations on compass direction of flights of *P. brassicae* at Harpenden in July and August 1940.

The second (Table 23B) was a strip of common land between the main road and the Laboratories. In this the butterflies were divided into two groups only; those crossing an east-west line of about 90 yards length going to the south, and those going to the north. One set of observations was made on Rothamsted Farm (Table 23C) in an open field across a front of about 120 yards.

In Table 23 there is given in addition to the exact numbers observed a corrected figure for the numbers which would have been observed if the front had been 100 yards and the period of observation five minutes. These are thus comparable for the different localities and different days.

From fig. 27 it will be seen that the first observation was on the 14th July and that the butterflies were passing to the south on almost every fine day until the 7th August, a total of 25 days. The flight started during a period with maximum temperature well below the July average for the locality, which is 69.4° F. The cold spell lasted till the 30th July and then there were 10 days with temperatures well above the average and 8°-10° F. hotter than the previous fortnight. The flight continued steadily during the greater part of this second period, indicating little or no effect of the increased temperatures. The hot spell in August was distinctly sunnier than the cool July, and no rain fell from the 27th July till the 10th August just after the flight had ceased.

The wind, which was from the south on the first day, changed to the north-east on the second, and then changed so frequently that it blew from all quarters except south-east without in any way affecting the direction of the flight. The only noticeable effect was that when it was strong a few butterflies seemed to be carried away with it against their inclination and unusually high in the air.

The standard numbers per 100 yards per 5 minutes shown in Table 23 varied from 3 to 170 and, according to the classification suggested on page 260, included groups I, II and III. Group III, which should be obvious to any field-naturalist, occurred on three days—the 19th, 22nd and 25th of July—and probably also on the 14th, but no exact counts were made on this day.

From the 15th July to the 22nd August continued observations were made for a total of 300 minutes and in that period 1627 insects were counted passing to the south and 256 to the north of an east-west line. If one ends the period at the 4th August the preponderance is considerably greater at 1391—154.

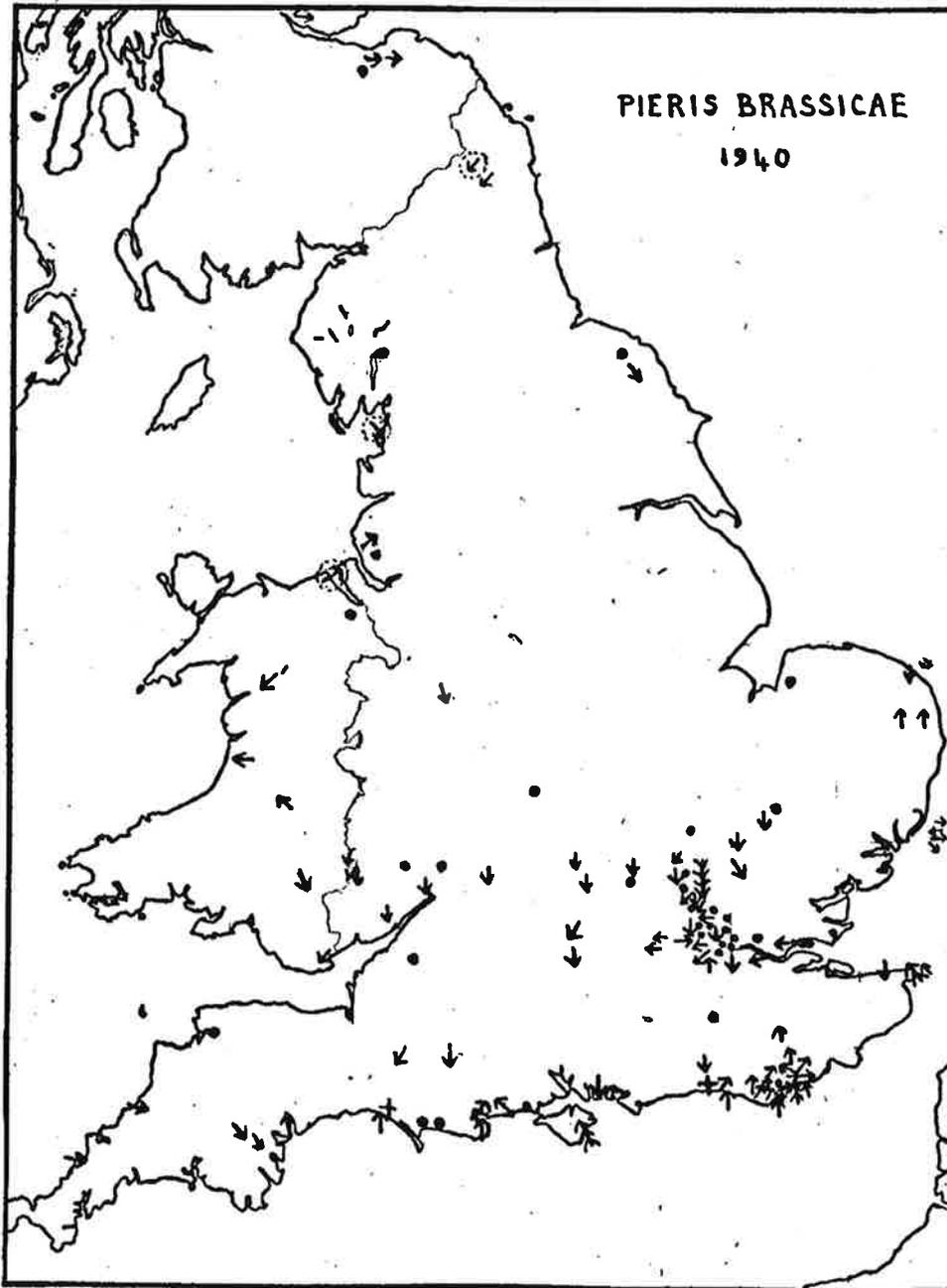
On the 9th August the first observation was obtained since the start of the flight in which the numbers passing to the north were equal to, or greater than, those going south.

Fig. 28 shows the observations made in the open cricket field on Harpenden Common, when the exact compass direction of each individual was recorded. Each arrowhead represents a single butterfly and the overwhelming preponderance of movement almost due south is easily seen. The second commonest direction is south-east or south-west, varying on different days, possibly owing to slight influence of cross winds.

A number of specimens were captured and were nearly all *P. brassicae* in good condition, with a few *P. rapae* and still fewer *P. napi*. For example, on 19th July the captures were :—

	Males	Females
<i>P. brassicae</i> . . .	10	18
<i>P. rapae</i> . . .	3	3
<i>P. napi</i> . . .	1	1

In the passage through the district eggs were laid on various cruciferous plants, and, in my own garden, particularly on nasturtium (*Tropaeolum*). On the whole, however, considerably fewer eggs were laid than might have been expected in the gardens and allotments and no large-scale damage followed in the district. Damage before the flight started had been distinctly more severe.



29

FIG. 29.—Records of flight of *P. brassicae* in England in 1940.