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PHYSIOLOGIC RACE SURVEY

FINAL REPORT

1968

NOT FOR PUBLICATION

I N D E X

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Physiologic Race Survey Committee ( Cereal Pathogens )

Secretary,

N. H. Chamberlain,

N. I. A. B. Cambridge.

PHYSIOLOGIC RACE SURVEYS - FINAL REPORT FOR 1968

Introduction

During 1968 five centres agreed to continue with the investigation of pathogens causing the major foliar diseases of cereals, and the identification of physiologic races of these pathogens. In 1968 the Department of Agriculture for Scotland, East Craigs, Edinburgh, found it necessary to discontinue their testing programme. Therefore there are no results for identification of mercury tolerant isolates of Pyrenophora avenae (previously Drechslera avenae) for samples sent to Edinburgh during 1968. Pyrenophora will also be omitted from the 1969 race survey.

The total number of disease isolates collected during 1968 and dispatched to the five centres was 932. This total is slightly less than 1967 (Table 1)

Table 1

Numbers of disease isolates collected for  
race identification

| Disease                 | No. of Isolates |      |
|-------------------------|-----------------|------|
|                         | 1967            | 1968 |
| Yellow rust - wheat     | 343             | 118  |
| Yellow rust - barley    | 48              | 49   |
| Brown rust - barley     | -               | 40   |
| Crown rust - oats       | 17              | 4    |
| Wildew - wheat          | 122             | 253  |
| Wildew - barley         | 173             | 283  |
| Wildew - oats           | 42              | 31   |
| Rhynchosporium - barley | 227             | 137  |
| Leaf spot - oats        | 62              | 17   |
| TOTAL                   | 1034            | 932  |

Barley brown rust has recently been included in the survey and numbers of isolates are small. However a race pattern is beginning to emerge from the results obtained during 1968. The small number of crown rust isolates has prevented assessment of the race spectrum in Britain.

Co-operation in the collection of isolates was provided by participants throughout Britain (Table 2) and we are grateful to all participants who contributed samples during 1968.

This report contains the results of identifications that have been completed on the 1968 isolates. Not all isolates have been tested. This is either due to the pressure of work at a particular centre, or to adverse growing conditions which have prevented spore multiplication. Therefore some isolates could not be tested on differential varieties in time for the result to be included in this report. Each centre has provided the completed results which are collectively presented in the following manner:-

1. Number of isolates received.
2. The varieties from which isolates were collected.
3. Locations from which isolates were collected.
4. Race identifications.
5. Summary.

Source of isolates collected during 1968

|  | Wheat<br>Rust | Barley<br>Yellow<br>Rust | Barley<br>Brown<br>Rust | Oat<br>Crown<br>Rust | Wheat<br>Mildew | Barley<br>Mildew | Oat<br>Mildew | Rhyncho-<br>sporium | Oat<br>Leaf<br>Spot | TOTAL |
|--|---------------|--------------------------|-------------------------|----------------------|-----------------|------------------|---------------|---------------------|---------------------|-------|
| N.A.S. Plant Pathologists                          | 18            | 1                        | 10                      | 1                    | 88              | 100              | 7             | 33                  | 8                   | 266   |
| N.I.A.B. Regional Trials Officers                  | 33            | 24                       | 7                       |                      | 105             | 68               | 7             | 31                  | 2                   | 104   |
| N.I.A.B. Head Quarters                             | 50            | 5                        | 15                      |                      |                 |                  |               | 19                  |                     | 89    |
| British Association of Plant Breeders              | 2             | 6                        |                         |                      | 49              | 60               | 4             | 18                  | 6                   | 145   |
| Dept. of Agriculture for Scotland                  |               |                          | 5                       |                      | 1               | 25               | 1             | 10                  |                     | 42    |
| Scottish Agricultural Colleges                     | 14            | 11                       | 1                       |                      | 1               | 1                |               | 9                   | 1                   | 38    |
| Plant Breeding Institute                           |               |                          |                         |                      |                 | 10               |               | 3                   |                     | 10    |
| Welsh Plant Breeding Station                       |               |                          | 1                       | 3                    |                 |                  | 1             |                     |                     | 5     |
| University of Reading                              |               |                          |                         |                      |                 |                  | 4             | 7                   |                     | 11    |
| Department of Agriculture<br>Dublin-Eire           |               |                          |                         |                      | 4               | 7                | 2             |                     |                     | 13    |
| Plant Breeding Dept. N.Ireland                     |               |                          |                         |                      |                 |                  | 2             | 1                   |                     | 3     |
| State Horticultural Advisory<br>Service - Guernsey |               |                          |                         |                      |                 |                  | 3             |                     |                     | 3     |
| Others   | 1             | 2                        | 1                       |                      | 5               | 9                |               | 5                   |                     | 23    |
| TOTAL  | 118           | 49                       | 40                      | 4                    | 253             | 280              | 31            | 136                 | 17                  | 928   |

Table 2

A.

Yellow rust - wheat. National Institute of Agricultural

Botany. Cambridge.

N.H. Chamberlain

1. A total of 118 samples of wheat yellow rust was received by the N.I.A.B. from the following varieties, during 1968.
2. Varieties from which isolates were received.  
Winter wheat varieties are given in Table 3, spring wheat varieties are given in Table 4.

Table 3

| Winter Wheat        | No. of Isolates |
|---------------------|-----------------|
| Cappelle Desprez    | 18              |
| Hybrid 46           | 9               |
| Champlein           | 7               |
| Joss Cambier        | 5               |
| Mildress            | 4               |
| Cama                | 3               |
| Maris Ranger        | 3               |
| West Desprez        | 3               |
| Elite Lepuple       | 1               |
| Maris Widgeon       | 1               |
| Zorba (Engelen 565) | 1               |
| Advance (IAE 8/8)   | 1               |
| Margin              | 1               |
| Bouquet (FDA.15)    | 1               |
| TOTAL               | 58              |

Table 4

| Spring Wheat    | No. of Isolates |
|-----------------|-----------------|
| Kloka           | 5               |
| Kolibri         | 5               |
| Opal            | 4               |
| Pompe (W9248)   | 3               |
| Clarion         | 3               |
| Janus           | 1               |
| Rothwell Sprite | 2               |
| Troll           | 1               |
| TOTAL           | 24              |

An additional 36 isolates were received from other varieties, many of them in yellow rust nurseries. These varieties were: Apollo, Belloy, Bon Fermier (2), Chinese 166, Eclipse, Falco, Apex (2), Harvest Queen (2), Helnes VII (3), Himalayan, Lucas (2), Maris Beacon, (TJB32/249), Maris Butler, Maris Dove, WGH.6264, Nord Desprez, Orca, Persian (2), Rothwell 355, Rubis, Tadorna, Triticum vulgare (2), Viking (2), Trou, Michigan Amber, Maris Settler (TB396/37), Heima-Desprez (FD2406).

5. Locations from which the wheat yellow rust isolates were collected  
 Isolates were collected from 31 locations in the British Isles. The location from which each isolate was collected and the variety from which it was collected is shown in the following table:--

Table 5

| Location                      | Source Variety            | No. of Isolates |
|-------------------------------|---------------------------|-----------------|
| Abergavenny (Mon)             | Champlein                 | 1               |
| Arundel (Sussex)              | Apex                      | 1               |
| Balmirer (Angus)              | Cappelle Desprez,         | 2               |
| Bemersyde (Derwicks)          | Mildress                  |                 |
| Bwlch (Brecks.)               | Cappelle Desprez,         | 2               |
| Chester                       | Hybrid 46                 | 1               |
| Cockle Park (North-umberland) | Cappelle Desprez          | 1               |
|                               | Himalayan                 |                 |
|                               | Hybrid 46, Cappelle       |                 |
|                               | Desprez, Champlein,       |                 |
|                               | Troll, Cama (2),          |                 |
|                               | MGH6264, Kolibri,         |                 |
|                               | Rothwell Sprite, Kloka,   |                 |
|                               | Opal, Margin, Heima-      |                 |
|                               | Desprez (FD2406),         |                 |
|                               | Clarrion, Viking, Janus,  |                 |
|                               | Heines VII, Pompe         |                 |
|                               | (W9248)                   | 19              |
| Cotton (Perths)               | Cappelle Desprez, Cama,   |                 |
|                               | Hybrid 46                 |                 |
| Dorchester (Dorset)           | Bellroy                   | 3               |
| Duhnow (Essex)                | Champlein, Cappelle       | 1               |
|                               | Desprez                   | 2               |
| Drayton (Hants)               | Kloka, Hybrid 46          | 2               |
| Edinburgh                     | Cappelle Desprez,         |                 |
|                               | Kolibri                   | 2               |
|                               | Apex                      | 1               |
| Glencarse (Perths.)           | Cappelle Desprez          | 1               |
| Halcobry Fen (Suffolk)        | Champlein (2), Opal,      | 1               |
| Harper Adams                  | Heines VII, Bon Fermier,  |                 |
| (Newport, Salop)              | Rubis, Persian, Chinese   |                 |
|                               | 166, Lucas, Cappelle      |                 |
|                               | Desprez, Harvest Queen    | 11              |
|                               | Kloka                     | 1               |
| Headley Hall (Yorks)          | Hybrid 46                 | 1               |
| Innerwick (East Lothian)      | Cappelle Desprez          | 1               |
| Kesteven (Lincs)              | Joss Cambier              | 1               |
| Kinver (Worcs.)               | Cappelle Desprez-         | 1               |
| Llanhamlech (Brecks.)         | Pompe (W9248)             | 1               |
| Morley (Norfolk)              | Opal (2), T. Vulgare (2), | 1               |
| N. I. A. B., (Cambridge)      | Kolibri (2), Nord Des-    |                 |
|                               | prez, Persian, Harvest    |                 |
|                               | Queen, Michigan Amber,    |                 |
|                               | Lucas, Bon Fermier,       |                 |
|                               | Tadorna, Falco, Heines    |                 |
|                               | VII, Maris Dove, Joss     |                 |
|                               | Cambier (3), Elite        |                 |
|                               | Lepeuple, Apollo,         |                 |
|                               | Advance (IAE8/8), Roth-   |                 |
|                               | well 355, Orca, West      |                 |
|                               | Desprez, Mildress (2),    | 27              |
|                               | Cappelle Desprez, Kloka   |                 |
|                               | Champlein                 | 2               |
| N. Belton (E. Lothian)        | Cappelle Desprez,         |                 |
| N. Murie (Perths.)            | Hybrid 46 (2), Maris      |                 |
| Spaxton (Bristol)             | Widgeon, West Desprez,    |                 |
|                               | Bouquet (FDA. 15),        |                 |
|                               | Joss Cambier, Maris       |                 |
|                               | Ranger                    | 8               |

Table 5 continued

| Location             | Source Variety  | No. of Isolates |
|----------------------|---|-----------------|
| Starcross (Devon)    | Hybrid 46, Kloka  | 2               |
| Sudbourne (Essex)    | Cappelle Desprez  | 1               |
| Terrington (Norfolk) | Kolibri, Maris Butler, Pompe (W9248), Clarion   | 4               |
| Winchester (Hants.)  | Cappelle Desprez (3), Viking, Eclipse, West Desprez, Champlein, Rothwell Sprite, Maris Ranger (2), Hybrid 46, Zorba (Engelen 565), Maris Beacon (TJB32/219) | 14              |
| Wye (Kent)           | Trou, Clarion   | 2               |
| Yeovil (Somerset)    |   |                 |
|                      | TOTAL   | 118             |

4. Race Identifications

Results for 1968 are not complete, although the majority of isolates have been tested and the race identified. Failure to complete the identification of the isolates is due to poor spore germination and infection, with the result that spore multiplication has been considerably hampered. Thus the quantities of spores produced have not been sufficient to inoculate the differential varieties. 20 isolates from 1968 failed to produce spores at the initial inoculation; there is no result for these isolates.

During 1968 89 isolates were successfully multiplied and tested on differential varieties. The results of identifications are shown in Table 6.

Table 6

| NIAB NO | Source of Isolate |                        |                    | Race       |
|---------|-------------------|------------------------|--------------------|------------|
|         | Date              | Location               | Variety            |            |
| 68/1    | 26/2/68           | Abergavenny            | Champlein          | 3/55       |
| 68/2    | 3/4/68            | Kesteven               | Cappelle Desprez   | Failed     |
| 68/3    | "                 | Wye                    | Cappelle Desprez   | 3/55       |
| 68/4    | 13/5/68           | "                      | Viking             | 3/55       |
| 68/5    | "                 | "                      | Eclipse            | Not tested |
| 68/6    | 21/5/68           | Starcross              | Cappelle Desprez   | 3/55       |
| 68/7    | 27/5/68           | N.I.A.B. Trial grounds | Hybrid 46          | 3/55       |
| 68/8    | "                 | Cambridge              | Opal               | 3/55       |
| 68/9    | "                 | "                      | Triticum vulgare   | 60         |
| 68/10   | "                 | "                      | Triticum vulgare   | 3/55       |
| 68/11   | "                 | "                      | Kolibri            | 60         |
| 68/12   | "                 | "                      | Opal               | 3/55       |
| 68/13   | 28/5/68           | Dorchester             | Bellroy            | 3/55       |
| 68/14   | "                 | Kinver                 | Joss Cambier       | 60         |
| 68/15   | 5/6/68            | Starcross              | Kloka              | Not tested |
| 68/16   | 6/6/68            | Wye                    | West Desprez       | 3/55       |
| 68/17   | "                 | "                      | Maris Beacon       | 3/55       |
| 68/18   | "                 | "                      | Champlein          | 3/55       |
| 68/19   | "                 | "                      | Rothwell Sprite    | Not tested |
| 68/20   | "                 | "                      | Maris Ranger       | Failed     |
| 68/21   | "                 | "                      | Hybrid 46          | Failed     |
| 68/22   | "                 | "                      | Maris Ranger       | 3/55       |
| 68/23   | "                 | "                      | Mildress           | 3/55       |
| 68/24   | "                 | "                      | Zorba(Engelen 565) | Not tested |
| 68/25   | "                 | "                      | Cappelle Desprez   | 3/55       |

Not tested 3/55

Not tested Failed

Not tested 3/55

Not tested Failed

Table 6 Cont'd.

| NIAB NO | Source of Isolate |                                      | Race                                     |
|---------|-------------------|--------------------------------------|--|
|         | Date              | Location                             |  |
| 68/26   | 10/6/68           | Harper Adams<br>(Newport,<br>Salop.) | Champlein<br>No result<br>Failed         |
| 68/27   | 11/6/68           | N.I.A.B.<br>Trial ground             | Nord Desprez<br>3/55                     |
| 68/28   | 10/6/68           | Harper Adams                         | Champlein<br>No result<br>Failed         |
| 68/29   | 12/6/68           | Chester                              | Himalayan<br>Not tested                  |
| 68/30   | 17/6/68           | Headley Hall                         | Kloka<br>3/55                            |
| 68/31   | 17/6/68           | N.I.A.B.<br>Trial ground             | Persian<br>60+? mixed                    |
| 68/32   | 17/6/68           | "                                    | Harvest Queen<br>60                      |
| 68/33   | 17/6/68           | "                                    | Kolibri<br>60                            |
| 68/34   | 17/6/68           | "                                    | Michigan Amber<br>3/55                   |
| 68/35   | 18/6/68           | Dunmow                               | Champlein<br>Not tested<br>Failed        |
| 68/36   | 18/6/68           | Dunmow                               | Cappelle Desprez<br>3/55                 |
| 68/37   | 19/6/68           | Halconby Fen                         | Cappelle Desprez<br>3/55                 |
| 68/38   | 24/6/68           | Spaxton                              | Cappelle Desprez<br>3/55                 |
| 68/39   | "                 | "                                    | Hybrid 46<br>3/55                        |
| 68/40   | "                 | "                                    | Maris Widgeon<br>3/55                    |
| 68/41   | "                 | "                                    | West Desprez<br>3/55                     |
| 68/42   | "                 | "                                    | Bouquet (FDA, 15)<br>3/55                |
| 68/43   | "                 | "                                    | Joss Cambier<br>3/55                     |
| 68/44   | "                 | "                                    | Maris Ranger<br>3/55                     |
| 68/45   | "                 | "                                    | Hybrid 46<br>60                          |
| 68/46   | 1/7/68            | Terrington                           | Kolibri<br>3/55                          |
| 68/47   | 1/7/68            | Morley                               | Pompe (W 9248)<br>3/55                   |
| 68/48   | 2/7/68            | Yeovil                               | Trou<br>No result<br>Failed              |
| 68/48a  | 2/7/68            | Yeovil                               | Clarion<br>No result<br>Failed           |
| 68/49   | 5/7/68            | Harper Adams                         | Opal<br>3/55                             |
| 68/50   | "                 | "                                    | Heines VII<br>60                         |
| 68/51   | "                 | "                                    | Bon Fermier<br>3/55                      |
| 68/52   | "                 | "                                    | Rubis<br>60                              |
| 68/53   | "                 | "                                    | Persian<br>3/55                          |
| 68/54   | "                 | "                                    | Chinese 166<br>60                        |
| 68/55   | "                 | "                                    | Lucas<br>3/55                            |
| 68/56   | "                 | "                                    | Cappelle Desprez<br>3/55                 |
| 68/57   | "                 | "                                    | Harvest Queen<br>60                      |
| 68/59   | "                 | Drayton                              | Kloka<br>3/55                            |
| 68/60   | "                 | "                                    | Hybrid 46<br>3/55                        |
| 68/61   | "                 | Aldeburgh                            | Cappelle Desprez<br>Failed               |
| 68/62   | 10/7/68           | Arndel                               | Apex<br>Failed                           |
| 68/63   | 15/7/68           | N.I.A.B.<br>Trial grounds            | Lucas<br>60                              |
| 68/64   | "                 | "                                    | Bon Fermier<br>3/55                      |
| 68/65   | "                 | "                                    | Tadorna<br>60                            |
| 68/66   | "                 | "                                    | Falco<br>3/55                            |
| 68/67   | "                 | "                                    | Heines VII<br>60                         |
| 68/68   | "                 | Blach Breccs.                        | Cappelle Desprez<br>3/55                 |
| 68/69   | 15/7/68           | Planhamlech                          | Cappelle Desprez<br>3/55                 |
| 68/70   | 17/7/68           | N.I.A.B.<br>Trial grounds            | Maris Dove<br>60                         |
| 68/71   | "                 | "                                    | Joss Cambier<br>60                       |
| 68/72   | "                 | "                                    | Elite Lepeuple<br>60                     |
| 68/73   | "                 | "                                    | Apollo<br>60                             |
| 68/74   | "                 | "                                    | Joss Cambier<br>60                       |
| 68/75   | "                 | "                                    | Advance (LAE 8/8)<br>60                  |
| 68/76   | "                 | "                                    | Rothwell 355<br>Failed                   |
| 68/77   | "                 | "                                    | Joss Cambier<br>60                       |
| 68/78   | "                 | "                                    | Orca<br>60                               |
| 68/80   | "                 | "                                    | West Desprez<br>No result<br>Failed      |
| 68/81   | "                 | "                                    | Wildress<br>Failed                       |
| 68/82   | 18/7/68           | Bridgets EHF                         | Cappelle Desprez<br>Not tested<br>Failed |
| 68/83   | 22/7/68           | Cockle Park                          | Hybrid 46<br>3/55                        |
| 68/84   | "                 | "                                    | Cappelle Desprez<br>3/55                 |
| 68/85   | "                 | "                                    | Champlein<br>3/55                        |
| 68/86   | "                 | "                                    | Troll<br>3/55                            |
| 68/87   | "                 | "                                    | Cama<br>No result<br>Failed              |

Table 6 Cont'd.

| NIAB NO | Source of Isolate |             |                             | Race        |
|---------|-------------------|-------------|-----------------------------|-------------|
|         | Date              | Location    | Variety                     |             |
| 68/88   | 22/7/68           | Cockle Park | MGH. 6264                   | 3/55        |
| 68/89   | "                 | "           | Kolibri                     | 3/55        |
| 68/90   | "                 | "           | Rothwell Sprite             | 1581        |
| 68/91   | "                 | "           | Kloka                       | 3/55?       |
| 68/92   | "                 | "           | Maris Settler<br>(TB396/37) | 1581        |
| 68/94   | "                 | "           | Opal                        | 3/55        |
| 68/95   | "                 | "           | Margin                      | 3/55        |
| 68/96   | "                 | "           | Heima-Desprez<br>(FD2406)   | 60          |
| 68/97   | "                 | "           | Clarion                     | 3/55        |
| 68/98   | "                 | "           | Pompe (W9248)               | 3/55        |
| 68/99   | "                 | "           | Viking                      | 1581 or 60? |
| 68/100  | "                 | Boghall     | Cappelle Desprez            | 3/55        |
| 68/101  | 28/7/68           | " Belton    | "                           | 1581?       |
| 68/102  | "                 | "           | Kloka                       | 3/55        |
| 68/103  | "                 | Innerwick   | Hybrid 46                   | 3/55        |
| 68/104  | 29/7/68           | Terrington  | Maris Butler                | 3/55        |
| 68/105  | "                 | "           | Pompe (W9248)               | 3/55        |
| 68/106  | "                 | "           | Clarion                     | 3/55        |
| 68/107  | 1/8/68            | Bemersyde   | Cappelle Desprez            | 3/55        |
| 68/108  | "                 | "           | Hybrid 46                   | 3/55        |
| 68/109  | 3/8/68            | Cotton      | Cappelle Desprez            | 3/55        |
| 68/110  | "                 | Glencarse   | ApeX                        | 3/55        |
| 68/111  | "                 | Balmirner   | Cappelle Desprez            | 1581        |
| 68/112  | "                 | North Murie | Champlein                   | 3/55        |
| 68/113  | "                 | Balmirner   | Mildress                    | 60          |
| 68/114  | 2/8/68            | Cockle Park | Cama                        | 1581        |
| 68/115  | "                 | "           | Janus                       | 3/55        |
| 68/116  | "                 | "           | Heines VII                  | Not tested  |
| 68/117  | 12/8/68           | Edinburgh   | Kolibri                     | Not tested  |
| 68/118  | 9/10/68           | Cotton      | Cama                        | No result   |
| 68/119  | "                 | "           | Hybrid 46                   | No result   |

5. Summary

Table 7 shows the number of races and isolates identified during 1968.

Table 7

| Race       | No. of Isolates |
|------------|-----------------|
| 3/55       | 57              |
| 60         | 23              |
| 1581       | 6               |
| Mixed      | 4               |
| No result  | 20              |
| Not tested | 8               |
| TOTAL      | 118             |

Race 3/55 was the most frequent race identified from the 1968 isolates. There are, however, variations in reaction on the differential varieties, between isolates of race 3/55 and the race could perhaps be considered as a race group consisting of a number of biotypes, which exhibit variable pathogenicity on varieties in the field. Race 60, frequently identified since 1966, was identified relatively few times from the 1968 isolates e.g. - 25% of isolates tested in 1968 cf 40% in 1969.



Many of these samples were collected from varieties adjacent to plants artificially inoculated with race 60. A number of isolates also came from yellow rust nurseries which contain varieties very susceptible to race 60. Very few isolates identified as race 60 were collected from naturally infected commercial wheat varieties.

The small number of isolates identified as race 60 could perhaps be attributed to the increase in acreage of winter wheat varieties resistant to race 60. Also, Joss Cambier and Elite Lepeuple which are Recommended List varieties susceptible to race 60 have very good field resistance to yellow rust. An interesting development in the yellow rust race spectrum is the appearance of a physiologic race giving reactions similar to race 58. Race 58 was previously identified in the glasshouse in 1960 (Macer - 1967. Trans. Brit. Mycol. Soc. 50(2) 305-310) and had not been recorded in the field. Results indicate that the isolates obtained in 1968 and provisionally identified as race '58' gave reactions on the differential varieties slightly different from those obtained by Macer. Because of these variations the 1968 isolates may be a new physiologic race. Samples have been sent to Dr. Eva Fuchs at the Biologisches Bundesanstalt für Land- und Forstwirtschaft, Braunschweig, Germany, for confirmation.

Tests on the virulence of this race on seedling and adult wheat plants are in progress, and provisional seedling tests indicate that the race is capable of infecting many varieties. Thus of the 118 isolates received during 1968 only races 3/55, 60 and '58' were identified. No isolates were identified as race 2b or race 8b, two races which were previously frequently recorded.

#### Mildress

In 1967 low levels of yellow rust were recorded on Mildress in variety trials in S.E. Scotland. Examination of these isolates have now been completed. The isolate has been tested on Mildress, screened through differential varieties and repeatedly tested on differential varieties. In all instances the race has been identified as race 60. It was therefore concluded that the Mildress isolates were race 60, and that under certain conditions, possibly involving cool temperatures, adult Mildress plants could become infected with yellow rust.

B.

Yellow rust - barley, National Institute of Agricultural Botany,

Cambridge.

M.H. Chamberlain

1. A total of 49 samples of barley yellow rust was received by the N.I.A.B. from the following varieties.

2. Varieties from which isolates were received.

Winter barley varieties are shown in Table 8 spring barley varieties in Table 9.

Table 8

| Winter barley | No. of Isolates |
|---------------|-----------------|
| Malta         | 4               |
| Dea           | 2               |
| Dura          | 2               |
| Maris Otter   | 2               |
| Leon          | 1               |
| TOTAL         | 11              |

Table 9

| Spring barley   | No. of Isolates |
|---|-----------------|
| Fern  | 5               |
| Deba Abed   | 4               |
| Proctor   | 3               |
| Sultan  | 3               |
| Felda (Schweiger<br>755/63)   | 2               |
| Alka  | 2               |
| Inis  | 2               |
| Cambrinus,<br>CIV.490/4, Giro,<br>Maris Concord,<br>Delisa, Europa,<br>Gerkra, Impala,<br>Isola, Julia,<br>Maris Druid,<br>Mosane, Swallow,<br>Tellus, Vada,<br>Zephyr, Abed, 416<br>... 1 each | 17              |
| TOTAL   | 38              |

3. Locations from which the barley yellow rust isolates were collected.

The isolates were received from 15 localities in the British Isles and the source of each isolate is shown in Table 10.

Table 10

| Location                       | Source Variety  | No. of Isolates |
|--------------------------------|---|-----------------|
| Chester                        | Maris Otter, Maris Druid, Deba Abed, Isola, Delisa, Abed 416  | 6               |
| Cockle Park (Northumberland)   | Sultan, Inis, Iypala, Deba Abed, Dea, Julia, Proctor, Tern, Zephyr, Rosane, Telius, Europa, Maris Concord, Cambrinus, CIV.490/4, Genkra, Felda (Schweiger 755/43) | 17              |
| Dunmow (Essex)                 | Malta, Dura   | 2               |
| East Craigs (Edinburgh)        | Ciro, Malta, Vada, Proctor, Tern  | 5               |
| Edinburgh                      | Felda (Schweiger 755/53)  | 1               |
| Flintshire                     | Deba Abed   | 1               |
| Harper Adams (Newport, Salop.) | Malta (2), Dea, Maris Otter, Dura, Leon   | 6               |
| Linlithgow (W. Lothian)        | Sultan  | 1               |
| Loughcall (N. Ireland)         | Tern, Inis  | 2               |
| N.I.A.B. (Cambridge)           | Alka  | 1               |
| Tulloch Gribben (Inverness)    | Sultan, Tern, Deba Abed, Alka, Proctor  | 5               |
| Winchester (Hants.)            | Swallow   | 1               |
| Wye (Kent)                     | Tern  | 1               |
|                                | TOTAL   | 49              |

4. Race identification

Many isolates failed to infect susceptible plants to produce spores for inoculation onto differential varieties. Of the 49 isolates sent to N.I.A.B. only 25 were successfully inoculated. Spore multiplication of these isolates however has been difficult and so far few isolates have been tested on differential varieties. The results obtained are shown in Table 11.

Table 11

| NIAB No. | Source of Isolate |                    |                             | Race       |
|----------|-------------------|--------------------|-----------------------------|------------|
|          | Date              | Location           | Variety                     |            |
| B/68/1   | 20/4/68           | Harper Adams       | Malta                       | 23         |
| B/68/2   | 10/6/68           | NIAB Trial Grounds | Akka                        | No result  |
| B/68/3   | "                 | Harper Adams       | Dea                         | "          |
| B/68/4   | "                 | "                  | Maris Otter                 | "          |
| B/68/5   | "                 | "                  | Dura                        | Not tested |
| B/68/6   | "                 | "                  | Malta                       | No result  |
| B/68/7   | "                 | "                  | Leon                        | "          |
| B/68/8   | 12/6/68           | Chester            | Maris Otter                 | "          |
| B/68/9   | "                 | "                  | Maris Druid                 | "          |
| B/68/10  | "                 | "                  | Deba Abed                   | "          |
| B/68/11  | "                 | "                  | Isola                       | "          |
| B/68/12  | "                 | "                  | Delisa                      | 24         |
| B/68/13  | "                 | "                  | Abed 416                    | Not tested |
| B/68/14  | 13/6/68           | Wye                | Pern                        | No result  |
| B/68/15  | 18/6/68           | Dunmow             | Malta                       | 24         |
| B/68/16  | 10/6/68           | "                  | Dura                        | No result  |
| B/68/17  | 16/7/68           | Flintshire         | Deba Abed                   | 24?        |
| B/68/18  | 18/7/68           | Bridgets W.H.F.    | Swallow                     | No result  |
| B/68/19  | 22/7/68           | Cockle Park        | Sultan                      | "          |
| B/68/20  | "                 | "                  | Inis                        | Not tested |
| B/68/21  | 22/7/68           | Cockle Park        | Impala                      | 24         |
| B/68/22  | "                 | "                  | Deba Abed                   | 24?        |
| B/68/23  | "                 | "                  | Dea                         | 24         |
| B/68/24  | "                 | "                  | Julia                       | 24         |
| B/68/25  | "                 | "                  | Proctor                     | No result  |
| B/68/26  | "                 | "                  | Tern                        | "          |
| B/68/27  | "                 | "                  | Zephyr                      | 24?        |
| B/68/28  | "                 | "                  | Mosane                      | 24         |
| B/68/29  | "                 | "                  | Tellus                      | Not tested |
| B/68/30  | "                 | "                  | Europa                      | 24         |
| B/68/31  | "                 | "                  | Concord                     | 24         |
| B/68/32  | "                 | "                  | Cambrinus                   | 24         |
| B/68/33  | "                 | "                  | C.I.V.490/4                 | 24         |
| B/68/34  | 30/7/68           | Loughgall          | Tern                        | Not tested |
| B/68/35  | "                 | "                  | Inis                        | 24         |
| B/68/36  | 31/7/68           | East Craigs        | Ciro                        | Not tested |
| B/68/37  | "                 | "                  | Malta                       | "          |
| B/68/38  | 2/8/68            | Cockle Park        | Gerkra                      | 24         |
| B/68/39  | "                 | "                  | Felda (Schweiger<br>755/63) | 24         |

Table 11 (contd.)

| MIAB No. | Source of Isolate |                 |                             | Race       |
|----------|-------------------|-----------------|-----------------------------|------------|
|          | Date              | Location        | Variety                     |            |
| B/68/40  | 5/8/68            | East Craigs     | Vada                        | No result  |
| B/68/41  | "                 | "               | Proctor                     | "          |
| B/68/42  | "                 | "               | Tern                        | "          |
| B/68/43  | 6/8/68            | Linlithgow      | Sultan                      | "          |
| B/68/44  | 12/8/68           | Edinburgh       | Felda (Schweiger<br>755/63) | "          |
| B/68/45  |                   |                 |                             | Brown Rust |
| B/68/46  |                   |                 |                             | Brown Rust |
| B/68/47  | 14/8/68           | Tulloch Gribben | Sultan                      | No result  |
| B/68/48  | "                 | "               | Tern                        | "          |
| B/68/49  | "                 | "               | Deba Abed                   | "          |
| B/68/50  | "                 | "               | Akka                        | "          |
| B/68/51  | "                 | "               | Proctor                     | "          |
| B/68/52  | 4/12/68           | West Mersea     | Zephyr                      | Brown Rust |
| B/68/53  | "                 | Mayland         | Maris Otter                 | "          |

5. Summary

The majority of barley isolates successfully tested were identified as race 24, only the first isolate received was identified as race 25. The prevalence of race 24 could perhaps be explained by the fact that the majority of barley varieties are susceptible to varying degrees to this race. It is difficult to speculate on the barley yellow rust spectrum in Britain because of the few results obtained. One of the main restrictions of race identification is the lack of a good set of differential barley varieties capable of separating the races effectively. Some barley varieties are resistant to race 25 and susceptible to race 24 but no varieties are susceptible to race 25 and resistant to race 24. Few varieties are resistant to both races. Therefore a large number of varieties are being examined to obtain a set of differential varieties capable of differentiating between the known races, and also any new races which may arise in future years should new varieties resistant to races 25 and 24 be produced.

Brown rust - barley - Welsh Plant Breeding Station.  
Aberystwyth.

B. Clifford

1. 40 isolates of barley brown rust were received by the W.P.B.S. during 1968 from the following varieties.
2. Varieties from which brown rust isolates were collected  
Winter barley varieties are shown in Table 12 spring barley varieties in Table 13.

Table 12

| Winter Barley | No. of Isolates |
|---------------|-----------------|
| Malta         | 1               |
| Dura          | 1               |
| Dea           | 1               |
| Maris Otter   | 1               |
| Pella         | 1               |
| TOTAL         | 5               |

Table 13

| Spring Barley          | No. of Isolates |
|------------------------|-----------------|
| Proctor                | 5               |
| Sultan                 | 5               |
| Impala                 | 4               |
| Deba Abed              | 4               |
| Inis                   | 2               |
| Midas (117/10/2)       | 2               |
| Tern, CIV.490/4        |                 |
| Vada, Maris Badger     |                 |
| CIV.136/22, Maris      |                 |
| Druid, Giro, Akka,     |                 |
| Julia, Maris Concord,  |                 |
| Maris Canon(HB 380/22) |                 |
| Lofa Abed(Abed 0317)   |                 |
| Imber(G 136/22)        |                 |
| 1 each                 | 13              |
| TOTAL                  | 35              |

3. Locations from which the barley brown rust isolates were collected.

The isolates were received from 9 locations in the British Isles, and the location from which each isolate was collected, and the variety from which it was collected, is shown in Table 14.

Table 14

| Location                     | Source Variety  | No. of Isolates |
|------------------------------|---|-----------------|
| Beverley (E.Yorks)           | Proctor, Julia, Impala, Sultan, Deba Abed   | 5               |
| Cockle Park (Northumberland) | Deba Abed, Proctor, Sultan, Impala, Fern, Inis  | 6               |
| Dunbar (E.Loethian)          | Sultan  | 1               |
| East Craigs (Edinburgh)      | Ciro, Akka, Proctor(2)<br>Impala  | 5               |
| Linlithgow (W. Loethian)     | Sultan  | 1               |
| N.I.A.B. (Cambridge)         | Proctor, HB.380/22, CIV.490/4, Midas(117/10/2)(2), Deba Abed(2), Vada, Inis, Maris Badger, Impala, CIV.136/22, Lofa Abed (Abed 0317), Imber (G.136/22), Maris Druid | 15              |
| Renfrewshire                 | Sultan  | 1               |
| W.P.B.S.(Aberystwyth)        | Maris Concord   | 1               |
| Zeals (Wilts)                | Malta, Pella, Dura, Dea, Maris Otter.   | 5               |
|                              | TOTAL   | 40              |

#### 4. Race Identification

Of the 40 isolates received, 20 were successfully cultured and identified. The 11 differential varieties employed for race determination consisted of 6 of the 9 North American differentials and 5 "supplemental" varieties selected because of their importance in European breeding programmes. It is felt that this set will allow reference to North American race groups but will also be more meaningful to European research workers and breeders.

Reaction types used are as follows

|    |   |  |
|----|---|--|
| Oi | - | Immune                                     |
| Oc | - | Chlorotic fleck                            |
| On | - | Necrotic fleck                             |
| 1  | - | Small pustule surrounded by necrosis       |
| 2  | - | Larger pustule surrounded by necrosis      |
| 3  | - | Small pustule surrounded by chlorosis      |
| 4  | - | Large pustules with little or no chlorosis |

No obtain major race groupings these categories were condensed into 3 classes

|                  |   |         |
|------------------|---|---------|
| Resistant (R)    | - | 0, 1, 2 |
| Intermediate (I) | - | 2+, 3-  |
| Susceptible (S)  | - | 3, 4    |

The intermediate class was non critical in race determination.

Detailed results of race identification are given in Tables 15 & 16.

Table 15

| Isolate No. | Date | Location                         | Variety                | Race      |
|-------------|------|----------------------------------|------------------------|-----------|
| BRS-68-1    | 25/6 | Zeals (Wilts)                    | Malta                  | C         |
| 2           |      |                                  | Fella                  | D         |
| 3           |      |                                  | Dura                   | B         |
| 4           |      |                                  | Dea                    | No result |
| 5           |      |                                  | Maris Other            | A         |
| 6           | 22/7 | Cockle Park (Northumberland)     | Deba Abed              | No result |
| 7           |      |                                  | Proctor                | A         |
| 8           |      |                                  | Sultan                 | A         |
| 9           |      |                                  | Impala                 | A         |
| 10          |      |                                  | Tern                   | No result |
| 11          | 6/8  | Linlithgow (W. Lothian)          | Inis                   | B         |
| 12          |      |                                  | Sultan                 | A         |
| 13          | 30/7 | N.I.A.B. Trial grounds Cambridge | Proctor                | B         |
| 14          |      |                                  | Maris Canon (HB 38/22) | No result |
| 15          |      |                                  | CIV 490/4              | B         |
| 16          |      |                                  | Midas                  | No result |
| 17          |      |                                  | (117/10/2)             | No result |
| 18          |      |                                  | Midas                  | A         |
| 19          |      |                                  | (117/10/2)             | No result |
| 20          |      |                                  | Deba Abed              | No result |
| 21          |      |                                  | Vada                   | No result |
| 22          |      |                                  | Inis                   | B         |
| 23          |      |                                  | Maris Badger           | No result |
| 24          |      |                                  | Deba Abed              | C         |
| 25          |      |                                  | Impala                 | A         |
| 26          |      |                                  | CIV 136/22             | D         |
| 27          |      |                                  | Lofa Abed              | No result |
| 28          | 31/7 | East Craigs (Edinburgh)          | (Abed 0317)            | E         |
| 29          |      |                                  | Maris Druid            | No result |
| 30          |      |                                  | Imber                  | E         |
| 31          | 5/8  |                                  | (G 136/22)             | No result |
| 32          |      |                                  | Ciro                   | No result |
| 33          |      |                                  | Akka                   | "         |
| 34          |      |                                  | Proctor                | "         |
| 35          |      |                                  | Proctor                | "         |
| 36          | 22/7 | Beverley (Yorks)                 | Impala                 | "         |
| 37          |      |                                  | Proctor                | "         |
| 38          |      |                                  | Julia                  | "         |
| 39          |      |                                  | Impala                 | "         |
| 40          | 9/8  | Dunbar                           | Sultan                 | "         |
|             | 29/7 | Renfrewshire                     | Deba Abed              | B         |
|             | 18/9 | W.P.B.S.                         | Sultan                 | No result |
|             |      | Aberystwyth                      | Maris Concord          | B         |





Table 16 continued

Reaction types and categories used for race identification

| Culture No. | Bolivia   | Raka 1     | Quinn     | Sudan    | Gold    | Egypt 4 | Estete   | Batna     | Peruvian   | Cebada capa | Ricardo    | Race Group |
|-------------|-----------|------------|-----------|----------|---------|---------|----------|-----------|------------|-------------|------------|------------|
| BRS-68 - 15 | I<br>3-   | R<br>1,2   | I<br>3-   | S<br>3+  | S<br>3  | S<br>3  | O1<br>1  | 1+        | 2+         | R<br>On     | R<br>1,2-  | B          |
| "           | R<br>On,1 | R<br>On,1  | R<br>On,1 | S<br>3+  | S<br>3+ | R<br>2  | O1<br>2  | R<br>On,1 | R<br>On,1  | R<br>On     | R<br>On,1  | A          |
| "           | R<br>On   | R<br>On    | R<br>On,1 | S<br>4   | S<br>3  | R<br>4  | On<br>4  | R<br>On,1 | R<br>On,2  | R<br>On     | R<br>On    | B          |
| "           | R<br>1,2  | R<br>3     | R<br>On,1 | S<br>1,2 | S<br>3  | R<br>On | Ocn<br>3 | R<br>1,2  | R<br>2     | R<br>On     | R<br>2,3   | C          |
| "           | R<br>O1n  | R<br>On    | R<br>Ocn  | S<br>4   | S<br>3+ | R<br>1  | Oc<br>1  | R<br>On,1 | R<br>O1o   | R<br>On     | R<br>On    | A          |
| "           | R<br>On,1 | S<br>3     | S<br>4-   | S<br>3+  | S<br>3+ | R<br>1+ | Oc<br>1  | R<br>1    | S<br>3     | R<br>On     | R<br>2-    | D          |
| "           | R<br>3    | R<br>On    | R<br>3-   | S<br>3+  | S<br>3+ | R<br>3+ | O1<br>3  | R<br>3    | S<br>3     | R<br>On     | R<br>On,2+ | H          |
| "           | S<br>3-   | R<br>On,1  | I<br>3-   | S<br>3+  | S<br>3  | R<br>3  | O1<br>3  | S<br>3+   | S<br>3     | R<br>On     | S<br>3     | H          |
| "           | R<br>1+   | R<br>2     | R<br>On,1 | R<br>3   | S<br>3  | R<br>3  | O1<br>3  | R<br>1+   | I<br>Oo,3- | R<br>On     | R<br>On,1- | B          |
| "           | R<br>1+   | R<br>On,1+ | R<br>2+   | R<br>3   | S<br>3+ | R<br>3  | O1<br>3  | R<br>1    | R<br>2+    | R<br>On     | R<br>1,2-  | B          |

5. Summary

The isolates separate into five major race groupings. There is a range of variability within the pathogen although resistance genes do not occur in varieties grown in Britain. There is also a relationship between numbers of isolates in a race group and breadth of virulence of those isolates - the more widely virulent the isolate the lower its frequency of detection. This is shown in Table 17.

Table 17

Relationship between isolate frequency and virulence spectrum

| Race Groups | No. of susceptible differentials | Frequency of isolates |     |
|-------------|----------------------------------|-----------------------|-----|
|             |                                  | Number                | %   |
| A           | 2                                | 7                     | 70  |
| B           | 3                                | 7                     | 70  |
| C           | 4                                | 2                     | 20  |
| D           | 4                                | 2                     | 20  |
| E           | 6                                | 2                     | 10  |
| TOTAL       |                                  | 20                    | 100 |

D.

Crown Rust - oats. Welsh Plant Breeding Station, Aberystwyth.  
B. Clifford.

1. A total of 4 samples was received at the W.P.B.S. from the following varieties.
2. Varieties from which crown rust isolates were collected.

Table 18.

| Variety           | No. of Isolates |
|-------------------|-----------------|
| Pendrwm           | 1               |
| Breeding Material | 3               |
| TOTAL             | 4               |

3. Locations from which oat crown rust isolates were collected.  
Only one isolate was received from a location other than the W.P.B.S.

Table 19.

| Location               | Source Variety    | No. of Isolates |
|------------------------|-------------------|-----------------|
| Penally (Pemps)        | Pendrwm           | 1               |
| W.P.B.S. (Aberystwyth) | Breeding material | 3               |
|                        | TOTAL             | 4               |

4. Race identification

All four samples were successfully cultured on disease free material and then inoculated on to the differential varieties. In each case the race identified was race 229. This race is virulent on the differentials Ukraine and Saja. Varieties carrying the Victoria gene are resistant e.g. Manod.

Mildew - wheat - Plant Breeding Institute, Cambridge -  
M.S. Wolfe

1. A total of 253 isolates was received by the P.B.I. from the following varieties.

2. Varieties from which isolates were collected  
 Winter wheat varieties are shown in Table 20, spring wheat varieties are shown in Table 21.

Table 20

| Winter Wheat        | No. of Isolates |
|---------------------|-----------------|
| Joss Cambier        | 20              |
| Maris Ranger        | 15              |
| Camra               | 14              |
| Cappelle Desprez    | 14              |
| Champlein           | 14              |
| Hybrid 46           | 12              |
| Maris Teal          | 11              |
| West Desprez        | 11              |
| Mildress            | 10              |
| Elite Lepuple       | 8               |
| Maris Settler       | 6               |
| Maris Widgeon       | 5               |
| Zorba (Engelen 565) | 5               |
| Maris Beacon        | 5               |
| MGH 6264            | 4               |
| Petrus 71/64        | 4               |
| Bouquet (FDA15)     | 4               |
| Marjin              | 3               |
| Maris Totem         | 3               |
| TOTAL               | 167             |

Table 21

| Spring Wheat    | No. of Isolates |
|-----------------|-----------------|
| Kloka           | 16              |
| Rothwell Sprite | 16              |
| Janus           | 15              |
| Troll           | 11              |
| Maris Ensign    | 10              |
| Kolibri         | 7               |
| TW 75           | 2               |
| TOTAL           | 77              |

A further 9 isolates were received from other varieties.

3. Locations from which wheat mildew isolates were collected  
 The isolates were collected from 43 locations in the British Isles. The location from which each isolate was collected and the variety from which it was collected is shown in Table 22.

Table 22

| Location   | Source Variety   | No. of Isolates   |
|--|--|---|
| Aberystwyth (Cards.)<br>Backweston (Co. Kildare, Ireland)<br>Berwickshire<br>Beverley (E. Yorks.)<br>Boston (Lincs.) | Kloka  | 1   |
|  | Janus, Kloka, Troll, Kolibri   | 4   |
|  | Maris Teal   | 1   |
|  | Janus, Troll, Rothwell Sprite, Kolibri<br>Maris Ranger Cama,<br>Maris Teal, Bouquet (FDA.15), Joss Cambier, Miladress<br>Bouquet (FDA.15), Joss Cambier, Miladress | 4   |
| Bristol  | Bouquet (FDA.15), Joss Cambier, Miladress  | 6   |
|  | Belloy, Joss Cambier, Maris Teal, Margin, Hybrid 46, Maris Ranger, Cama, Maris Widgeon, Cappelle Desprez, West Desprez   | 11  |
|  | Maris Widgeon, Miladress, Joss Cambier, Cama   | 4   |
|  | Troll, Cama, Janus, Hybrid 46, West Desprez, Maris Ranger, Joss Cambier, Elite   |   |
|  | Lepuple, Cappelle Desprez, Champlein, MGH.5264, Rothwell Sprite, Maris Teal, Kloka, Maris Ensign, Maris Settler  | 16  |
|  | Cama   | 1   |
|  | Cappelle Desprez, Champlein, Elite   |   |
|  | Lepuple, Hybrid 46, Maris Ranger, Miladress, Joss Cambier, Rothwell Trident, Kloka, Rothwell Sprite, Janus   | 11  |
|  | Maris Ensign   | 1   |
|  | Deeping St. James (Norfolk)<br>Doncaster (Yorks.)<br>Dorchester (Dorset)   | Kloka, Rothwell Sprite, Janus<br>West Desprez, Cappelle Desprez, Margin, Maris Widgeon, Belloy, Cama, Joss Cambier, Maris Teal, Bouquet (FDA.15), Hybrid 46, Maris Ranger |
| Dunmow (Essex)   | Kloka, Troll, Rothwell Sprite, Janus, Kolibri  | 11  |
|  | Maris Ensign, Petkus 71/64, Cappelle Desprez, Champlein, Joss Cambier, Miladress, Hybrid 46, Cama, West Desprez, Maris Ranger                                      |   |
|  | Joss Cambier   | 15  |
|  | Troll, Janus, Rothwell Sprite  | 3   |
|  | Kloka, Troll, Rothwell Sprite, Janus   | 4   |
| E.Grinstead (Sussex)<br>Halsall (Lancs.)<br>Culcheth (Lancs.)  |  |   |

Table 22 continued

| Location  | Source Variety   | No. of Isolates |
|---|--|-----------------|
| Harper Adams<br>(Newport, Salop)                                    | Hybrid 46, Cappelle-Desprez, Cama, Champ-lein, Mildress, Elite Lepeuple, Zorba, (Engelen 565), Maris Ensigm, Joss Cambier, Maris Totem, Maris Settler, Maris Beacon (2), Maris Envoy (TJB 55/253), Maris Ranger, West Desprez, Maris Teal  | 17              |
| Headley Hall (Yorks.)   | TW/31, TW75 (2), Hybrid 46, TL 102, Joss Cambier, Champ-lein, Maris Totem, Maris Beacon, Maris Settler<br>Mildress   | 10              |
| Hereford<br>Hockwold Fen (Essex)                                    | Elite Lepeuple, Champ-lein   | 1               |
| Inverness<br>Kelvedon (Essex)                                       | Champlein<br>Cappelle Desprez, Champlein, Joss Cambier, Maris Ranger, Kloka, Maris Ensigm, Rothwell Sprite<br>Cama   | 2<br>1          |
| Kingsfield (West Lothian)<br>Kinver (Worcs.)                        | Cama, Cappelle Desprez, Champlein, Elite Lepeuple, Hybrid 46, Joss Cambier (2), Maris Ranger, Maris Ensigm, Janus, Kloka, Troll, Rothwell Sprite, West Desprez, Kolibri Kloka, Sirius, Opal, Troll, Janus, Rothwell Sprite, Maris Ranger, Joss Cambier<br>Janus  | 7<br>1          |
| Kirby (Lancs)   | Desprez, Kolibri Kloka, Sirius, Opal, Troll, Janus, Rothwell Sprite, Maris Ranger, Joss Cambier  | 15              |
| Lincoln   | Janus  | 6               |
| Loughgall (Ireland)<br>Moulton (Northants)<br>Orlinbury (Northants) | Joss Cambier<br>Kloka, Rothwell, Sprite, Janus, Maris Ensigm, Troll, Claron, Caesar Hybrid 46, Cappelle Desprez, Champlein, Mildress, Maris Ranger West Desprez, Elite Lepeuple, Zorba (Engelen 565), Maris Ensigm, Cama, Joss Cambier, Kloka, Janus, Troll, Rothwell Sprite, Maris Teal, MGH6264, Petkus 71/64, Maris Beacon, Maris Settler<br>Cappelle Desprez | 1<br>1          |
| Rosemaund (Hereford)  | Mildress, Maris Ranger West Desprez, Elite Lepeuple, Zorba (Engelen 565), Maris Ensigm, Cama, Joss Cambier, Kloka, Janus, Troll, Rothwell Sprite, Maris Teal, MGH6264, Petkus 71/64, Maris Beacon, Maris Settler<br>Cappelle Desprez   | 7               |
| Rothamsted<br>(Harpenden, Herts.)<br>Rothwell (Hincs.)              | Zorba (Engelen 565)  | 20<br>1<br>1    |

Table 22 continued

| Location   | Source Variety  | No. of Isolates |
|--|---|-----------------|
| S. Kyme (Kent)   | Cappelle Desprez,<br>Maris Widgeon (2),<br>Cama, Margin, Maris<br>Ranger, Joss Cambier,<br>West Desprez, Maris<br>Teal  | 9               |
|  | West Desprez, Kioka,<br>Rothwell Sprite,<br>Cappelle Desprez,<br>Hybrid 46, Champlain<br>Joss Cambier   |                 |
|  | Champlain, Rothwell<br>Sprite   |                 |
|  | Maris Ranger  |                 |
|  | Hybrid 46, Champlain,<br>Cappelle Desprez,<br>Mildress, Maris   |                 |
|  | Ranger, West Desprez,<br>Elite Tepeuple,<br>Engelen 565, Maris<br>Ensign, Joss Cambier,<br>Maris Totem, Maris<br>Settler, Kioka,<br>Kolibri, Rothwell   |                 |
|  | Sprite, Janus, Troll,<br>Petkus 71/64, MGH6264,<br>Maris Teal, Cama,<br>Maris Beacon  |                 |
|  | Kolibri   |                 |
|  | Kioka   |                 |
|  | Mildress  |                 |
| Welshpool (Montgomery)<br>Wenroe (Glam.)<br>Woodbridge (Suffolk)<br>Wye (Kent) | Zorba (Engelen 565),<br>Champlain, Cama,<br>Hybrid 46, Maris<br>Ranger, Maris Ensign,<br>Cappelle Desprez,<br>Joss Cambier, Mil-<br>dress, Elite Lepeuple,<br>West Desprez, Kolibri,<br>Kioka, Rothwell Sprite<br>Janus, Maris Teal,<br>Petkus 71/94, MGH6264,<br>Maris Settler | 22              |
|  | TOTAL   |                 |
|  | 19  |                 |
|  | 1   |                 |
|  | 1   |                 |
|  | 1   |                 |
|  | 1   |                 |
|  | 1   |                 |
|  | 1   |                 |
|  | 1   |                 |
| TOTAL  | 253   |                 |

4. Race Identification

Identification of the physiologic race has been completed on 152 isolates; and the results obtained are given in Table 23.

Table 23

| Race | No. of Isolates | Variety and Place  |
|------|-----------------|--|
| 0    | 7               | Hybrid 46 (Headley Hall, Terring-<br>ton), Mildress (Dunnow), Elite<br>Leuple (Hockwold Fen, Wye), Joss<br>Cambier (Morpeth), Maris Ranger<br>(Spaxton)  |
| 2    | 3               | Margin (S. Kyme), West Desprez<br>(Terrington), Janus (Beverley)<br>Mildress (Croome Farm), Maris<br>Ranger (S. Kyme, Cockle Park,<br>Croome Farm), Kioka (Croome<br>Farm, Rosemaund), Maris Ensign<br>(Rosemaund), Hybrid 46 (Wye), |
| 3    | 29              |  |



Table 23 continued

| Race     | No. of Isolates | Variety and Place  |
|----------|-----------------|--|
| 4        | 4               | West Desprez (Wye, Dunnow),<br>Champlein (Cockle Park, Dunnow,<br>Sutton Bonington), Joss Cambier<br>(Spaxton, Cockle Park, S. Kyne,<br>Kelvedon, Croome Farm), Petkus<br>71/64, (Dunnow), Cappelie Desprez<br>(Rothamsted, Dunnow, Terrington),<br>Maris Settler (Terrington, Rose-<br>maund, Cockle Park), Maris<br>Totem (Headley Hall), Janus<br>(Terrington), Cama (Terrington)<br>Troll (Rosemaund)  |
| 13       | 39              | Cappelie Desprez (Wye), Kloka,<br>Troll (Kinver), Cama (Rosemaund)<br>Maris Ensign (Harper Adams,<br>Cockle Park, Terrington, Kinver)<br>Champlein (Rosemaund, Kinver),<br>Kloka (Aberystwyth, Terrington,<br>Croome Farm, Kirby), Janus<br>(Backweston, Cockle Park, Kirby,<br>Rosemaund), Mildress (Harper<br>Adams), Maris Ranger (Terring-<br>ton, Wye, Dunnow), Troll<br>(Culcheth, Beverley), Cappelie<br>Desprez (Spalding, Harper Adams)<br>Rothwell Sprite (Terrington,<br>Kinver, Cockle Park, Rosemaund),<br>T. W. 75 (Headley Hall (2)),<br>Maris Settler (Headley Hall),<br>Zorba (Engelen 565) (Terring-<br>ton, Harper Adams), Cama (Kings-<br>field), Kolibri (Dunnow, Terr-<br>ington), Joss Cambier (Wye),<br>Bouquet (F.D.A.15) (Spaxton),<br>MGH6264 (Cockle Park), Maris<br>Teal (Rosemaund) Maris Totem<br>(Harper Adams)<br>Zorba (Engelen 565) (Wye),<br>Joss Cambier (Terrington),<br>Hybrid 46 (Dorchester), Champ-<br>lein (Sutton Bonington), Elite<br>Kolibri (Backweston), Elite<br>Lepuple (Harper Adams)<br>West Desprez (Dorchester),<br>Cama (Chester), Hybrid 46<br>MGH6264 (Rosemaund), Joss<br>Cambier (Rosemaund, Harper<br>Adams) |
| 16       | 29              | Champlein (Wye, Croome Farm,<br>Headley Hall, Terrington),<br>West Desprez (Harper Adams,<br>Rosemaund), Petkus 71/64<br>(Rosemaund), Cama (Kinver,<br>Wye, S. Kyne), Maris Ranger<br>(Harper Adams, Terrington),<br>Rothwell Sprite (Beverley),<br>Janus (Halsall), Hybrid 46<br>(Cockle Park, Spalding),<br>Bouquet (FDA15) (Dorchester)<br>Kloka (Dunnow), Troll (Kirby)<br>Belloy (Spaxton), Elite<br>Lepuple, MGH6264 (Terrington),<br>Mildress (Terrington, Rose-<br>maund), Maris Ensign (Dunnow) Maris<br>Widgeon, Maris Teal (S. Kyne),<br>Trident (Croome Farm), Joss<br>Cambier (Wye)   |
| 18<br>19 | 1<br>2          | TJB 32 (Headley Hall)<br>Maris Widgeon (Spaxton),<br>Cappelie Desprez (Croome Farm)  |

Table 23 continued

| Race | No. of Isolates | Variety and Place   |
|------|-----------------|---|
| 26   | 12              | Maris Widgeon, Cappelle Desprez, Maris Ranger (S.Kyme), Elite Lepuple (Kinver, Croome Farm), Troll (Halsall), Mildress (Wye, Rothwell), Kloka (Kelvedon), Maris Settler (Wye, Harper Adams), Maris Teal (Harper Adams)              |
| 27   | 2               | West Desprez (S.Kyme), Maris Teal (Wye)   |
| 35   | 12              | Rothwell Sprite (Halsall, Croome Farm), Cappelle Desprez, Elite Lepuple, Zorba (Engelen 565), Maris Ranger (Rosemaund), Hybrid 46, Janus (Croome Farm), Bellroy (Dorchester), Joss Camblier (Headley Hall, Chester), Sirius (Kirby) |
| 13   | 152             | TOTAL   |

Summary

13 Physiologic races were identified, and of these races 3 (29 isolates), 13 (39), 16 (29), 26 (12) and 35 (12) were most frequently identified. The number of races identified from each variety is indicated in Table 24.

Table 24

| Variety               | Race |   |   |   |    |    |    |    |    |    |    |    |    | Total Isolates | Total Races |
|-----------------------|------|---|---|---|----|----|----|----|----|----|----|----|----|----------------|-------------|
|                       | 1    | 2 | 3 | 4 | 13 | 14 | 15 | 16 | 18 | 19 | 26 | 27 | 35 |                |             |
| Joss                  | 1    | 5 | 1 | 1 | 1  | 2  | 1  | -  | -  | -  | -  | -  | 2  | 13             | 7           |
| Camblier              | 1    | - | - | - | -  | -  | -  | -  | -  | -  | -  | -  | -  | -              | -           |
| Maris                 | 1    | - | - | - | -  | -  | -  | -  | -  | -  | -  | -  | -  | -              | -           |
| Ranger                | 1    | 3 | - | 3 | -  | 2  | -  | 2  | -  | -  | 1  | -  | 1  | 11             | 6           |
| Champlein             | -    | - | - | - | -  | -  | -  | -  | -  | -  | -  | -  | -  | 10             | 4           |
| Cappelle              | -    | 3 | 1 | 2 | -  | -  | -  | 1  | 1  | 1  | -  | -  | 1  | 9              | 6           |
| Desprez               | -    | 2 | 1 | 4 | -  | -  | 1  | -  | -  | -  | -  | -  | 1  | 9              | 5           |
| Kloka                 | -    | 1 | - | - | -  | -  | -  | -  | -  | -  | -  | -  | -  | 8              | 5           |
| Hybrid 46             | -    | 1 | 1 | 4 | -  | 1  | 2  | -  | -  | -  | -  | -  | 1  | 8              | 5           |
| Janus                 | -    | 1 | 1 | 1 | -  | 1  | -  | -  | -  | -  | -  | -  | -  | 7              | 5           |
| Camra                 | -    | 1 | 1 | 1 | -  | 1  | 3  | -  | -  | -  | -  | -  | -  | 7              | 5           |
| Elite                 | 2    | - | - | - | 1  | -  | 1  | -  | -  | -  | 2  | -  | 1  | 7              | 5           |
| Lepuple               | 1    | 1 | - | 1 | -  | 1  | -  | -  | -  | 2  | -  | -  | 1  | 7              | 5           |
| Mildress              | -    | - | - | - | -  | -  | -  | -  | -  | -  | 2  | -  | -  | 7              | 5           |
| Rothwell              | -    | - | - | - | 4  | -  | -  | 1  | -  | -  | -  | -  | 2  | 7              | 3           |
| Sprite                | -    | - | - | - | -  | -  | -  | -  | -  | -  | -  | -  | -  | 7              | 3           |
| West                  | -    | - | - | - | 4  | -  | -  | 1  | -  | -  | -  | -  | 2  | 7              | 3           |
| Desprez               | -    | 1 | 2 | - | -  | 1  | 2  | -  | -  | -  | 1  | -  | -  | 7              | 5           |
| Maris                 | -    | - | - | - | -  | -  | -  | -  | -  | -  | -  | -  | -  | 7              | 5           |
| Ensign                | -    | 1 | - | 4 | -  | -  | 1  | -  | -  | -  | -  | -  | -  | 6              | 3           |
| Maris                 | -    | - | - | - | -  | -  | -  | -  | -  | -  | -  | -  | -  | 6              | 3           |
| Settler               | -    | 3 | 1 | 1 | -  | -  | -  | -  | -  | 2  | -  | -  | -  | 6              | 3           |
| Troll                 | -    | 1 | 1 | 2 | -  | -  | 1  | -  | -  | 1  | -  | -  | -  | 6              | 3           |
| Zorba (Engelen 565)   | -    | - | - | - | 2  | 1  | -  | -  | -  | -  | -  | -  | 1  | 4              | 3           |
| Maris Teal (TB29/1/5) | -    | - | - | - | 1  | -  | -  | -  | -  | -  | -  | -  | -  | 4              | 3           |
| Kolibri               | -    | - | - | - | 1  | 1  | -  | -  | -  | 1  | 1  | -  | -  | 4              | 4           |
| Maris                 | -    | - | - | - | 2  | 1  | -  | -  | -  | -  | -  | -  | -  | 4              | 2           |
| Widgeon               | -    | - | - | - | -  | -  | -  | -  | 1  | -  | 1  | -  | -  | 3              | 2           |
| NGH 6264              | -    | - | - | - | -  | -  | -  | 1  | 1  | -  | -  | -  | -  | 3              | 2           |
| Bellroy               | -    | - | - | - | 1  | -  | 1  | -  | -  | -  | -  | -  | 1  | 3              | 2           |
| Bouquet               | -    | - | - | - | -  | -  | -  | 1  | -  | -  | -  | -  | 1  | 2              | 2           |
| (FD15)                | -    | - | - | - | 1  | -  | 1  | -  | -  | -  | -  | -  | -  | 2              | 2           |

Table 24 continued/

| Variety      | Race |    |    |    |    |    |    |    |    |    |    |    |    |    |     | Total Isolates | Races |
|--------------|------|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|----------------|-------|
|              | 0    | 2  | 3  | 4  | 13 | 14 | 15 | 16 | 18 | 19 | 26 | 27 | 35 | 35 |     |                |       |
| Maris Totem  | --   | 1  | -- | 1  | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 2   | 2              |       |
| Petkus 71/64 | --   | -- | 1  | -- | -- | -- | -- | 1  | -- | -- | -- | -- | -- | -- | 2   | 2              |       |
| TW 75        | --   | -- | -- | 2  | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 2   | 1              |       |
| Marglin      | --   | 1  | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1   | 1              |       |
| Sirius       | --   | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1  | 1   | 1              |       |
| TJB 32       | --   | -- | -- | -- | -- | -- | -- | -- | 1  | -- | -- | -- | -- | 1  | 1   | 1              |       |
| Trident      | --   | -- | -- | -- | -- | -- | -- | -- | 1  | -- | -- | -- | -- | 1  | 1   | 1              |       |
| TOTAL        | 7    | 3  | 29 | 4  | 39 | 6  | 6  | 6  | 29 | 1  | 2  | 12 | 2  | 12 | 152 | 13             |       |

Mildress

Eleven isolates were received from Mildress, a milder resistant variety.

Seven of these were analysed (see above) but only one isolate (ref. W8/254), a race 26 isolate from Rothwell was virulent on seedlings of Mildress.

Kolibri

Eight isolates were received from this mildew resistant variety, of which only three could be race tested. Tests on Kolibri itself are still in progress; there appears to be a variable response from the variety to different isolates, but isolate W8/250 from Backweston, Eire, (identified as race 14) produces a heavier attack than the other isolates.

F.

Mildew -- barley. Plant Breeding Institute, Cambridge.  
M. S. Wolfe.

1. 285 isolates of barley mildew were received by the P.B.I. from the following varieties.

2. Varieties from which isolates were collected.

Winter barley varieties are shown in Table 25, spring barley varieties in Table 26.

Table 25

| Winter barley | No. of Isolates |
|---------------|-----------------|
| Maris Otter   | 12              |
| Dea           | 9               |
| Malta         | 8               |
| Dura          | 7               |
| Pella         | 7               |
| Pioneer       | 6               |
| Senta         | 6               |
| Leon          | 5               |
| TOTAL         | 60              |

Table 26

| Spring Barley               | No. of Isolates |
|-----------------------------|-----------------|
| Inis                        | 32              |
| Sultan                      | 34              |
| Julia                       | 28              |
| Proctor                     | 24              |
| Deba Abed                   | 20              |
| Impala                      | 20              |
| Vada                        | 12              |
| Maris Canon<br>(HB. 380/22) | 8               |
| Tern                        | 5               |
| Zephyr                      | 5               |
| Maris Druid                 | 4               |
| Emir                        | 3               |
| Gerkra                      | 3               |
| Crusader<br>(MGH. 59175)    | 3               |
| Tellus                      | 3               |
| TOTAL                       | 204             |

A further 19 isolates were received from other varieties.

3. Locations from which barley mildew isolates were collected.  
 The isolates were collected from 67 locations in the British Isles. The location from which each isolate was collected and the variety from which it was collected is shown in Table 27

Table 27

| Location                     | Source Variety  | No. of Isolates |
|------------------------------|---|-----------------|
| Aberystwyth (Cards)          | Proctor, Impala, Inis   | 3               |
| Auchincruive                 | Sultan, Akka, Lofa Abed (Abed 0317), Julia, Inis, Maris Canon (HB380/22)                              | 6               |
| Backweston (Ireland)         | Impala, Sultan, Inis, Tern, Deba Abed   | 5               |
| Banbury (Oxford)             | Sultan  | 1               |
| Bishops Burton (Yorks)       | Julia, Vada, Impala, Sultan, Proctor, Deba Abed   | 6               |
| Blandford (Dorset)           | Inis  | 1               |
| Bonvilston (Glam.)           | Inis (2), Julia, Proctor (2)  | 5               |
| Boxworth (Cams.)             | Unknown   | 1               |
| Bradwell (Essex)             | Sultan  | 1               |
| Brough (Westmorland)         | Julia   | 1               |
| Cambridge                    | Maris Canon (HB380/22) (3), Sultan (3), Emir (3), Vada (2) Gopal (2), Inis                            | 14              |
| Cardigan                     | Impala, Inis, Deba Abed, Proctor  | 4               |
| Chester                      | Sultan, Inis, Maris Druid, Tern   | 4               |
| Cirencester (Glos.)          | Tellus, Julia, Crusader (MGH 59175)   | 3               |
| Cockle Park (Northumberland) | Impala, Proctor, Inis, Pioneer, Dura, Maris Otter, Dea, Julia, Deba Abed                              | 9               |
| Coningsby (Lincs.)           | Inis  | 1               |
| Croome Farm (Worcs.)         | Proctor, Julia, Impala, Deba Abed, Inis   | 5               |
| Culcheth (Lancs.)            | Impala, Sultan, Proctor, Deba Abed, Julia, Vada   | 6               |
| Diss (Norfolk)               | Sultan  | 1               |
| Docking (Norfolk)            | Julia, Inis   | 2               |
| Doncaster (Yorks.)           | Vada, Proctor, Deba Abed, Inis, Sultan, Impala, Julia   | 7               |
| Dunbar (E. Lothian)          | Sultan, Tern, Julia, Proctor, Maris Canon (HB 380/22)   | 5               |
| Dunmow (Essex)               | Deba Abed, Proctor, Vada, Impala, Inis, Julia, Malta, Pella, Dura, Maris Otter                        | 10              |
| Durweston (Dorset)           | Dura, Sultan, Inis  | 3               |
| Edinburgh                    | Akka, Trias, Vada, Pioneer, Proctor, Dea, Maris Druid, Impala, Malta, Maris Otter, Inis, Pella, Leon. | 13              |

Table 27 cont.

| Location                        | Source Variety   | No. of Isolates |
|---------------------------------|--|-----------------|
| Exeter (Devon)                  | Vada, Crusader(MGH 59175),<br>Sultan, Julia, Inis  | 5               |
| Fakenham (Norfolk)              | Sultan   | 1               |
| Halsall (Lancs)                 | Gerkra, Deba Abed, Impala,   | 3               |
| Headley Hall (Yorks.)           | Maris Druid, Maris Canon<br>(HB 380/22), Deba Abed, Inis,<br>Sultân  | 5               |
| Inverurie (Aberdeen)            | Julia  | 1               |
| Kelvedon (Essex)                | Maris Otter (2)  | 2               |
| King's Lynn (Norfolk)           | Sultan   | 1               |
| Kinver (Worcs.)                 | Tern, Proctor, Sultan, Vada,<br>Pella, Dea, Malta, Maris Otter,<br>Pioneer, Dura, Deba Abed,<br>Impala, Inis, Julia            | 14              |
| Kirby (Lancs.)                  | Proctor, Vada, Julia, Gerkra,<br>Deba Abed, Impala, Zephyr,<br>Mosane, Miln's Golden Promise                                   | 9               |
| Leamington Hastings<br>(Warks.) | Impala, Sultan, Proctor,<br>Inis, Zephyr, Mosane,<br>Deba Abed   | 7               |
| Lincoln                         | Julia  | 1               |
| Lleyn (Caerns.)                 | Deba Abed, Impala, Proctor   | 3               |
| Loughgall (Ireland)             | Deba Abed, Proctor   | 2               |
| Loughney (Ireland)              | Tellus, Julia, Inis, Zephyr  | 4               |
| Lytton Cheyney (Dorset)         | Inis   | 1               |
| Market Weighon (Yorks.)         | Vada   | 1               |
| Montgomery                      | Impala   | 1               |
| Morley (Norfolk)                | Maris Otter, Dea, Dura,<br>Malta, Pella, Leon, Pioneer,<br>Algerian  | 8               |
| Newquay (Cornwall)              | Sultan   | 1               |
| Northallerton (Yorks)           | Zephyr   | 1               |
| Oxenwood (Wilts.)               | Dea  | 1               |
| Reading (Berks.)                | Sultan   | 1               |
| Renfrew                         | Sultan   | 1               |
| Rosemaund (Hereford)            | Pioneer, Dea, Maris Otter, Dura,<br>Malta, Leon, Pella, Proctor,<br>Impala, Deba Abed, Inis, Julia,<br>Maris Canon (HB 380/22) | 13              |
| Sewstern (Leics.)               | Inis, Sultan, Julia  | 3               |
| Shelbourne (Wilts)              | Senta  | 1               |
| Spalding (Lincs.)               | Malta, Maris Otter, Julia,<br>Sultan, Impala, Proctor,<br>Deba Abed  | 7               |
| Spaxton (Glos.)                 | Leon, Pella, Malta, Dura,<br>Senta, Dea, Maris Otter   | 7               |
| Stevenage (Herts.)              | Sultan   | 1               |
| Sutton Bonington<br>(Notts.)    | Dea, Dura, Proctor, Inis,<br>Julia   | 5               |

Table 27 cont.

| Location                    | Source Variety   | No. of Isolates |
|-----------------------------|--|-----------------|
| Ferrington(Norfolk)         | Proctor, Impala, Deba Abed, Inis, Sultan, Tern, Julia, Maris Canon(HB380/22)   | 8               |
| Tidenham (Glos)             | Sultan   | 1               |
| Tulloch (Spey)              | Proctor, Inis (2), Deba Abed, Julia  | 5               |
| Warminster (Wilts)          | Malta, Pella, Dea, Leon, Dura, Senta   | 6               |
| Wellingborough (Northants.) | Inis, Sultan   | 2               |
| Wellton (Cumberland)        | Crusader(MGH 59175), Maris Canon (HB 380/22), Proctor, Imber(G.136/22), Julia, CIV 490/4, Tellus, Gerkra, Zephyr, Lofa Abed(Abed 0317), Sultan, Felda(Schweiger 755/651) | 12              |
| White Leckington (Somerset) | Sultan   | 1               |
| Wimborne (Dorset)           | Maris Druid, Senta (3), Dea  | 5               |
| Wolverhampton(Staffs)       | Inis   | 1               |
| Woodbridge (Suffolk)        | Sultan   | 1               |
| West Suffolk                | Julia  | 1               |
| Wye (Kent)                  | Julia, Impala, Inis, Deba Abed, Proctor & 3 others   | 9               |
|                             | Other varieties  | 3               |
|                             | TOTAL  | 283             |

#### 4. Race identification

The races have been identified following tests on the basic differentials, Proctor, Europa, Maris Concord and Impala. 136 isolates have been identified and the results are shown in Table 28.

Table 28

| Race Group         | Source Variety   | No. of Isolates |
|--------------------|--|-----------------|
| Proctor            | Sultan (2), Vada(2), Inis  | 5               |
| Europa MLG         | Sultan (2), Vada(2), Akka, Dea, Dura, Julia, Maris Otter, Pella  | 10              |
| Maris Concord MLa6 | Maris Otter, Pella   | 2               |
| Impala             | <u>Source variety group</u>  |                 |
| MLa 6 + MLG        | <u>Proctor</u> : Proctor(11), Malta(6), Maris Otter(4), Dea(3), Dura(3), Leon (3), Pioneer (3), Gerkra (2), Miln's Golden Promise, Trias | 37              |
|                    | <u>Europa</u> : Deba Abed (12), Julia (12), Mosane (2), Zephyr (2)   | 28              |
|                    | <u>Maris Concord</u> : Maris Druid(3)  | 3               |
|                    | <u>Impala</u> : Inis(16), Impala (15)  | 36              |
|                    | <u>Maris Canon</u> (HB380/22) (5)  |                 |
|                    | <u>Others</u> , Sultan (11), Vada (4), Emir (2), Tern (1)  | 18              |
|                    | TOTAL  | 136             |

The proportion of Impala virulent isolates appears to be higher than in 1967, being 88% of the total analysed (77% in 1967). Of the Impala virulent races, 35% were obtained from Impala Group varieties (Impala, Inis, Maris Canon (HB380/22)) compared with 29% in 1967. This occurred in spite of a reduction in the Impala acreage and may therefore be a reflection of the increase in the Inis acreage.

A number of isolates were obtained from resistant varieties and the results of race identifications are shown below.

Table 29

| Variety                   | Race |    |    |    |    |    |    |     |   |    | TOT/L |
|---------------------------|------|----|----|----|----|----|----|-----|---|----|-------|
|                           | A1   | A7 | C2 | C4 | C5 | C6 | C7 | C10 |   |    |       |
| Inis                      | 1?   | -  | -  | 3  | 11 | -  | -  | -   | - | 15 |       |
| Vada*                     | 1    | 1  | 1  | 1  | 2  | -  | -  | 1   | - | 7  |       |
| Emir                      | -    | -  | -  | -  | 1  | -  | -  | -   | - | 1  |       |
| Maris Canon<br>(HB380/22) | -    | -  | -  | 1  | 1  | -  | -  | -   | - | 2  |       |
| Akka. †                   | -    | -  | -  | -  | -  | 1  | -  | -   | - | 1  |       |

\* None of the Vada isolates were fully virulent on Vada

† The Akka isolates did not re-infect Akka

Similarly, two isolates from Rothwell Tern, one Proctor Group and one Impala Group, did not attack Tern seedlings.

Sultan

Seven isolates were virulent in tests on Sultan seedlings and the completed results of differential tests are shown in Table 30.

Table 30

| Differential Variety | B8/52 *<br>NIAB |  | B8/96<br>NIAB |  | Isolate<br>B8/232<br>E. Yorks |  | B8/233<br>Hogdley<br>Hall |  | B8/260<br>Renfrew |  | B8/282 *<br>L. G. 54 -<br>Wyn. |  | B8/283<br>Twyfords |  |
|----------------------|-----------------|--|---------------|--|-------------------------------|--|---------------------------|--|-------------------|--|--------------------------------|--|--------------------|--|
|                      |                 |  |               |  |                               |  |                           |  |                   |  |                                |  |                    |  |
| WEP127422            | S               |  | R             |  | S                             |  | R                         |  | R                 |  | S                              |  | R                  |  |
| W37/136              | R               |  | R             |  | S                             |  | S                         |  | R                 |  | S                              |  | S                  |  |
| W41/145              | S               |  | S             |  | I                             |  | S                         |  | S                 |  | S                              |  | S                  |  |
| M. Concord           | S               |  | R             |  | R                             |  | R                         |  | R                 |  | S                              |  | R                  |  |
| GM 511               | S               |  | S             |  | S                             |  | R                         |  | R                 |  | S                              |  | R                  |  |
| GM 501               | S               |  | R             |  | R                             |  | R                         |  | R                 |  | S                              |  | R                  |  |
| HOR 1063             | R               |  | R             |  | R                             |  | R                         |  | R                 |  | S                              |  | R                  |  |
| HOR 1657             | S               |  | S             |  | S                             |  | S                         |  | S                 |  | S                              |  | S                  |  |
| HOR 1036             | R               |  | R             |  | R                             |  | R                         |  | R                 |  | S                              |  | R                  |  |
| Algerian             | R               |  | R             |  | R                             |  | R                         |  | R                 |  | R                              |  | R                  |  |
| HOR 1104             | R               |  | R             |  | R                             |  | R                         |  | R                 |  | R                              |  | R                  |  |
| HOR 1402             | R               |  | R             |  | R                             |  | R                         |  | R                 |  | R                              |  | R                  |  |
| Sultan               | S               |  | S             |  | S                             |  | S                         |  | S                 |  | S                              |  | S                  |  |
| Arabische            | I               |  | I             |  | I                             |  | I                         |  | I                 |  | I                              |  | No test            |  |
| Proctor              | S               |  | S             |  | I                             |  | I                         |  | I                 |  | I                              |  | S                  |  |
| Race                 | B17             |  | A3            |  | B15                           |  | DI                        |  | A7                |  | G5                             |  | DI                 |  |

S = Susceptible R = Resistant I = Intermediate

Two isolates\* were also virulent on Impala and these isolates were obtained from widely separated locations. These isolates were divided into the basic race groups using a standard series of differential varieties, but each isolate was capable of attacking Sultan seedlings. Therefore these races could be called - e.g. C5 Sultan, B15 Sultan, etc.



g. Mildew - oats. Welsh Plant Breeding Station Aberystwyth.  
I.P. Jones

1. A total of 31 isolates of oat mildew was received by the W.P.B.S. from the following varieties.
2. Varieties from which isolates were collected.

These are shown in Table 31.

Table 31

| Variety   | No. of Isolates |
|---|-----------------|
| Condor  | 14              |
| Manod   | 5               |
| Padarn  | 2               |
| Pendrwn   | 2               |
| Mostyn  | 1               |
| Waris Osprey(AB158/7),<br>Sun II, Aristata, Aurea,<br>Picton ... 1 each | 5               |
| Unknown Varieties   | 2               |
| TOTAL   | 31              |

3. Locations from which oat mildew isolates were collected.

Isolates were collected from 14 locations in the British Isles. The location, and the variety from which each isolate was collected is shown in Table 32.

Table 32

| Location                       | Source Variety                  | No. of Isolates |
|--------------------------------|---------------------------------|-----------------|
| Backweston (Ireland)           | Mostyn, Condor                  | 2               |
| Blaenpennal (Gards)            | Condor                          | 1               |
| Cockle Park (Northumberland)   | Manod, Condor                   | 2               |
| Guernsey                       | Condor + 2 other varieties      | 3               |
| Kinver(Worcs)                  | Padarn, Condor, Manod, Pendrwn  | 4               |
| Leeds                          | Condor                          | 1               |
| Lleyrn (Caerns.)               | Condor                          | 1               |
| Loughgall (N. Ireland)         | Condor, Manod                   | 2               |
| Montgomeryshire                | Manod, Condor (2)               | 3               |
| Reading (Berks)                | Aristata, Aurea, Picton, Condor | 4               |
| Renfrewshire                   | Condor                          | 1               |
| Rosemaund (Hereford)           | Padarn, Pendrwn, Waris Osprey   | 5               |
| Trawscoed (Aberystwyth Gards.) | (AB158/7), Condor, Manod        | 1               |
| W.P.B.S. (Aberystwyth, Gards.) | Condor                          | 1               |
|                                | Sun II                          | 1               |
|                                | TOTAL                           | 31              |

4. Race identification

25 isolates were successfully identified and the results are indicated in table 33.

Table 33

| Isolate No. | Date    | Location                  | Variety                    | Race         |
|-------------|---------|---------------------------|----------------------------|--------------|
| 68/1        | 21/5/68 | Rosemund                  | Padarn                     | 2            |
| 2           | 21/5    | "                         | Pendwrn                    | 2            |
| 3           | 25/5    | "                         | Maris Osprey<br>(AB 158/7) | 2            |
| 4           | 27/5    | Kinver                    | Padarn                     | 2            |
| 5           | 28/5    | Rosemund                  | Gondor                     | 2            |
| 6           | 28/5    | "                         | Manod                      | 2            |
| 7           | 10/6    | W.P.B.S.                  | Sunil                      | 2            |
| 8           | 25/6    | Kinver                    | Gondor                     | 2            |
| 9           | 10/6    | "                         | Pendwrn                    | No<br>result |
| 10          | 10/6    | "                         | Manod                      | 2+3?         |
| 11          | 5/7     | Doncaster                 | Gondor                     | 2            |
| 12          | 9/7     | Guernsey                  | Not Known                  | Failed       |
| 13          | 9/7     | "                         | Gondor                     | 2            |
| 14          | 9/7     | "                         | Not Known                  | 2            |
| 15          | 15/7    | Lleyn (Gaerns)            | Gondor                     | 2            |
| 16          | 22/7    | Backreston                | Mostyn                     | 2            |
| 17          | 22/7    | "                         | Gondor                     | 2            |
| 18          | 22/7    | Cockle Park               | Manod                      | 2            |
| 19          | 22/7    | "                         | Gondor                     | 2            |
| 20          | 22/7    | Trawscoed                 | Gondor                     | 2+1?         |
| 21          | 23/7    | Reading                   | Aristata                   | 3            |
| 22          | 23/7    | "                         | Aurea                      | 2            |
| 23          | 23/7    | "                         | Picton                     | Failed       |
| 24          | 23/7    | "                         | Gondor                     | Failed       |
| 25          | 26/7    | Montgomery-<br>shire      | Manod                      | 2            |
| 26          | 26/7    | "                         | Gondor                     | Failed       |
| 27          | 26/7    | "                         | Gondor                     | Failed       |
| 28          | 29/7    | Renfrewshire              | Gondor                     | 2            |
| 29          | 22/7    | Cardiganshire             | Gondor                     | 2            |
| 30          | 30/7    | Loughgall<br>(N. Ireland) | Gondor                     | 2            |
| 31          | 30/7    | "                         | Manod                      | 2            |

Summary

The results of the 1968 survey are summarised in Table 34.

Table 34

| Race       | Variety  | No. of Isolates |
|------------|--|-----------------|
| 2          | Padarn (2), Pendrwn, Marris<br>Osprey (AB158/7), Condor(10)<br>Manod (4), Sun II, Mostyn,<br>Aurea + 1 other | 22              |
| 3          | Aristata   | 1               |
| 2+3? mixed | Manod  | 1               |
| 2+1? mixed | Condor   | 1               |
|            | TOTAL  | 25              |

Race 2 was found to be the prevalent oat mildew race in Britain during 1968. It was recovered in samples from England, Scotland, N. Ireland and Wales. There was no major change in the race spectrum when compared with that for previous years.

Only one sample of mildew was received from the resistant variety, Mostyn. Severity of attack was light and identification of the race revealed that it was race 2, which failed to re-infect Mostyn seedlings.

H.

Rhynchosporium - barley. The University of Reading.

H. Owen.

1. A total of 137 samples of Rhynchosporium was sent to the University of Reading.
2. Varieties from which samples were received.  
Winter barley varieties are shown in Table 35, spring barley varieties in Table 36.

Table 35

| Winter barley                 | No. of samples |
|-------------------------------|----------------|
| Maris Otter                   | 14             |
| Malta                         | 7              |
| Senta                         | 7              |
| Dura                          | 4              |
| Dea                           | 3              |
| La Mesita                     | 3              |
| Pellara                       | 3              |
| Pioneer                       | 3              |
| Atlas                         | 2              |
| Atlas 46                      | 2              |
| Brier                         | 2              |
| Hudson                        | 2              |
| Leon                          | 2              |
| MoDoc                         | 2              |
| Topper                        | 2              |
| Turk                          | 2              |
| Wisconsin Winter x<br>Glabron | 2              |
| Wong                          | 2              |
| Osiris                        | 2              |
| Trebi                         | 1              |
| TOTAL                         | 66             |

Table 36

| Spring barley | No. of samples |
|---------------|----------------|
| Sultan        | 14             |
| Deba Abed     | 10             |
| Tern          | 8              |
| Inis          | 7              |
| Julia         | 7              |
| Proctor       | 7              |
| Impala        | 5              |
| Alka          | 4              |
| Vada          | 3              |
| Unknown       | 2              |
| TOTAL         | 71             |

3. Locations from which samples were received

The samples were received from 33 locations in the British Isles, and the source of each sample is shown in Table 37.

Table 37

| Location                | Source variety   | No. of Samples |
|-------------------------|--|----------------|
| Aberdeen                | Inis, Julia, Tern  | 3              |
| Aberystwyth             | Impala   | 1              |
| Anglesey                | Sultan   | 1              |
| Belfast                 | Proctor or Sultan  | 1              |
| Beverley (Yorks)        | Deba Abed, Julia, Sultan   | 3              |
| Bishop's Castle (Salop) | Sultan, Unknown  | 2              |
| Bristol                 | Dea, Senta   | 2              |
| Cambridge               | Tern, unknown (3)  | 4              |
| Carmarthenshire         | Proctor, Sultan, Tern  | 4              |
| Cockle Park (Northumb)  | Deba Abed, Maris Otter, Pioneer, Proctor, Sultan, Tern, Topper   | 3              |
| Devon                   | Maris Otter  | 7              |
| Dorset                  | Senta  | 1              |
| Dunmow (Essex)          | Akka, Malta, Maris Otter, Sultan   | 2              |
| Edinburgh               | Akka, Deba Abed, Impala, Inis, Malta, Maris Otter (2), Tern, Vada.   | 4              |
| Flintshire              | Deba Abed  | 9              |
| Garstang (Lancs)        | Deba Abed, Sultan  | 1              |
| Glamorgan               | Deba Abed, Inis (2) Julia (2); Senta, Sultan (2); unknown (2)  | 2              |
| Harper Adams (Salop)    | Dea, Deba Abed, Dura, Impala, Inis, Julia, Leon, Malta, Maris Otter  | 10             |
| Inverness               | Pella, Pioneer, Proctor, Sultan, Tern  | 14             |
| Kelvedon (Essex)        | Deba Abed, Inis, Julia, Proctor, Sultan, Tern  | 6              |
| Kinver (Worcs)          | Maris Otter  | 2              |
| Leominster (Herefs.)    | Dea, Deba Abed, Dura, Impala, Inis, Julia, La Mesita, Malta, Maris Otter, Pella, Pioneer, Proctor, Sultan, Tern, Vada. | 15             |
| Montgomery              | Maris Otter  | 1              |
| Norfolk                 | Deba Abed  | 1              |
| Oxfordshire             | Maris Otter, unknown (3)   | 4              |
| Padstow (Cornwall)      | Maris Otter  | 1              |
| Rosemaund (Herefs)      | Atlas, Atlas 46, Brier, Hudson, La Mesita, Modoc, Osiris, Trebi, Turk, Wisconsin Winter x Glabron, Wong                | 11             |
| Seale Hayne (Devon)     | Dura, Malta, Maris Otter, Sultan   | 4              |
|                         | Atlas, Atlas 46, Brier, Hudson, La Mesita, Modoc Turk, Wisconsin Winter x Glabron, Wong.                               | 9              |

| Location       | Source variety                                      | No. of samples |
|----------------|---|----------------|
| Theale (Berks) | Malta   | 1              |
| Unknown        | Akka, Sultan, Topper                                | 3              |
| Wiltshire      | Senta   | 2              |
| Wye (Kent)     | Unknown   | 1              |
| Zeals (Wilts)  | Dura, Leon, Malta,<br>Maris Otter, Pella,<br>Senta. | 6              |
|                | TOTAL   | 137            |

#### 4. Race Identification

50 isolations of the fungus were obtained from the 1968 samples of Rhynchosporium. Very few of these were from varieties with the RH<sub>4</sub> gene for resistance. These isolates were identified as race B, and it was possible that there was a mix-up over labelling, or that the diseased plants were rogues. The remaining isolates have not yet been tested partly because of staff difficulties and partly because it was expected that they would belong to races A & B. It has been decided that races A & B should be re-named

i.e. Race A = U.K.1

Race B = U.K.2

#### Summary

Races of Rhynchosporium identified from the 1968 samples, i.e. U.K.1 & U.K.2 were distributed throughout Britain. Few isolates were obtained from varieties with the RH<sub>4</sub> gene.

Final Summary

1. 932 samples of disease were collected in 1968 compared with 1034 in 1967. The proportion of yellow rust and Rhynchosporium samples was less, whereas mildew samples had increased. Brown rust samples numbered 50.
2. The majority of wheat yellow rust samples were identified as belonging to the race 3/55 group (58% of 40% in 1967). Race 60 was identified relatively few times mainly from susceptible disease nursery varieties rather than commercial varieties (23% of 40% in 1967). Several isolates were identified as being similar to race 58, previously only identified in the glasshouse. These isolates may be a new physiologic race. Seedling tests indicate that many varieties are susceptible to this race.
3. Many barley yellow rust isolates were unsuccessfully inoculated onto susceptible varieties. Spore multiplication of the remaining isolates has been slow and few isolates have been tested. Race 24 was the most frequent race from samples successfully identified.
5. Barley brown rust could be divided into five virulence groups, A, B, C, D & E. Commercial barley varieties grown in Britain exhibit no major gene resistance to these races although some varieties exhibit field resistance.
6. The four oat crown rust samples were identified as race 229, which does not attack the Victoria gene for resistance.
7. Thirteen races of wheat mildew were identified from the 1968 samples. Of these, races 3, 13, 16 and 26 were most frequently identified. No new races were identified although an isolate of race 26 was found to be virulent on seedlings of the mildew resistant variety Willdress.
8. Seven isolates of barley mildew were virulent on the previously resistant variety Sultan. Two of these isolates were also capable of attacking the Impala resistance M1a6 and M1g). The majority of barley mildew isolates (88% of 77% 1967) were identified as belonging to the Impala race group capable of attacking the M1a6 + i M1g genes for resistance and thus the majority of barley varieties grown commercially in Britain.
9. Rhynchosporium races were identified and placed into two race groups. Race A, renamed UK1, and race B, renamed UK2. These races appear to be distributed evenly throughout Britain.
10. The survey of mercury tolerant strains of Pyrenophora avenae was discontinued during 1968.
11. More detailed information concerning the results of particular isolates, or the general work and results of the physiologic race surveys may be obtained from the Secretary who would welcome comments and queries.
12. I would like to thank Dr. W.S. Wolfe, Dr. H. Owen, Dr. B. Clifford and Mr. I.T. Jones who carried out the identifications and contributed the information contained in this report.
13. Those of us concerned with the identification of races and the preparation of this report would like to thank all participants who have contributed to this survey by sending in samples. Their co-operation has greatly assisted in carrying out the aims of this survey, i.e. the early identification of new physiologic races of cereal pathogens.

1st July, 1969

N. H. Chamberlain,  
Secretary.

