

J. D. Johnson

PHYSIOLOGIC RACE SURVEYS

FINAL REPORT

1971

NOT FOR PUBLICATION

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Physiologic Race Survey Committee (Cereal Pathogens)

Secretary
N.H. Chamberlain,
N.I.A.B., Cambridge.

PHYSIOLOGIC RACE SURVEYS - CEREAL PATHOGENS

FINAL REPORT FOR 1971

SUMMARY

GENERAL

- Samples of diseases for race identification were again collected in 1971. The total number of samples collected for each disease is shown in Table 1.

Table 1

Disease	Number of Samples		
	1969	1970	1971
Yellow Rust - Wheat	227	166	541
Yellow Rust - Barley	48	16	4
Brown Rust - Barley	289	369	131
Crown Rust - Oats	28	10	35
Mildew - Wheat	173	289	265
Mildew - Barley	359	469	361
Mildew - Oats	105	106	91
Rhynchosporium - Barley	512	54	30
TOTAL	1741	1479	1458

- Testing has been completed on nearly all of the samples received during 1971. Those which have not been identified are undergoing confirmatory tests.
- Only samples for which a race identification has been obtained have been included in the table of results. Samples which failed to establish have not been included in the tables of results.
- The following report is compiled from the results obtained at the three testing centres. Detailed results are presented in tabular form, a summary is given below.
- It should be emphasised that sampling is not on a random basis and therefore the frequency and distribution of races shown by the survey may not reflect that in the country as a whole.

YELLOW RUST OF WHEAT

Eleven races were identified from the 541 samples collected in 1971 ie 8B (32 E128), 54 (36 E132), 60 (37 E132), 2B (40 E72), 3/55 Cleo (40 E136), 58 (41 E8), 58C (41 E136), 43 E138, 3/55 Opal (104 E9), 3/55D (104 E137) and 1B (108 E9). Race 3/55D (104 E137) was identified most frequently, from samples collected from

all parts of Britain and Ireland, with 58C (41 E136) the second most important race but restricted mainly to S E Scotland and N E England. Several of the older races (8B (32 E128), 54 (36 E132) and 2B (40 E72)), not recorded in Britain for some years were identified in 1971, indicating that they had not disappeared completely. The new race 43 E138, capable of overcoming the Yr7 gene for resistance, was identified twice. This is a new combination of virulence genes in the pathogen; no races have been recorded previously in Britain with the ability to infect varieties with this resistance. All eleven races were identified from samples collected from Joss Cambier, but 3/55D (104 E137) was most frequently identified from this variety.

YELLOW RUST OF BARLEY

Five samples were collected during 1971. One was found to be brown rust and a second failed to establish. Of the three remaining samples, one was race 23 and two race 24.

BROWN RUST OF BARLEY

One hundred and thirty one samples of brown rust were collected, including two from wheat. Most of the samples were from spring varieties, coming mainly from the south-west, south and east of England. The predominant races were E and F (77 samples) both being widely virulent; races A, B and H were also identified but from very few samples.

CROWN RUST OF OATS

The races most frequently identified from the thirty five samples collected during 1971 were 229 and 251. A race previously unrecorded in Britain (289) was detected in five samples. It is similar to the known race 272 and has limited virulence. Other races identified were 234, 235, 265, 272 and 471.

MILDEW OF WHEAT

A total of 265 samples was received from thirty two winter and twenty four spring wheat varieties. From these eighty one isolates have been identified and classified into eighteen races. Races 13 and 14 continued to predominate with race 3 having declined further compared with previous years.

Virulence for the Mle resistance allele was confirmed. Six isolates from varieties with the Mle resistance were received and all were of a new race type. This has been provisionally labelled '67' and is similar to race 13 with in addition Mle virulence. Races with virulence on varieties derived from wheat/rye hybrids are relatively common in the wheat mildew population.

MILDEW OF BARLEY

A total of 361 isolates was received from seven winter and sixty one spring varieties. From these, 204 isolates have been identified and classified into sixty races. The general race pattern is similar to that in 1970, with complex races predominating on varieties with the Mlg resistance allele and relatively simple races predominating on Sultan and related varieties.

Six isolates have been found which are fully virulent on seedlings of Vada. These isolates were obtained from a wide range of localities and covered a wide range of races from A0-V (Vada virulence only) to C.10.-SV (9 virulence alleles).

MILDEW OF OATS

Ninety one samples of oat mildew were received during 1971. Three races were identified: 2, 3 and 4. Race 4 was identified on varieties other than Mostyn for the first time.

RHYNCHOSPORIUM OF BARLEY

Of the thirty samples received the majority were collected from the varieties Maris Otter and Proctor. All samples were identified as Race UK1.

YELLOW RUST - WHEAT

NATIONAL INSTITUTE OF AGRICULTURAL BOTANY, CAMBRIDGE

N.H.CHAMBERLAIN AND JULIA SMITH

1. During 1971, 541 samples of wheat yellow rust were received at the NIAB.

The number of samples collected from winter wheat varieties is shown in

Table 2, spring wheat varieties in Table 3

Table 2

Winter wheat	No. of samples
Joss Cambier	267
Cama	67
Cappelle Desprez	58
Maris Beacon	37
Maris Ranger	21
Maris Nimrod	19
Champlain	13
Maris Templar	11
Maris Huntsman	8
Heina Desprez	7
Tommy	7
Hybrid 46	5
Urban	5
Armentieres	4
Maris Settler	4
Mildress	4
Benno	3
SR 156/218	3
West Desprez	3
Maris Widgeon	2
VR 7610C6	2
VR 761079	2
Limelight	1
Lincoln	1
Maris Floughman	1
Tourack	1
Viking	1
60/AF/173	1
TOTAL	445

Table 3

Spring wheat	No. of samples
Cardinal	10
Sappo	8
Janus	7
Maris Halberd	5
Tilly	5
Troll	2
Capta	1
Kolibri	1
Maris Butler	1
Maris Ensign	1
Sovereign	1
TOTAL	55

A further forty-one samples were received from the following varieties
 Heines VII (3); Opal (3), Bon Fermier (2), Harvest Queen (2), Little
 Club (2), Rubis (2), Tadorna (2), Triticum vulgare (2) Cappelle x Ibis,
 Cappelle x SA 62/345, Chambord, Eclipse, Gaines Winter Wheat, Lucas,
 Mexican 13, Michigan Amber, Redman, TJB 54/224/1/5/244, TP 226,
 Triticale Graze Grain 70, Triticum spelta saharensis, Zorba, Unknown (9).

2. RACE IDENTIFICATION

The full results of all samples successfully tested are given in Table 4.

The present system of race nomenclature is being replaced by a system based on binary notation (Hobgood 1970, *Nature* 227, 1268). A full description of the new system of race nomenclature, together with the proposed new name for each of the races identified in Britain, is being published by Johnson, Stubbs, Fuchs and Chamberlain in the Transactions of the British Mycological Society 58 (3). (In print).

The proposed new name is being used in this report, in conjunction with the currently used name.

TABLE 4 YELLOW RUST OF WHEAT - RACE IDENTIFICATION

Location	NIAB Code No. 71/-	Variety	Race	
<u>Northern Region</u>				
Northumberland	505	Unknown	58C	41 E136
Alnmouth	240	Cappelle Desprez	58C	41 E136
	503	Maris Beacon?	3/55D + 58C	104 E137 + 41 E136
Ancroft	131	Joss Cambier	58C	41 E136
	241	Cappelle Desprez	58C + 54	41 E136 + 36 E132
Chevington	242	Joss Cambier	58C	41 E136
Cockle Park	437	Maris Tomplar	58C	41 E136
	438	Joss Cambier	58C	41 E136
	439	Tilly	58C + 3/55D	41 E136 + 104 E137
	440	Janus	3/55D + ?	104 E137 +?
	441	Maris Halbord	58C + 3/55D	41 E136 + 104 E137
	538	Troll	3/55D	104 E137
	539	Sappo	58C	41 E136
Lowick	130	Cappello Desprez	58C	41 E136
	135	Joss Cambier	58C	41 E136
Morpeth	502	West Desprez	58C + ?	41 E136 + ?
	234	Joss Cambier	54 + 3/55D	36 E132 + 104 E137
Shoreswood	132	Joss Cambier	58C	41 E136
	133	" "	58C	41 E136
	134	Champlein	3/550pal	104 E9

TABLE 4 CONTD

Location	NIAB Code No. 71/-	Variety	Race	
<u>Yorks & Lancs Region</u>				
Yorkshire	443	Champlain	3/55D	104 E137
	266	Maris Beacon	3/55D + 60	104 E137 + 37 E132
Beeford	321	Joss Cambier	3/55D	104 E137
Driffield	308	Cana	3/55D	104 E137
	309	Joss Cambier	3/55D	104 E137
	310	Maris Beacon	3/55D	104 E137
<u>East Midlands</u>				
	391	Champlain	3/55D	104 E137
	392	Cappelle Desprez	3/55D	104 E137
	393	" "	3/55D	104 E137
	394	Champlain	3/55D	104 E137
	395	Cappelle Desprez	3/55D	104 E137
	397	Joss Cambier	3/55D	104 E137
Leicestershire				
Sutton Bonington	381	Janus	3/55D + ?	104 E137 + ?
Lincolnshire				
Boston	2	Triticum vulgare	58C	41 E136
Dry Doddington	279	Maris Beacon	3/55D	104 E137
Fulstow, Louth	370	Joss Cambier	3/55D	104 E137
Gedney Marsh, Spalding	286	Joss Cambier	3/55D	104 E137
Halton Fen, Lindsey	275	Cana	3/55D	104 E137
Kirton	136	Cappelle Desprez	3/55D	104 E137
	270	Joss Cambier	3/55D	104 E137
Lindsey	277	Cappelle Desprez	3/55D	104 E137
Marcham le Fen	16	Maris Beacon	3/55D	104 E137
	146	Heima Desprez	3/55D	104 E137
	147	Maris Beacon	3/55D	104 E137
	148	Cana	3/55D	104 E137
	253	Maris Beacon	3/55D	104 E137
	254	Cana	3/55D	104 E137
	255	Maris Ranger	3/55D	104 E137
	256	Maris Nimrod	60	37 E132
	257	Cappelle Desprez	3/55D	104 E137
Spalding	4	Cappelle x SA62/345 (F1)	1B	108 E9
	188	Heines VII	8B	32 E128
	189	Joss Cambier	3/55D	104 E137
	190	Maris Beacon	3/55D	104 E137
	191	Maris Settler	3/55D	104 E137
	192	TP 226	3/55 Opal	104 E9
	293	Maris Ranger	1B	108 E9
	299	" "	1B + 3/55D	108 E9 + 104 E137
Surfleet	300	Joss Cambier	3/55D	104 E137
	249	Cana ?	1B	108 E9
	262	Joss Cambier	3/55D	104 E137
Sutterton Dowdyke, Boston	311	Cana	3/55D	104 E137
Sutton Bridge	183	Joss Cambier	3/55D	104 E137
Tydd St Mary	320	" "	3/55D	104 E137
Wainfleet	278	Cana	3/55D	104 E137
Wingland, Sutton Bridge	195	Joss Cambier	3/55D	104 E137
	196	Cana	3/55D	104 E137
	197	Joss Cambier	1B	108 E9
	198	Maris Ranger	3/55D	104 E137
	199	Cana	3/55D	104 E137
	200	Joss Cambier	3/55D	104 E137
Wykham Chapel, Spalding	116	Cana	8B	32 E128
	117	Maris Templar	58C	41 E136

TABLE 4 CONTD

Location	NIAB Code No. 71/-	Variety	Race	
Northamptonshire				
Ashton Roade	288	Maris Ranger	3/55 Opal	104 E9
Deene	232	Maris Beacon	8B + 3/55D	32 E128 + 104 E137
None Valley	460	Unknown	3/55D	104 E137
Sulgrave	287	Joss Cambier	3/55D	104 E137
Rutland				
Exton, Oakham	383	" "	3/55D	104 E137
West Midlands				
Cheshire	419	" "	3/55D	104 E137
Farndon, Chester	100 101 102	Maris Ranger Maris Beacon Cana	1B 3/55D 58C	108 E9 104 E137 41 E136
Hereford				
Rosemound	463 464 465 466 467 468 469	Joss Cambier Janus Cana Cardinal Tilly Maris Beacon Cappelle Desprez	3/55D 3/55D 3/55D 3/55D 3/55D 3/55D 3/55 Opal	104 E137 104 E137 104 E137 104 E137 104 E137 104 E137 104 E9
Shropshire				
Harper Adams, Newport	152 153	Maris Beacon Maris Nimrod	3/55D 3/55D	104 E137 104 E137
Sambrook, Newport	201 202	Joss Cambier Maris Beacon	3/55D 3/55D	104 E137 104 E137
Warwickshire				
Ashorne	127	Cana	3/55D	104 E137
Worcestershire				
Bretforton	128	Joss Cambier	3/55D	104 E137
Eastern Region				
	364 382 413 414 418 422 442 445 455 456	Joss Cambier Champlain Maris Ranger Joss Cambier Cappelle Desprez Maris Ranger Cana Maris Ranger Joss Cambier "	3/55D 3/55 Cleo 1B 3/55D 3/55D 58C 3/55D 3/55D 3/55D 3/55D	104 E137 40 E136 108 E9 104 E137 104 E137 41 E136 104 E137 104 E137 104 E137 104 E137
Bedfordshire				
Pepperstock	75	Cana	3/55D	104 E137
Cambridgeshire				
Boxworth	125	Joss Cambier	3/55D	104 E137
Madingley	472	Cardinal	3/55D	104 E137
March	144	Cappelle Desprez	3/55D	104 E137
NIAB Cambridge	294 37 56 57 58 60 61 63 233 243	Joss Cambier Sappo Maris Nimrod Joss Cambier Maris Templar Cana Cappelle Desprez Maris Huntsman 60/AF/173 Janus	3/55D 3/55 Opal 3/55D 3/55D 58C 3/55D 3/55D 3/55D 54 3/55D	104 E137 104 E9 104 E137 104 E137 41 E136 104 E137 104 E137 104 E137 36 E132 104 E137

TABLE 4 CONTD

Location	NIAB Code No. 71/-	Variety	Race	
NIAB Contd	244	Maris Ploughman	3/55D	104 E137
	344	Bon Fernier	3/55 Opal	104 E9
	345	<u>Triticum spelta</u> <u>saharensce</u>	3/55D	104 E137
	346	Redman	3/55D	104 E137
	347	Little Club	3/55D	104 E137
	348	Rubis	3/55D	104 E137
	349	Opal	3/55 Opal	104 E9
	350	Harvest Queen	3/55 Opal	104 E9
	351	Cappelle Desprez	3/55 Opal	104 E9
	352	Michigan Amber	3/55D	104 E137
	353	Harvest Queen	3/55 Opal	104 E9
	354	Heines VII	3/55D	104 E137
	355	Lucas	3/55D	104 E137
	356	Tadorna	60?	37 E132 + ?
	357	Chambord	3/55D	104 E137
	470	Sappo	3/55D	104 E137
	471	Cardinal	3/55D	104 E137
	541	Triticale	60	37 E132
Shippey Hill, Littleport	398	Joss Cambier	3/55D	104 E137
Stapleford	22	Viking	3/55D	104 E137
	23	Joss Cambier	3/55D	104 E137
Trumpington	167	Maris Templar	58C	41 E136
	168	Maris Ranger	1B	108 E9
	169	TJB 54/224/1/5/2+4	1B	108 E9
	170	Maris Beacon	3/55D	104 E137
Whittlesey	280	Joss Cambier	60 + 3/55D + 43 E138	37 E132 + 104 E137 + 43 E138
Essex				
Orsett, Grays	319	Maris Beacon	3/55D	104 E137
Wix, Harwich	97	Joss Cambier	3/55D	104 E137
	98	" "	3/55D	104 E137
	99	Cana	3/55D	104 E137
Hertfordshire				
Rothansted	40	Cana	3/55D	104 E137
	85	Joss Cambier	3/55D	104 E137
	86	Cappelle Desprez	3/55D	104 E137
	87	Gaines Winter Wheat	3/55D	104 E137
Norfolk				
Aylsham	283	Cana	3/55D	104 E137
Dilham, Norwich	284	Joss Cambier	3/55D	104 E137
Docking	285	Maris Ranger	3/55D	104 E137
	187	Maris Beacon	3/55D	104 E137
	436	Maris Ranger	3/55D	104 E137
	33	Maris Beacon	3/55D	104 E137
	34	Maris Minrod	3/55D	104 E137
	35	Cappelle Desprez	3/55D	104 E137
	36	Cappelle x Ibis	3/55D	104 E137
	73	Joss Cambier	3/55 Cleo	40 E136
	74	Maris Huntsman	3/55D	104 E137
Ingham, Norwich	314	Joss Cambier	3/55D+?	104 E137 + ?
	315	Cana	3/55D	104 E137
Morley	268	Joss Cambier	3/55D	104 E137
	333	Cardinal	3/55D	104 E137
	407	Joss Cambier	3/55D	104 E137
	408	" "	58C + 3/55D	41 E136 + 104 E137
	410	Sovereign	3/55D	104 E137
	411	Cardinal	3/55D	104 E137
Old Buckenham	298	Maris Beacon	3/55D	104 E137
Somerton	297	Joss Cambier	3/55D	104 E137
Stalham	412	Cappelle Desprez	3/55D + 1B	104 E137 + 108 E9

TABLE 4 CONTD

Location	NIAB Code No. 71/-	Variety	Race	
Terrington	178	Tourack	3/55D	104 E137
	179	Limelight	3/55D	104 E137
	180	Maris Beacon	3/55D	104 E137
	182	Maris Halberd	3/55D	104 E137
	208	Joss Cambier	3/55D	104 E137
	209	Lincoln	3/55D	104 E137
	385	Maris Halberd	3/55D	104 E137
	386	Tilly	3/55D	104 E137
	387	Maris Ranger	1B	108 E9
	388	Cana	3/55D + ?	104 E137 + ?
Suffolk				
East Bergholt	222	Joss Cambier	3/55D	104 E137
Hendlesham, Stowmarket	231	Maris Beacon	3/55D	104 E137
Stoke by Nayland, Clare	84	Joss Cambier	3/55D	104 E137
Stradbroke	247	" "	3/55D	104 E137
Stradishall	219	" "	3/55D	104 E137
<u>South-Eastern Region</u>	371	" "	60 + 3/55D	36 E132 + 104 E137
	389	" "	3/55D	104 E137
	403	" "	58	41 E8
	405	Cappelle Desprez	3/55D	104 E137
	457	" "	3/55 Opal	104 E9
	458	" "	3/55D	104 E137
	459	" "	3/55D	104 E137
Berkshire				
Challow, Wantage	258	Joss Cambier	3/55D	104 E137
Newbury	259	Joss Cambier	3/55D	104 E137
	137	" "	3/55D	104 E137
Buckinghamshire				
Buckingham	271	" "	3/55D	104 E137
Chenies	194	" "	3/55D	104 E137
Lacey Green, Princes Risborough	218	" "	3/55D	104 E137
Hampshire				
Bridgets, Winchester	223	" "	3/55D	104 E137
	224	Maris Beacon	3/55D	104 E137
	302	Maris Beacon	3/55D	104 E137
East Meon, Petersfield	313	Joss Cambier	2B + ?	40 E72 + ?
Ramsdell, Basingstoke	269	" "	3/55D + 60	104 E137 + 37 E132
Sparsholt	76	" "	8B	32 E128
	126	Maris Beacon	3/55D	104 E137
	129	Joss Cambier	3/55D	104 E137
	225	Janus	3/55D	104 E137
	226	Sappo	3/55D	104 E137
	227	Cappelle Desprez	3/55D	104 E137
	245	Tilly	3/55 Cleo	40 E136
Sutton Scotney	24	Cana	3/55D	104 E137
	25	Maris Ninrod	3/55D	104 E137
Kent				
Ash	184	Joss Cambier	3/55D	104 E137
Canterbury	62	" "	3/55D	104 E137
Deal	143	Cana	3/55D	104 E137
Elnstead	185	Joss Cambier	3/55D	104 E137
Hollingbourne	230	" "	3/55D	104 E137
Milstead, Sittingbourne	337	" "	3/55D	104 E137
	339	Champlain	3/55 Opal	104 E9
Romney Marsh	20	Unknown	3/55D	104 E137
Shoppey	145	Cana	3/55D	104 E137
Stelling Minnis	115	Joss Cambier	3/55D	104 E137
	239	" "	3/55D	104 E137
Stowting	238	Cappelle Desprez	3/55D	104 E137

TABLE 4 CONTD

Location	NIAB Code No. 71/-	Variety	Race
Wye	1	Joss Cambier	3/55D 104 E137
	8	Joss Cambier	3/55D 104 E137
	9	" "	3/55D 104 E137
	10	Eclipse	3/55D 104 E137
	11	Joss Cambier	3/55D 104 E137
	12	Maris Beacon	60 + 3/55D 37 E132 + 104 E137
	13	Heina Desprez	8B 32 E128
	15	Cappelle Desprez	3/55D + 60 104 E9 + 37 E132
	19	Joss Cambier	3/55D 104 E137
	45	Heina Desprez	3/55D 104 E137
	46	Maris Wigdon	3/55D 104 E137
	47	Champlein	3/55D 104 E137
	48	Cappelle Desprez	3/55D 104 E137
	49	SR 156/218	3/55D 104 E137
	50	Maris Ninrod	3/55D 104 E137
	51	" "	3/55D 104 E137
	52	Cana	3/55D 104 E137
	53	Maris Beacon	3/55D 104 E137
	64	Troll	3/55D 104 E137
	65	Sappo	3/55D 104 E137
	66	Maris Halberd	3/55D 104 E137
	68	Cardinal	3/55D 104 E137
	69	Maris Butler	3/55D 104 E137
	70	Janus	3/55D 104 E137
	71	Tilly	3/55D 104 E137
	72	Joss Cambier	3/55D + 60 104 E137 + 37 E132
	235	SR 156/218	3/55D 104 E137
	236	Tommy	54 + 3/55D 36 E132 + 104 E137
	237	Benno	3/55D 104 E137
	296	Cardinal	3/55D 104 E137
Oxfordshire	54	Cana	3/55D 104 E137
	55	Maris Ranger	3/55D 104 E137
	248	Maris Beacon	3/55D 104 E137
Adderbury	267	Joss Cambier	3/55D 104 E137
Kings Sutton, Adderbury	95	" "	3/55D 104 E137
Kingston Blount	210	Cappelle Desprez	3/55 Cleo 40 E136
	211	Joss Cambier	3/55D 104 E137
	212	Maris Ninrod	3/55D 104 E137
	213	Cana	3/55D 104 E137
	214	Maris Templar	3/55D 104 E137
	215	Maris Beacon	3/55D 104 E137
	216	Heina Desprez	3/55D 104 E137
	217	Tommy	3/55D 104 E137
Postcombe	42	Joss Cambier	3/55D 104 E137
	43	Armentieres	3/55D 104 E137
Sussex			
Burpham	273	Sappo	54 36 E132
Chichester	21	Joss Cambier	3/55D 104 E137
Halland	207	Joss Cambier	3/55D 104 E137
Lewes	203	Maris Beacon	3/55D 104 E137
	204	Maris Ninrod	3/55D 104 E137
	205	Cana	3/55 Opal 104 E9
	206	Joss Cambier	3/55D 104 E137
Northian	274	" "	3/55D 104 E137
South Western Region	361	Joss Cambier	
	444	Unknown	3/55D 104 E137
Cornwall			
Stoke Climsland	312	Maris Beacon	3/55D 104 E137

TABLE 4 CONTD

Location	NIAB Code No. 71/-	Variety	Race
Devon			
Ashburton	291	Janus	3/55D 104 E137
Newton St Cyrs, Exeter	281	Cappelle Desprez	2B 40 E72
	282	Maris Widgeon	2B + ? 40 E72 + ?
Seale Hayne	110	Maris Beacon	3/55D 104 E137
	111	" "	3/55D 104 E137
	112	Champlain	3/55D 104 E137
	113	Maris Ninrod	3/55D 104 E137
	114	Armentieres	3/55D 104 E137
Totnes	118	Joss Cambier	3/55D 104 E137
Uton, Crediton	317	Cardinal	3/55D 104 E137
	318	Maris Halbord	
Dorset			
Dorchester	335	Unknown	3/55D 104 E137
Gloucestershire			
Calcot, Tetbury	272	Cappelle Desprez	3/55D 104 E137
Eastleach	90	Joss Cambier	3/55D 104 E137
Edgeworth, Stroud	251	" "	3/55D 104 E137
Hatherop, Cironcoster	186	" "	3/55D 104 E137
Kingscote, Tetbury	122	" "	3/55D 104 E137
	123	Cappelle Desprez	8B 32 E128
Somerset			
Butleigh, Glastonbury	124	Joss Cambier	2B 40 E72
Cannington	250	Joss Cambier	3/55D 104 E137
Cothelstone	334	Sappo	3/55 Opal 104 E9
	177	Joss Cambier	3/55D + 60 104 E137 + 37 E132
Higher Claveshan	172	Cana	3/55D 104 E137
	173	Maris Huntsman	3/55D 104 E137
	174	Maris Beacon	3/55D 104 E137
	175	Joss Cambier	3/55D 104 E137
	176	Maris Ninrod	3/55D 104 E137
Langport	44	Joss Cambier	3/55D 104 E137
North Petherton	89	" "	3/55D 104 E137
	264	Cana	3/55D 104 E137
	265	Tommy	3/55D 104 E137
Sherford	171	Champlain	3/55D 104 E137
Stawell, Bridgewater	252	Joss Cambier	3/55D 104 E137
West Quantoxhead	120	" "	60 + 3/55D 37 E132 + + 3/55 104 E137 + Opal + 8B 104 E9 + 32 E128
Wrington	17	" "	3/55D 104 E137
	18	" "	3/55D 104 E137
	59	" "	3/55D 104 E137
Wiltshire			
Broad Hinton	104	Armentieres	3/55D 104 E137
	105	Maris Huntsman	3/55D 104 E137
	106	Cappelle Desprez	3/55D 104 E137
	107	Maris Beacon	3/55D 104 E137
	108	Maris Ninrod	3/55D 104 E137
	109	Joss Cambier	3/55D 104 E137
	306	Maris Beacon	3/55D 104 E137
	307	Cappelle Desprez	3/55D 104 E137
Chiseldon, Swindon	7	Joss Cambier	3/55D 104 E137
	26	" "	3/55D 104 E137
	27	" "	3/55D 104 E137
	28	" "	3/55D 104 E137
	29	Champlain	3/55D 104 E137
	30	Mixed	3/55D 104 E137
	31	Unknown	3/55D 104 E137
	32	Joss Cambier	3/55D 104 E137
	93	" "	3/55D 104 E137

TABLE 4 CONTD

Location	NIAB Code No. 71/-	Variety	Race	
Little Hinton, Swindon	6	Joss Cambier	3/55D	104 E137
Marlborough	103	Maris Ranger	3/55D	104 E137
	220	Joss Cambier	3/55D	104 E137
Swindon	303	Joss Cambier	3/55D	104 E137
	304	" "	3/55D	104 E137
Whiteparish	229	" "	3/55D	104 E137
Winterbourne Earls	91	" "	3/55D	104 E137
Wishford, Salisbury	228	" "	54 + 3/55 Opal	36 E 132 + 104 E9
Toffont	88	" "	3/55D	104 E137
<u>Wales</u>	362	Cappelle Desprez	58 C	41 E136
	373	" "	3/55D	104 E137
Anglesey	384	Cana	3/55D	104 E137
Caernarvonshire				
Llandudno	119	Cappelle Desprez	3/55D	104 E137
<u>Scotland</u>				
<u>Angus</u>				
Forfar	473	" "	58C	41 E136
	474	Hybrid 46	3/55D	104 E137
	475	Cana	58C	41 E136
	476	Maris Templar	58C	41 E136
	477	Maris Huntsman	58C	41 E136
	478	Maris Ninrod	3/55D	104 E137
Inverkeilor	380	Joss Cambier	3/55D	104 E137
Berwickshire				
Chirnside	432	" "	58C	41 E136
Coldstream	81	" "	2B	40 E72
	164	" "	58C	41 E136
	424	" "	58C	41 E136
	425	" "	58C	41 E136
	426	" "	58C + 54	41 E136 + 36 E132
	427	" "	58 C	41 E136
	488	West Desprez	2D	40 E72
Duns	77	Cappelle Desprez	58C	41 E 136
	78	Cana	58C	41 E136
	79	Urban	3/55D	104 E137
	80	Cappelle Desprez	58C	41 E136
	154	" "	58C	41 E136
	155	Cana	60 + 2B	37 E132 + 40 E72
	156	Maris Beacon	58C	41 E136
	157	Urban	58C	41 E136
	158	Benno	58C	41 E136
	159	VR 761006	3/55D	104 E137
	160	VR 761079	3/55 Cleo	40 E136
	161	Mildress	58C	41 E136
	162	Cana	3/55D	104 E137
	431	"	58C + 3/55D	41 E136 + 104 E137
	489	Cappelle Desprez	58C	41 E136
	490	Cana	58C	41 E136
	491	Urban	58C	41 E136
	492	Mildress	58C	41 E136
	493	Cappa	-	43 E138
	494	Cappelle Desprez	58C	41 E136
	495	Maris Huntsman	58C	41 E136
	496	Maris Templar	58C	41 E136
	497	Maris Ninrod	58 + 3/55D	41 E136 + 104 E137
	498	Heina Desprez	58C	41 E136
	499	Maris Beacon	3/55D	104 E137

TABLE 4 CONTD

Location	NIAB Code No. 71/-	Variety	Race	
Duns cont	500	Cana	58C	41 E136
	501	Joss Cambier	58C + ?	41 E136 + ?
Leitholn	3	Hybrid 46	3/55 Opal	104 E9
	82	" "	3/55 Opal	104 E9
	83	Maris Ranger	3/55 D	104 E137
	428	Hybrid 46	3/55 Opal	104 E9
	429	" "	3/55 Opal	104 E9
	430	Maris Ranger	3/55 Opal	104 E9
Swinton	246	Cana	58C	41 E136
East Lothian				
Bolton	141	Joss Cambier	58C	41 E136
	142	Cappelle Desprez	60	37 E132
	367	Cana	58C	41 E136
	368	Joss Cambier	58C	41 E136
	369	Cappelle Desprez	58C	41 E136
	433	Cana	58C	41 E136
	434	Joss Cambier	58C	41 E136
	435	Cappelle Desprez	58C	41 E136
	504	Cana	58C	41 E136
Dunbar	510	Cappelle Desprez	2B	40 E72
	511	Unknown	2B	40 E72
East Linton	512	Cappelle Desprez	58C	41 E136?
	513	Cana	58C + 3/55D	41 E136 + 104 E137
	514	Urban	58C + 3/55D	41 E136 + 104 E137
	515	VR 761079	2B	40 E72
	516	Mildress	58C + 3/55D	41 E136 + 104 E137
	517	Maris Beacon	58C	41 E136
	518	Cana	58C	41 E136
	519	Maris Ninrod	58C	41 E136
	520	Cappelle Desprez	58C	41 E136
	521	Maris Settler	58C	41 E136
	522	Maris Templar	58C	41 E136
	523	Maris Huntsman	58C	41 E136
Gullane	290	Cana	58C	41 E136
Haddington	151	"	3/55D	104 E137
	509	"	58C	41 E136
Long Niddry	289	Joss Cambier	58C	41 E136
	507	" "	58C	41 E136
	508	Champlain	58C	41 E136
Saltoun	365	Cana	58C	41 E136
	366	Champlain	58C	41 E136
Upper Bolton	150	Joss Cambier	58C + ?	41 E136 + ?
Fife				
Arncroach	324	Cappelle Desprez	3/55D	104 E137
	325	Cana	58C	41 E136
	326	Tommy	58C + 3/55Opal	41 E136 + 104 E9
	327	Urban	58C	41 E136
	328	Benno	58C	41 E136
	329	VR 761006	58C	41 E136
	330	Mildress	58C + 60	41 E136 + 37 E132
St Andrews	331	Zorba	58C	41 E136
	487	West Desprez	3/55 Opal + ?	104 E9 + ?
Midlothian				
Edinburgh	447	Cappelle Desprez	58C	41 E136
	448	Cana	58C	41 E136
	449	Joss Cambier	58C	41 E136
	450	Maris Ninrod	58C	41 E136

TABLE 4 CONTD

Location	NIAB Code No. 71/-	Variety	Race	
Edinburgh contd	451	Maris Templar	58C	41 E136
	452	SR 156/218	58C	41 E136
	453	Heima Desprez	58C	41 E136
	454	Maris Settler	58C	41 E136
Perthshire Coupar Angus	528	Cana	58C	41 E136
	529	Maris Ninrod	58C	41 E136
	530	Maris Settler	58C + ?	41 E136 + ?
	531	Cappelle Desprez	58C	41 E136
	532	Maris Templar	8B	32 E128
	533	Cana	58C	41 E136
	534	Maris Huntsman	58C	41 E136
	260	Joss Cambier	58C	41 E136
	261	" "	58C + 3/55D	41 E136 + 104 E137
	527	Cana	58C	41 E136
Findogask Invergowrie	322	Maris Ensign	3/55D	104 E137
	323	Triticum vulgare	3/55 Opal	104 E9
	479	Cana	58C	41 E136
	480	Tommy	2B	40 E72
	481	Tadorna	58C	41 E136
	482	Heines VII	58C	41 E136
	483	Rubis	58C	41 E136
	484	Bon Fernier	3/55 + ?	104 E137 + ?
	485	Little Club	58C	41 E136
	486	Opal	3/55 Opal	104 E9
Roxburghshire Kelso	121	Joss Cambier	8B + 58C	32 E128 + 41 E136
	163	" "	58C	41 E136
	524	" "	54 + 58C	36 E132 + 41 E136
	525	" "	58C	41 E136
Sprouton	526	Cana	58C + 3/55 Opal	41 E136 + 104 E9
West Lothian Ratho	374	Cana	58C	41 E136
	375	Cappelle Desprez	58C	41 E136
	376	Maris Ninrod	58C	41 E136
	377	Maris Templar	58C	41 E136
	378	Tommy		
	379	Heima Desprez	58C	41 E136
	535	Cappelle Desprez	58C	41 E136
	536	Cana	3/55D	104 E137
	537	Joss Cambier	-	43 E138
Eire Co. Kildare Backweston, Leixlip	506	Mexican 13	58C + 3/550pal	41 E136 + 104 E9
	540	Opal	3/55D	104 E137

Fifty-five samples failed to establish. Eleven races were identified from the samples successfully tested. These races together with the number of sites from which the race was identified and the percentage frequency of identification are shown in Table 5.

TABLE 5. RACES OF YELLOW RUST IDENTIFIED IN 1971

Old Race Nomenclature	Proposed	No. of Sites	Percentage frequency of identification
8B	32 E128	9	3.7
54	36 E132	8	3.3
60	37 E132	12	5.0
2B	40 E72	8	3.3
3/55 Cleo	40 E136	5	2.1
58	41 E8	1	0.4
58C	41 E136	37	15.4
-	43 E138	3	1.2
3/55 Opal	104 E9	16	6.6
3/55D	104 E137	134	55.6
1B	108 E9	8	3.3

Forty seven of the samples were mixed, in some cases as many as four distinct races were isolated from the mixture. Many isolations of the less frequently identified races were from the mixtures.

The percentage frequency has been calculated by selecting only one sample identified as a given race from any one site.

Race 3/55D (104 E137) was the most frequently recorded race (55% of samples), being identified from samples collected from all parts of Britain but especially from the south of England. This race was responsible for much of the infection on Joss Cambier in the South, hitherto thought to be moderately resistant.

However, no differences could be observed on seedlings between the isolates of 3/55D (104 E137) from Joss Cambier and that collected from Maris Beacon in 1969.

Race 58C (41 E136) was the second most frequently identified race, being recorded on samples collected mainly from S.E. Scotland and N.E. England, where it has been recorded for the last three years. Isolates of the race were, however, obtained from Wales, Eire and Eastern England in 1971, indicating a possible spread of the race. Race 58C (41 E136) was responsible for much of the infection in S.E. Scotland and Northumberland on the variety Joss Cambier and again cannot be distinguished from that first identified in 1967.

The remaining races were identified relatively infrequently. The hitherto important races, 3/55 Opal (104 E9) and 60 (37 E132) were identified from 6% and 5% of the samples respectively, whereas races 8B (32 E128) and 2B (40 E72), important in 1952-55 are still present in the country, but at a very low frequency.

Race 54 (36 E132) was recorded from 3% of the samples but this race has not been recorded in Britain since 1964 and its re-appearance cannot be explained. The race 58 (41 E8) recorded by Macer in 1960 from a glasshouse infection has been recorded in the field for the first time, was obtained from one sample.

The new race of yellow rust 43 E138, was identified from two sites in S E Scotland. This race is very similar to 58C, but with added virulence on Thatcher, possessing the Yr7 gene for resistance. Races with virulence on Thatcher have not been recorded in Britain by previous surveys.

In the eleven races identified in 1971, there are at least five genes for virulence, in various combinations. Races able to overcome resistance derived from the Yr3 gene in Cappelle-Desprez occur most frequently in the rust population. The races are able to overcome all sources of resistance frequently used in breeding programmes in Britain, only the Yr5 and Yr8 resistance genes still confer resistance. However, there are now no varieties grown in Britain resistant at the seedling stage to races identified in Britain, with the exception of those derived from wheat-rye hybrids.

YELLOW RUST - BARLEY

KILMAR - 1980-1981

NATIONAL INSTITUTE OF AGRICULTURAL BOTANY - CAMBRIDGE

N.H.CHAMBERLAIN AND JULIA SMITH

Five samples of barley yellow rust were sent to the NIAB during 1971. All samples were from spring varieties, one each from the following - Akka, Imber, Lofa Abed, Midas and Proctor.

2. RACE IDENTIFICATION

Full results of samples successfully tested are given in Table 6.

Table 6 YELLOW RUST OF BARLEY - RACE IDENTIFICATION

Location	NIAB Code No: B/71/-	Date of Reception 1971	Variety	Race
<u>West Midlands</u>				
Cheshire				
Farndon, Chester	1	10/6	Lofa Abed	24
	2	"	Imber	24
<u>South Eastern Region</u>				
Oxfordshire				
Oxford	3	28/6	Akka	23

One sample was found to be brown rust, a second failed to establish.

Sample	Material	Method	Antibiotic	Antibiotic	Additional
1	Whole plant	Wet	N/A	N/A	
2	Whole plant	Wet	N/A	N/A	
3	Whole plant	Wet	N/A	N/A	
4	Whole plant	Wet	N/A	N/A	
5	Whole plant	Wet	N/A	N/A	
6	Whole plant	Wet	N/A	N/A	
7	Whole plant	Wet	N/A	N/A	
8	Whole plant	Wet	N/A	N/A	
9	Whole plant	Wet	N/A	N/A	
10	Whole plant	Wet	N/A	N/A	
11	Whole plant	Wet	N/A	N/A	
12	Whole plant	Wet	N/A	N/A	
13	Whole plant	Wet	N/A	N/A	
14	Whole plant	Wet	N/A	N/A	
15	Whole plant	Wet	N/A	N/A	
16	Whole plant	Wet	N/A	N/A	
17	Whole plant	Wet	N/A	N/A	
18	Whole plant	Wet	N/A	N/A	
19	Whole plant	Wet	N/A	N/A	
20	Whole plant	Wet	N/A	N/A	
21	Whole plant	Wet	N/A	N/A	
22	Whole plant	Wet	N/A	N/A	
23	Whole plant	Wet	N/A	N/A	
24	Whole plant	Wet	N/A	N/A	
25	Whole plant	Wet	N/A	N/A	
26	Whole plant	Wet	N/A	N/A	
27	Whole plant	Wet	N/A	N/A	
28	Whole plant	Wet	N/A	N/A	
29	Whole plant	Wet	N/A	N/A	
30	Whole plant	Wet	N/A	N/A	
31	Whole plant	Wet	N/A	N/A	
32	Whole plant	Wet	N/A	N/A	
33	Whole plant	Wet	N/A	N/A	
34	Whole plant	Wet	N/A	N/A	
35	Whole plant	Wet	N/A	N/A	
36	Whole plant	Wet	N/A	N/A	
37	Whole plant	Wet	N/A	N/A	
38	Whole plant	Wet	N/A	N/A	
39	Whole plant	Wet	N/A	N/A	
40	Whole plant	Wet	N/A	N/A	
41	Whole plant	Wet	N/A	N/A	
42	Whole plant	Wet	N/A	N/A	
43	Whole plant	Wet	N/A	N/A	
44	Whole plant	Wet	N/A	N/A	
45	Whole plant	Wet	N/A	N/A	
46	Whole plant	Wet	N/A	N/A	
47	Whole plant	Wet	N/A	N/A	
48	Whole plant	Wet	N/A	N/A	
49	Whole plant	Wet	N/A	N/A	
50	Whole plant	Wet	N/A	N/A	
51	Whole plant	Wet	N/A	N/A	
52	Whole plant	Wet	N/A	N/A	
53	Whole plant	Wet	N/A	N/A	
54	Whole plant	Wet	N/A	N/A	
55	Whole plant	Wet	N/A	N/A	
56	Whole plant	Wet	N/A	N/A	
57	Whole plant	Wet	N/A	N/A	
58	Whole plant	Wet	N/A	N/A	
59	Whole plant	Wet	N/A	N/A	
60	Whole plant	Wet	N/A	N/A	
61	Whole plant	Wet	N/A	N/A	
62	Whole plant	Wet	N/A	N/A	
63	Whole plant	Wet	N/A	N/A	
64	Whole plant	Wet	N/A	N/A	
65	Whole plant	Wet	N/A	N/A	
66	Whole plant	Wet	N/A	N/A	
67	Whole plant	Wet	N/A	N/A	
68	Whole plant	Wet	N/A	N/A	
69	Whole plant	Wet	N/A	N/A	
70	Whole plant	Wet	N/A	N/A	
71	Whole plant	Wet	N/A	N/A	
72	Whole plant	Wet	N/A	N/A	
73	Whole plant	Wet	N/A	N/A	
74	Whole plant	Wet	N/A	N/A	
75	Whole plant	Wet	N/A	N/A	
76	Whole plant	Wet	N/A	N/A	
77	Whole plant	Wet	N/A	N/A	
78	Whole plant	Wet	N/A	N/A	
79	Whole plant	Wet	N/A	N/A	
80	Whole plant	Wet	N/A	N/A	
81	Whole plant	Wet	N/A	N/A	
82	Whole plant	Wet	N/A	N/A	
83	Whole plant	Wet	N/A	N/A	
84	Whole plant	Wet	N/A	N/A	
85	Whole plant	Wet	N/A	N/A	
86	Whole plant	Wet	N/A	N/A	
87	Whole plant	Wet	N/A	N/A	
88	Whole plant	Wet	N/A	N/A	
89	Whole plant	Wet	N/A	N/A	
90	Whole plant	Wet	N/A	N/A	
91	Whole plant	Wet	N/A	N/A	
92	Whole plant	Wet	N/A	N/A	
93	Whole plant	Wet	N/A	N/A	
94	Whole plant	Wet	N/A	N/A	
95	Whole plant	Wet	N/A	N/A	
96	Whole plant	Wet	N/A	N/A	
97	Whole plant	Wet	N/A	N/A	
98	Whole plant	Wet	N/A	N/A	
99	Whole plant	Wet	N/A	N/A	
100	Whole plant	Wet	N/A	N/A	
101	Whole plant	Wet	N/A	N/A	
102	Whole plant	Wet	N/A	N/A	
103	Whole plant	Wet	N/A	N/A	
104	Whole plant	Wet	N/A	N/A	
105	Whole plant	Wet	N/A	N/A	
106	Whole plant	Wet	N/A	N/A	
107	Whole plant	Wet	N/A	N/A	
108	Whole plant	Wet	N/A	N/A	
109	Whole plant	Wet	N/A	N/A	
110	Whole plant	Wet	N/A	N/A	
111	Whole plant	Wet	N/A	N/A	
112	Whole plant	Wet	N/A	N/A	
113	Whole plant	Wet	N/A	N/A	
114	Whole plant	Wet	N/A	N/A	
115	Whole plant	Wet	N/A	N/A	
116	Whole plant	Wet	N/A	N/A	
117	Whole plant	Wet	N/A	N/A	
118	Whole plant	Wet	N/A	N/A	
119	Whole plant	Wet	N/A	N/A	
120	Whole plant	Wet	N/A	N/A	
121	Whole plant	Wet	N/A	N/A	
122	Whole plant	Wet	N/A	N/A	
123	Whole plant	Wet	N/A	N/A	
124	Whole plant	Wet	N/A	N/A	
125	Whole plant	Wet	N/A	N/A	
126	Whole plant	Wet	N/A	N/A	
127	Whole plant	Wet	N/A	N/A	
128	Whole plant	Wet	N/A	N/A	
129	Whole plant	Wet	N/A	N/A	
130	Whole plant	Wet	N/A	N/A	
131	Whole plant	Wet	N/A	N/A	
132	Whole plant	Wet	N/A	N/A	
133	Whole plant	Wet	N/A	N/A	
134	Whole plant	Wet	N/A	N/A	
135	Whole plant	Wet	N/A	N/A	
136	Whole plant	Wet	N/A	N/A	
137	Whole plant	Wet	N/A	N/A	
138	Whole plant	Wet	N/A	N/A	
139	Whole plant	Wet	N/A	N/A	
140	Whole plant	Wet	N/A	N/A	
141	Whole plant	Wet	N/A	N/A	
142	Whole plant	Wet	N/A	N/A	
143	Whole plant	Wet	N/A	N/A	
144	Whole plant	Wet	N/A	N/A	
145	Whole plant	Wet	N/A	N/A	
146	Whole plant	Wet	N/A	N/A	
147	Whole plant	Wet	N/A	N/A	
148	Whole plant	Wet	N/A	N/A	
149	Whole plant	Wet	N/A	N/A	
150	Whole plant	Wet	N/A	N/A	
151	Whole plant	Wet	N/A	N/A	
152	Whole plant	Wet	N/A	N/A	
153	Whole plant	Wet	N/A	N/A	
154	Whole plant	Wet	N/A	N/A	
155	Whole plant	Wet	N/A	N/A	
156	Whole plant	Wet	N/A	N/A	
157	Whole plant	Wet	N/A	N/A	
158	Whole plant	Wet</			

BROWN RUST - BARLEY

WELSH PLANT BREEDING STATION, ABERYSTWYTH

B.C. CLIFFORD AND R.B. CLOTHIER

1. During 1971, 131 samples of barley brown rust were received at the WPBS.

The number of samples collected from winter varieties is given in Table 7, those from spring varieties in Table 8.

Table 7

Winter Barley	No. of Samples
Maris Otter	12
Mirra	6
Senta	6
Astrix	1
TOTAL	25

Table 8

Spring Barley	No. of Samples
Berac	12
Lofa Abed	12
Sultan	12
Hassan	9
Imber	9
Mazurka	9
Vada	8
Gerkra	7
Proctor	5
Akka	4
Midas	4
Clermont	1
Emir	1
Zephyr	1
TOTAL	94

A further twelve samples were received from the varieties Duplex, Estate,

Gravpenkorn, Groundkeeper, Jet, Kobai Saitama, Nessa, Vic 1, Vulcan and an unknown variety and from the winter wheats Cama and Maris Beacon.

2. RACE IDENTIFICATION

Full results of samples successfully tested are given in Table 9

Table 9. Brown Rust of Barley - Race Identification

Location	WPBS Code No BRB 71/-	Date of Reception 1971	Variety	Race
<u>Yorks and Lancs Region</u>				
Yorkshire	28	18/6	Maris Otter	Mixture
	35	29/6	Maris Otter	B+
	36	"	Mirra	F
	37	"	Senta	F
	47	6/7	Akka	E
	50	"	Midas	Mixture
	51	"	Proctor	Mixture
	52	"	Sultan	E+
	65	8/7	Midas	E

Table 9 Continued

Location	WPBS Code No BRB 71/-	Date of Reception 1971	Variety	Race
<u>Yorks and Lancs Region(Cont'd)</u>				
Yorkshire(Cont'd)	66	8/7	Sultan	E
<u>East Midlands</u>				
Lincolnshire	5	26/4	Maris Otter	Mixture
<u>West Midlands</u>				
Cheshire	16	9/6	Imber	F+
	18	"	Maris Otter	F+
	19	"	Senta	F
	21	"	Vada	E
Herefordshire	12	"	Maris Otter	E
	57	"	Gerkra	E
	58	"	Hassan	Mixture
	59	"	Imber	E
	61	"	Mazurka	E
	62	"	Sultan	E+
<u>Eastern Region</u>				
Cambridgeshire				
Cambridge	30	21/6	Duplex	E
	31	"	Gravpenkorn	Mixture
	32	"	Kobai Saitama	E
	33	"	Maris Otter	E
Norfolk	29	"	Maris Otter	A
	39	28/6	Berac	Mixture
	40	"	Gerkra	E
	41	"	Hassan	F
	42	"	Imber	E
	43	"	Lofa Abed	Mixture
	44	"	Mazurka	E
	45	"	Sultan	Mixture
	53	5/7	Imber	E
	99	15/7	Gerkra	E+
	101	"	Imber	Mixture
	102	"	Lofa Abed	E+
	103	"	Mazurka	E+
	104	"	Midas	E+
<u>South Eastern Region</u>				
Hampshire	6	27/4	Mirra	F
	8	"	Maris Otter	F+
Kent	22	9/6	Maris Otter	F
	23	"	Mirra	F
	24	"	Senta	E
	108	19/7	Berac	E+
	109	"	Gerkra	F+
	110	"	Hassan	F+
	111	"	Imber	F+
	112	"	Lofa Abed	E+
	113	"	Mazurka	E+
	114	"	Sultan	E
	115	"	Vada	E
Sussex	72	11/7	Imber	F+
<u>South Western Region</u>				
Cornwall	15	9/6	Senta	F
	84	12/7	Berac	F
	85	"	Hassan	F
	86	12/7	Mazurka	F
	87	"	Sultan	F
Devon	90	14/7	Berac	F
	91	"	Gerkra	E+
	92	"	Hassan	F
	93	"	Imber	F
	94	"	Lofa Abed	E+
	95	"	Mazurka	F
	96	"	Sultan	E+

Table 9 Continued

Location	WFBS Code No BRB 71/-	Date of Reception 1971	Variety	Race
<u>South Western Region</u>				
(cont'd)				
Devon (Con't)	129	23/8	Lofa Abed	F
	130	"	Maris Otter	R+
	131	"	Mazurka	E+
Dorset	73	13/7	Berac	F
	74	"	Gerka	F
	75	"	Hassan	F
	76	"	Imber	F
	77	"	Lofa Abed	F
	78	"	Mazurka	F
	79	"	Sultan	F
Wiltshire	10	10/5	Mirra	Mixture
	25	15/6	Maris Otter	F
	26	"	Mirra	F
	27	"	Senta	E
	88	13/7	Berac	F+
	89	"	Lofa Abed	F
<u>Wales</u>				
Anglesey	119	"	Midas	E
	120	"	Proctor	F+
	121	"	Zephyr	E
Cardiganshire	14	4/6	Jet	?
	54	8/7	Unknown	Mixture
	123	2/8	Emir	E
	124	"	Estate	E+
<u>Scotland</u>				
W. Lothian	116	21/7	Akka	F
Perthshire	126	9/8	Akka	B+
	128	"	Proctor	E+
<u>Ireland</u>				
Co. Kildare	34	24/6	Groundkeeper	E+
	107	16/7	Nessa	E+

No brown rust was found on ten of the samples, twenty eight of the remaining 119 failed to establish. The predominant races were races E(39 samples) and F (38 samples.) These races are both widely virulent differing only in the ability of race F to infect Reka 1. One each of races A and H were identified and two of race B. One sample has not yet been identified, and the remaining eleven samples proved to be mixtures of races.

CROWN RUST - OATS

(Lemurian) at side T

WELSH PLANT BREEDING STATION ABERYSTWYTH

B.C.CLIFFORD AND R.B.CLOTHIER

1. During 1971, thirty-five samples of oat crown rust were received at the WPBS. The number of samples collected from winter varieties are given in Table 10, spring varieties in Table 11.

Table 10

Winter Oats	No. of Samples
Maris Quest	5
Peniarth	3
Pendrwm	2
TOTAL	10

Table 11

Spring Oats	No. of Samples
Mostyn	5
Manod	3
Selma	2
TOTAL	10

One sample was received from each of the following fifteen varieties - selection from Creme, Dyfed, Karin, Landhafer, Pendrwm, W1010, 03004 Cn29, 03314 Cn, 04434 Cn 22/18/19, 04434 Cn 31/6/159, 04435 Cn 6/43/88, 04435 Cn 8/56/1, 8786 Cn 25/10/154, 9065 Cn 6/3/74, Tall Oat Grass.

2. RACE IDENTIFICATION

Full results of samples successfully tested are given in Table 12.

Table 12 Crown Rust of Oats Race Identification

Location	WPBS Code No CRS 71/-	Date of Reception 1971	Variety	Race
<u>Eastern Region</u>				
Cambridge	27	26/8	Maris Quest	(251)
	29	"	Selma	229
	30	"	Mostyn	229
	31	"	9065 Cn 6/3/74	251
<u>South Western Region</u>				
Cornwall	12	19/7	Manod	(330)
	13	"	Maris Quest	235
	14	"	Mostyn	289
	15	"	Pendrwm	229
	16	"	Peniarth	289
	17	"	Selma	()
Devon	11	14/7	Maris Quest	234
	24	23/8	Karin	Mixture
	25	"	Maris Quest	(251)
	26	"	Pendrwm	251

Table 12(continued)

Location	WPBS Code No. LRS 71/-	Date of Reception 1971	Variety	Race
<u>Wales</u>				
<u>Cardiganshire</u>	2	7/7	Maris Quest	251
	3	"	Peniarth	289
	4	"	W.1010	229
	5	7/7	03314 Cn	(251)
	7	"	04434 Cn 31/6/159	289
	8	"	04435 Cn 6/43/88	272
	9	"	04435 Cn 8/56/1	229
	10	"	8786 Cn 25/10/154	234
	18	19/7	Selection from Creme	251
	19	"	Landhafer	265
	20	"	Manod R	471
	21	"	Manod R7	251
	22	"	Purdue	251
	23	17/8	Mostyn	229
	33	1/9	Mostyn	289
	35	16/9	03004 Cn 29	(280)

() confirmatory test in progress

Five samples failed to establish, one of which was from Tall Oat-grass. The most commonly occurring races were 229 and 251 (six samples from each). A race previously unrecorded in Britain, 289, was detected in five samples. It has limited virulence and is similar to the known race 272 and does not therefore represent an important departure from the known spectrum of virulence. One sample each of the Landhafer-virulent race 265 and the Victoria-virulent race 471 was detected in Cardiganshire. Other races identified were 234(two samples), 235 and 272, while one sample was a mixture of races. Confirmatory tests are in progress on the remaining six samples.

MILDEW WHEAT

PLANT BREEDING INSTITUTE, CAMBRIDGE

M.S. WOLFE

1. During 1971, 265 samples of wheat mildew were sent to the PBI. Winter varieties from which samples were received are given in Table 13, spring varieties in Table 14.

Table 13

Winter wheat	No. of samples
Cappelle Desprez	26
Cana	23
Maris Beacon	19
Maris Nimrod	19
Maris Templar	12
Joss Cambier	9
Armentieres	5
Heima Desprez	5
Maris Ploughman	5
Maris Ranger	5
Tommy	5
Cebeco 148	4
FD 2813/55	4
Maris Huntsman	4
VR 477	3
Banno	2
Champlain	2
Hybrid 46	2
TJB 75A	2
Bouquet	1
Caribo	1
FD 2912	1
FD 2915/253	1
Kid	1
Lepeupule 5	1
Maris Butler	1
Maris Widgeon	1
MR 22	1
Noreste 66	1
Rubis	1
Tourack (TF 1666)	1
Val	1
TOTAL	169

Table 14

Spring wheat	No. of samples
Kolibri	21
Kleiber	13
Cardinal	10
Sirius	9
Maris Dove	7
Maris Ensign	6
Maris Halberd (TW 130/11)	5
Rask	3
Tilly	3
TW 74/34/9	3
WR 112/79/73/7	2

Table 14 Continued

Spring wheat	No. of samples
BW 21/31/4	1
BW 57/16	1
BW 73/12	1
Dart (SV 61474)	1
Hope x Timstein	1
Maris Butler	1
Opal	1
Redman	1
Selkirk	1
TP 241	1
TP 260	1
Universe	1
Weih M1	1
TOTAL	95

One sample was collected from wild oats growing in a crop of wheat.

2. RACE IDENTIFICATION

Full results of samples successfully tested are given in Table 15.

Table 15. MILDEW OF WHEAT - RACE IDENTIFICATION

Location	PBI Code No W71/	Date of Reception 1971	Variety	Race
<u>Northern Region</u>				
Durham				
Sandberwe	222 224	2/7 "	M Beacon M Nimrod	21 25
<u>Northumberland</u>				
Cockle Park	251 253 259 260	22/7 " " "	Cama Cappelle Kolibri M Ensign	13 16 13 13
<u>Yorks and Lancs Region</u>				
Lancashire				
Rainford	225	2/7	Kolibri	13
Bilsborrow	108	17/6	Cama	13
Yorkshire				
Headley Hall	166 168 169 170 173 174 176 178 179 182 277	30/6 " " " " " " " " " 29/7	Rask TW 74/34/9 TW 130/11 WR 112/79/73/7 Cama Cappelle Cebecco 148 Kleiber Kolibri M Huntsman? Cardinal	now 13 NYT 14 14 26 3 13 13 new no 67
<u>East Midlands</u>				
Lincolnshire				
Deene	147 152 153 155	25/6	Cama Maris Nimrod Maris Ranger Tommy	14 13 13 13
Dry Doddington	210 212 213 217	1/7 " " "	Maris Ranger Joss Cambier Heima Desprez Armentieres	19 13 14 14
Spalding	11	5/5	Cama	13
Sutterton	162	28/6	Benno	NYT
Weston	23	20/5	Maris Dove	14

Table 15. Continued

Location	PBI Code No 71/	Date of Reception 1971	Variety	Race
Weston (Cont)	24 25	20/5 "	Kolibri Kleiber	14 14
Northamptonshire Moulton	35 38	24/5 "	Bouquet Maris Nimrod	13 13
Nottinghamshire Widmerpool	190 192 193 198	30/6 " " "	Cappelle Cama Joss Cambier Armentieres	13 13 13 14
West Midlands				
Herefordshire Rosemaund	15 17 18 19	12/5 " " "	Cappelle Maris Beacon Maris Nimrod Maris Nimrod	35 22 3 13
Shropshire Harper Adams	122 123 125	24/6 " "	Cama Cappelle FD 2813/55	13 14 3
Eastern Region				
Cambridgeshire PBI	3	31/12	Maris Beacon	25
Norfolk Morley	238 186 187 188 250	" 30/6 " " 21/7	Weih M1 Cappelle Maris Nimrod Cama Maris Dove	new 15 7 13 25
Terrington	90 93 94 95 96 97 98 100 104 245	15/6 " " " 16/6 " " " " 15/7	Kleiber Maris Ensign Sirius WR 112/79/73 Cama Cappelle Cebeco 148 Maris Beacon VR 477 TW 130/11	13 13 14 NYT 13 13 26 21 4 new no 67
South Eastern Region				
Buckinghamshire Fingest	231 234 235 237	8/7 " " "	Kolibri Cappelle Cebeco 148 Cardinal	13 13 16 new
Kent Wye College	61 84 86 88	8/6 11/6 " "	Maris Ensign Cama Maris Nimrod Cappelle	14 13 18 16
South Western Region				
Bristol Westbury-on-Trym	8 9	20/4 "	Cama Cappelle	13 0
Devon Starcross Wembury	73 268 270	10/6 22/7 "	Maris Beacon Cama Maris Beacon	33 13 new no 51
Dorset Chideock	220	2/7	Wild Oats	Oat mildew
Gloucestershire Tetbury	208	1/7	Cappelle	14

Table 15 Continued

Location	PBI Code No 771/	Date of Reception 1971	Variety	Race
<u>Wales</u>				
Anglesey	117	22/6	Kolibri	13
Cardiganshire				
Trawscoed	261	22/7	Cardinal	new 67
	266	"	Tilly	new 67
Monmouthshire				
Cleppa Park	119	23/6	Cama	13
<u>Northern Ireland</u>				
Co Armagh				
Loughgall	22	18/5	Hybrid 46	0
	46	27/5	Redman	13
	48	"	Rubis	3
Co Down				
Crossnacreevy	64	9/6	Hybrid 46	14
	65	"	Joss Cambier	14
	69	"	Cappelle	13
	74	10/6	Val	14
	77	"	FD 2912	13
	82	"	TF 1666	13
	83	"	TJB 75A	13

Table 16 gives a summary of the races of wheat mildew identified, and the varieties from which they were collected. The relative frequency of the races is shown in table 17, and the isolates obtained from resistant varieties are shown in tables 18 and 19.

Table 16. RACES OF MILDEW IDENTIFIED FROM SPECIFIC VARIETIES

Variety	0	3	4	7	13	14	15	16	18	19	21	22	25	26	33	35	"51"	"67"	Total
Cama					11	3													14
Cappelle	1				4	3	1	2											12
Kolibri					5	1													6
Maris Ninrod	1		1		2				1										6
Maris Beacon																			7
Kleiber	1				1	1													3
Maris Ensign					2	1													3
Joss Cambier					2	1													3
Hybrid 46	1					1													2
Maris Ranger					1					1									2
Armentieres							2												2
Maris Dove						1						1							2
Cebeco 148							1						2						3
Cardinal																			3
TW 130/11					1														2
FD 2813/55		1																	1
VR 477			1																1
TF 1666				1															1
Heima Desprez						1													1
Sirius							1												1
Maris Templar					1														1
Bouquet						1													1
Redman						1													1
TJB 75A					1														1
Maris Huntsman						1													1

Table 16. Continued

Variety	Race number																		Total
	0	3	4	7	13	14	15	16	18	19	21	22	25	26	33	35	"51"	"67"	
FD 2912					1														1
Tommy					1														1
Val						1													1
Tilly																			1
Rubis			1																1
Weih M1																			1
TW 74/34/9																			1
TOTAL	2	4	1	1	37	17	1	3	1	1	2	1	3	2	1	1	2	7	87

Table 17. RELATIVE FREQUENCY OF RACES IN 1968, 1969, 1970 and 1971

Races	0	2	3	4	7	8	9	10	13	14	15	16	18	19	21	22	23	25	26	27	32	33	35	39	"51"	"67"	Absolute Total
1968	5	2	20	3	-	-	-	-	26	4	4	20	1	1	-	-	-	-	8	1	-	-	8	-	-	152	
1969	-	-	15	4	-	4	1	4	29	4	1	10	1	4	2	-	1	-	14	-	2	1	4	-	-	81	
1970	3	-	16	3	3	3	-	-	28	7	3	16	7	-	-	-	2	1	2	-	2	2	-	2	-	72	
1971	2	-	5	1	1	-	-	-	43	20	1	4	1	1	2	1	-	4	2	-	-	1	1	-	2	8	87
No of diff's infected	0	1	1	2	2	3	3	4	2	1	2	3	3	2	2	3	2	3	3	3	2	5	4	4	4	3	

Table 18. ISOLATES OBTAINED FROM RESISTANT VARIETIES

Variety	No of samples	No vir on host vars	No avir on host vars	No FTE
Cardinal	10	3, race "67" (1, race "67")*	0	7
Tilly	3	(1, race "67")*	0	2
Rask	3	0	(1, NYT)*	2
TW 130/11	5	(1, race "67")*	(1, race 13)*	3
TW 74/34/9	3	(1, race "67")*	0	2
Weih M1	1	1, race "67"	0	0
Cebeco 148	4	(2, race 26)##	(1, race 13)##	1
VR 477	3	(1, race 4)##	0	2

* - not tested on host variety, but virulent or avirulent on Cardinal, TP 229

and ELS, which have the same resistance gene, Mle from T. carthlicum.

- not tested on host variety, but virulent or avirulent on St. 14/44, which has the same resistance gene, Mlh.

Virulence for the Mle resistance allele derived from T. carthlicum, first observed in 1970, was confirmed in 1971. Twenty five samples from six varieties with the Mle resistance were received from widespread locations. From these, seven isolates of a new race type, provisionally labelled "67", were determined. This is the same as the most common race, 13, with the addition of Mle virulence.

The occurrence of isolates of races 4 and 26, which posses virulence for the rye chromosome addition line St 14/44, on VR 477 and Cebeco 148, indicates that these varieties, which were derived from wheat/rye hybrids, possess the same resistance as St 14/44. Virulence for St 14/44 is relatively common in the wheat mildew population.

Table 19. ISOLATES OBTAINED FROM RESISTANT VARIETIES

Variety	No of samples	Races determined		No FTE
		virulent on Pm2	avirulent on Pm2	
Maris Beacon	19	6 - races 21, (2) 22, 25, 33, "51"	0	13
Maris Ninrod	19	3 - races 7, 18, 25	3 - races 3, 13(2)	13
Maris Templar	12	0	1, race 13	11
Maris Ploughman	5	-	-	5
Maris Huntsman	4	0	1, race 13	3
Maris Dove	7	1, race 25	1, race 14	5

The relationship between the resistance of Maris Dove, derived from T. durum, and the resistance of other Plant Breeding Institute varieties derived from T. timopheevi, was confirmed. Maris Beacon and Maris Ninrod appear to possess only the Mla (Pm2) resistance allele, whilst Maris Templar and Maris Huntsman possess resistance in addition to Pm2. No isolates fully virulent on the latter two varieties were identified in 1971. Maris Dove also possesses Mla and additional resistance, but the additional resistance is different from that in Maris Templar and Maris Huntsman. An isolate of race 25 was obtained from Maris Dove and is virulent on that variety. Similar isolates were obtained from Maris Beacon and Maris Ninrod which are able to attack Maris Dove.

PATHOGEN POPULATION STRUCTURE

Analyses of frequencies of virulence genes in the wheat and barley mildew populations and of observed and expected race frequencies show that reassortment of virulence genes in the pathogen is almost entirely random. One implication of this is that complex races, that is those with many virulence genes, will tend to occur with a low frequency purely by chance and not necessarily as a result of lower aggressiveness when compared with simpler races.

Exceptions to the random reassortment occur in both wheat and barley mildew and these may represent points of interest to the breeder, since in each case the observed frequency of particular virulence gene combinations is less than expected.

MILDEW - BARLEY

PLANT BREEDING INSTITUTE - CAMBRIDGE

M.S.WOLFE

1. During 1971, 361 samples of barley mildew were sent to the PBI.

The number of samples collected from winter varieties is given in Table 20, spring varieties in Table 21.

Table 20

Winter Barley	No. of Samples
Maris Otter	30
Senta	13
Mirra	9
Malta	4
Astrix	1
Engelen 2300	1
Lepeuple 206	1
TOTAL	59

Table 21

Spring Barley	No. of Samples
Julia	30
Proctor	30
Sultan	28
Midas	27
Hassan	22
Lofa Abed	17
Deba Abed	13
Clermont	12
Vada	12
Zephyr	12
Impala	9
Akka	5
Berac	5
Pallas	5
Drake	4
Gerkra	4
Imber	4
Maris Imp	4
Universe (139/251)	4
Wing	4
Freegold	3
Mazurka	3
Samantha (W144164)	3
Goldfield (155/49)	2
Maris Canon	2
Tern	2
Cavalier	1
Cebeco 6501	1
Feronia	1
Golden Promise	1
HB 411	1
HMS 659 M118	1
Hornisse	1
Knook	1
Kristina	1
Maris Mink	1
Premi (W42467)	1
RPB 3269	1
RPB 11069	1
Sabarlis	1
SJ 678060	1
Stockton	1
SV66438	1
Varunda (IVP63/10)	1
TOTAL	284

varieties:- Barba, Batna, Bolivia, Cebada Capa, Crusader, Egypt 4, Estate, Gold, Hunter, Nessa, Peruvian, Quinn, Reka I, Ricardo, Sudan and Tellus. One sample was from an unknown variety and one from Agropyron repens growing in a barley crop.

2. RACE IDENTIFICATION

Detailed results of samples successfully tested are given in Table 22.

Table 22 MILDEW OF BARLEY - RACE IDENTIFICATION

Location	PBI Code No. B71/	Date of Reception 1971	Variety	Race
<u>Northern Region</u>				
Cumberland				
Langwathby	88	7/6	Clermont	B12-S
	89	"	Deba Abed	C2-S
	90	"	Drake	C6
	91	"	IVP 63-10	A23-S
	93	"	Lofa Abed	D1
	94	"	Midas	C4
	141	21/6	Maris Imp (HB551/48)	C2-S
Northumberland				
Cockle Park	312	22/7	Deba Abed	B3
	321	"	Lofa Abed	A7
Norham	253	9/7	Julia	C2
	254	9/7	Midas	C5
	255	"	139/251	new, 10, 1
	256	"	Sultan	A7-S
<u>Yorks and Lancs Region</u>				
Lancashire				
Culcheth	222	2/7	Hassan	A3-S
	224	"	Midas	C10
	225	"	Julia	C5
Myerscough	123	17/6	Wing	C13
	124	"	Deba Abed	C10
	125	"	Proctor	B3-S
	127	"	Julia	C5
	128	"	Sultan	new, 26e, 1
	129	"	Clermont	C5
	130	"	Midas	C5-S
	131	"	Akka	C13-S
	132	"	Hassan	new, 2, 1
	133	"	Lofa Abed	E1-S
	134	"	Vada	C5-S
	136	"	Senta	C5-S
	137	"	Mirra	new, 54e
Yorkshire				
Headley Hall	178	30/6	Cebeco 6501	new, 26, 1
	179	"	Deba Abed	C10
	180	"	Drake	C10
	182	"	Hassan	C9-S
	183	"	Maris Imp	18e, 1
	184	"	Hornisse	C13
	185	"	Julia	C4
	186	"	Lofa Abed	new, 62
	187	"	Midas	C26
	188	"	Mirra	C2-S
	189	"	Proctor	new, 2, 1
	191	"	RPB11069	C7-S
	192	"	Senta	new, 2, 1
	193	"	SJ678060	B12
	194	"	Sultan	A7-S
	196	"	Vada	AO

Table 22 continued

Location	PBI Code No. B71/	Date of Reception 1971	Variety	Race
Sand Hutton	246	9/7	Midas	new, 54
	248	"	Julia	C2
South Milford	100	9/6	Proctor	A23-S
	101	"	Proctor (Calixin treated)	A23
	102	"	Zephyr	C9
<u>East Midlands</u>				
Lincolnshire				
Weston, Spalding	35	28/4	Lofa Abed	A23-S
	36	"	Deba Abed	C10
	37	"	Midas	C10
	38	"	Proctor	C4-S
	39	5/5	Sultan	A7-S
	40	"	Mazurka	D3-S
	41	"	Julia	C2
	42	"	Hassan	A0-S
	69	20/5	Clermont	C2
	70	"	Impala	C5
<u>West Midlands</u>				
Cheshire				
Farndon, Chester	105	10/6	Drake	new, "B1"
	106	"	Akka	new, 251, 1
Herefordshire				
Rosemaund	161	24/6	Proctor	D1-S
	162	"	Julia	C5
	163	"	Impala	C10
	164	"	Midas	C26
	165	"	Deba Abed	C10
	166	"	Clermont	A7-S
	167	"	Hassan	A23-S
Shropshire				
Harper Adams	159	24/6	Vada	C9
	160	"	139/251	C10-S
Newport	72	27/5	Julia	C10
	74	"	Midas	C5
	75	"	Hassan	A7-S
Staffordshire				
Trysull, Wolverhampton	205	30/6	Midas	C5-S
	206	"	Lofa Abed	C6
	207	"	Sultan	mixed
	208	"	Vada	C2
<u>Eastern Region</u>				
Cambridge				
PBI	56	19/5	Maris Canon	C10
	57	"	HB411	C5
	58	"	Maris Imp	new, 146, 1
	59	"	Maris Mink	C5-S
	87	4/6	Maris Canon	C10
Hertfordshire				
Rothamsted	175	29/6	Senta	D3-S
	176	"	Midas	C10
	177	"	Julia	C2-S
Norfolk				
Brancaster	27	17/3	M Otter (Milstem)	A3-S
	30	"	M Otter (Milstem)	A7-S
Burnham Market	1	2/11/70	Maris Otter	new, 2, 1
	2	"	M Otter (Milstem)	A23-S
	17	17/3	Maris Otter	A3-S
	22	"	Maris Otter	new, 54e, 1
	23	"	Maris Otter	E2-S

Table 22 continued

Location	PBI Code No. B71/	Date of Reception 1971	Variety	Race
Norfolk				
Burnham Market continued	25 26 29 50 51 52	17/3 " " 12/5 " "	Maris Otter Maris Otter Maris Otter M Otter (Milstem) M Otter (Milstem) Maris Otter	new, 54, 1 C5-S C7 B12-S C2 C7-S
Snettisham Choseley	21 53 54	17/3 " "	Maris Otter Proctor (Milstem) Proctor	new, 54e, 1 B3 new, 2, 1
Mattishall Burgh Morley	3 202 203 204	9/11/70 30/6 " "	Maris Otter Clermont Deba Abed Proctor	C5-S D1-S C10 D6-S
Ringstead Terrington	43 110 111 112 113 114 115 116 117 118 119	5/5 15/6 " " " " " " " " 139/251	M Otter (Milstem) Deba Abed Hassan Impala Julia Lofa Abed Midas Proctor Sultan Vada	C5-S C5 A7 C10 C4 A7-S A23 C10
<u>South Eastern Region</u>				
Buckinghamshire				
Fingest	245	8/7	Proctor	new, 2, 1
Kent				
Wye College	95 96 97 98 99 108	8/6 " " " " 11/6	Julia Proctor Midas Hassan Clermont Mirra	C9 C26-S C10 D1-S C5 C4-S
<u>South West Region</u>				
Bristol				
Westbury-on-Trym	32 33 34	20/4 " "	Senta Mirra Malta	C9-S new, 2, 1 C5-S
Dorset				
Wimborne St Giles	68	20/5	Berac	C2
Somerset				
Burrington Liscombe	55 323 324 328		Sultan Midas Julia Lofa Abed	D1-S C5 C4 A7-S
Wiltshire				
Codford	60 61 62 63 65 66	20/5 " " " " "	Zephyr Midas Sabarlis Imber Sultan Julia	C26 C5 C26 C2 A23-S C4-S
Salisbury	139 140	18/6 "	Senta Malta	C2 C5
Wishford	5 6 7	9/11/70 " "	Maris Otter Malta Astrix	C5-S D1-S C5

Table 22 continued

Location	PBI Code No. B71/	Date of Reception 1971	Variety	Race
<u>Wales</u>				
	15	8/1	Pallas	C5-S
	16	"	Pallas	C26
<u>Anglesey</u>	142	22/6	Sultan	new, 66, 1
	155	23/6	Sultan (Milstem)	D5-S
<u>Cardiganshire</u>				
WPBS, Aberystwyth	76	2/6	Deba Abed	C5
	77	"	Hassan	E2-S
	78	"	Julia	C5
	79	"	Impala	E1-S
	81	"	Midas	C5
	82	"	Proctor	C26-S
	83	"	Senta	D3-S
	84	"	Sultan	D5-S
	85	"	Vada	A7
<u>Denbighshire</u>				
Whitchurch	45	6/5	Maris Otter	C10-S
	46	"	M Otter (Milstem)	new, 18e, 1
	47	"	Julia	C4
<u>Scotland</u>				
<u>Peeblesshire</u>				
Biggar	298	20/7	Julia	C5
	299	"	Impala	C26
	301	"	Proctor	A7-S
	302	"	Sultan	D1-S
	303	"	Hassan	A23-S
	304	"	Vada	new, 34, 1
	307	"	Senta	C2-S
<u>West Lothian</u>				
Bo'ness	334	23/7	Impala	C26
	336	"	Proctor	E2
	337	"	Sultan	new, 10, 1
	338	"	Hassan	C10-S
	339	"	Vada	D5-S
	342	"	Senta	D5
<u>Northern Ireland</u>				
<u>Co Antrim</u>				
Aghalee	343	28/7	Proctor	C5
	347	"	Zephyr	C26
<u>Greenmount</u>	143	23/6	Pallas	C4
	144	"	Zephyr	C4-S
	145	"	Sultan	C9-S
	146	"	Julia	C4
	149	"	Imber	C5
	150	"	Berac	
	151	"	Hassan	A7-S
	153	"	Freegold	C7-S
	154	"	W.144164	C2-S
<u>Co Armagh</u>				
Loughgall	309	21/7	Freegold	new, 29e, 1
<u>Co Down</u>				
Ardglass	209	1/7	Pallas	D5-S
	210	"	Zephyr	C6
	211	"	Sultan	A23-S
	212	"	Julia	C10
	215	"	Imber	C5-S
	216	"	Berac	C10
	217	"	Freegold	C2-S
	218	"	W.144164	C2-S
<u>Crossnacreevy</u>	103	10/6	Lepeuple 206	new, 63e, 1
	219	"	W.42467	E2
	220	"	HMS 659M118	C4
	221	"	155/49	C6-S

TABLE 22 CONTINUED

Location	PBI Code No. B71/	Date of Reception 1971	Variety	Race
Co Down				
Crossnacreevy	234	7/7	Stockton	B3
continued	235	"	Knook	C5
	238	"	Zephyr	C26
	239	"	W.144164	B3-S
	240	"	Cavalier	A7
	241	"	Kristina	C10
	242	"	155/49	new, 2, 1
Donaghadee	120	16/6	Zephyr	new, "Bl-S"
	121	"	Sultan	C14-S

Table 23 RELATIVE FREQUENCIES OF RACES FOUND IN 1971 GROUPED BY THE VARIETY FROM WHICH THEY WERE COLLECTED AND BY THEIR MAJOR RACE GROUP

Race group	Variety group							Absolute total
	O	Mlg	Mlh	Mla ₆	Impala	Sultan	Vada	
Proctor, O	31	0	9	0	0	39	20	54
Europa, Mlg	34	37	10	0	0	12	7	41
Impala Mlg+Mla ₆	24	34	6	21	9	1	5	82
Absolute total	157	43	16	17	8	32	19	177

NOTE:-

Only one isolate of the Concord group was found.
With one exception, all E-group races came from non-Mlg varieties.
The varieties included in the groups above are as follows:-
no known genes: Proctor, Pallas, Clermont, M Otter, Kristina, HMS659M118, Freegold, W.144164, Cavalier, Berac.
Mlg: Julia, Zephyr, Imber, Deba, Drake, Gerkra, Stockton, Knook.
Mlh: Mirra, Astrix, Lepeuple 206, Malta, Senta.
Mla₆: Midas, HB411, Sabarlis.
Impala: Impala, Maris Canon.
Sultan: Sultan, Hassan, W.42467, 155/49.
Vada: Vada, Universe, Lofa Abed, Varunda, RPBl1069.

Table 24 shows the change in the proportion of Impala virulent isolates.

Table 24

Proportion of Impala vir isol.	1967	1968	1969	1970	1971
	77	88	65	51	46
Proportion of those obtained from vars. Mlg+Mla ₆	29	35	28	11	4

Many samples were obtained from resistant varieties and the results of these are shown in Table 25.

Table 25 ISOLATES FROM RESISTANT VARIETIES

Variety	No. of Isolates	Reaction on host variety		No FTE
		Virulent	Avirulent	
Lkka	5	2, races Cl3-S, and new 251, 1, not fully virulent-intermediate	-	3
Feronia	1	-	-	1
Wing	4	1, race Cl3	-	3
Hornisse	1	1, race Cl3	-	1
Tern	2	-	-	2
Mazurka	3	0	1, race D3-S	2
Lofa Abed	17	5, races A7(2)A7-S, A23-S, D1, E1-S, C6, new 62.	-	9
Vada	12	5, race A0, A7, A23, new 34, 1, and C2	0	4
		3 isolates not yet tested on Vada - races C9, D5-S, C5-S.		

Table 25 continued

Variety	No. of Isolates	Reaction on host variety		No FTE
		Virulent	Avirulent	
Universe	4	2, races C10, C10-S	1, race new 10, 1	1
IVP63-10	1, race 423-S*	-	-	-
RPB11069	1, race C7-S*	-	-	-
RPB32-69	1	-	-	1

* - not yet tested on host variety.

Two isolates have now been identified which are virulent on varieties derived from Lyallpur 3645. They were obtained from Hornisse at Headley Hall and Wing at Myerscough Hall. Two other isolates obtained from Akka, a Monte Cristo derivative, gave an intermediate reaction on seedling leaves of Akka. All four isolates were virulent on HOR 1063, one of the differential varieties.

From a total of 36 isolates received from Vada and other varieties derived from Hordeum laevigatum, 20 have survived for race testing.

From this group 7 isolates were found to be fully virulent on varieties possessing only the Vada resistance allele, and 1 was avirulent. The 7 virulent isolates were obtained from a wide range of localities and covered a wide range of races from A0-V, ie Vada - virulence only, to C10-SV which possesses at least 9 virulence alleles. The C10-SV isolate and 2 others, C2-V and C10-V are both able to infect varieties possessing the combination of Vada resistance and the M1g resistance allele.

The A0-V isolate grows more vigorously on Vada than on Proctor, Golden Promise and other susceptible varieties. On varieties such as Proctor, it grows less well than a standard isolate of C5, which possesses at least 8 virulence alleles.

NEW RACES

The following races were identified in this country for the first time:

"34,1" virulent on 41/145, Concord and Sultan; B71/304, from Vada.

"10,1" " 41/145, M511, and Sultan, B71/255; from Universe.

B71/337; from Sultan.

"B1-S" " CP127422, Goldfoil, 41/145 and Sultan; B71/120, from Zephyr.

"26,1" " CP127422, Goldfoil, 41/145, 511 and Sultan; B71/178 from Cebeco 6501.

"62" " CP127422, Goldfoil, 41/145, Concord, 511, and 1657; B71/186 from Lofa Abed.

"146,1" virulent on CP127422, Goldfoil, 41/145, H.1063 and Sultan;
B71/58, from HB557/48.

"251,1" " " CP127422, Goldfoil, 37/136, 41/145, Concord, 511,
501, H.1063, Sultan, and intermediate on Akka;
B71/106 from Akka.

"115e,1" " " Goldfoil, 37/136, 41/145, Concord, 501 and Sultan;
B71/9 from Senta.

"29e,1" " " Goldfoil, 37/136, 511, 1657, Sultan; B71/309 from
Freegold.

"26e,1" " " Goldfoil, 41/145, 511, Sultan; B71/111 from Hassan
B71/128 from Sultan.

"54e" " " Goldfoil, 41/145, Concord, 1657; B71/137 from Mirra.

"54e,1" " " Goldfoil, 41/145, Concord, 1657 and Sultan;
B71/21 from Maris Otter.
B71/22 from Maris Otter.

"23e,1" " " Goldfoil, 37/136, 41/145, 1657 and Sultan;
B71/11 from Maris Otter.

SUMMARY

Analyses of frequencies of virulence genes in the wheat and barley mildew populations and of observed and expected race frequencies show that reassortment of virulence genes in the pathogen is almost entirely random. One implication of this is that complex races, that is those with many virulence alleles, will tend to occur with a low frequency purely by chance, and not necessarily as a result of lower aggressiveness when compared with simpler races.

Exceptions to the random reassortment occur in both wheat and barley mildew and these may represent points of interest to the breeder since in each case, the observed frequency of particular virulence gene combinations is less than expected.

Single isolates of both wheat and barley mildew were obtained which exhibited a low degree of tolerance of the fungicide Ethirimol. Both were obtained as glasshouse isolates from Dr R C F Macer and were identified as race 26 of wheat mildew and race C10 of barley mildew. Tests are in progress to determine the aggressiveness of the isolates.

MILDEW - OATS

WELSH PLANT BREEDING STATION - ABERYSTWYTH

I.T.JONES AND R.B.CLOTHIER

1. During 1971, 91 samples of oat mildew were sent to the WPBS. The number of samples collected from winter varieties is given in Table 26, spring varieties in Table 27.

Table 26

Winter Oats	No. of Samples
Peniarth	13
Maris Quest	9
Pendrwm	8
Padarn	2
Total	32

Table 27

Spring Oats	No. of Samples
Condor	13
Mostyn	11
Manod	9
AJB 4/51/B1	3
Maris Titan (AJB 4/1/B2)	3
Nelson (W16711)	3
Selma	3
Astor	2
AJ 13/11	1
Leanda	1
Total	49

One sample was received from each of the following 9 varieties:-
CC4146, Stormont Sceptre, W1010, 03314 Cn, 04434 Cn 31/6/159,

04435 Cn n/24/88, 04435 Cn 8/56/1, 7718 Cn & 8786 Cn 25/10/154
and one was received from an unknown variety.

2. RACE IDENTIFICATION

Full results of samples successfully tested are given in Table 28.

Table 28 MILDEW OF OATS - RACE IDENTIFICATION

Location	WPBS Code No. OMS71/-	Date of Reception 1971	Variety	Race
<u>Northern Region</u>				
Northumberland	77	21/7	Condor	2
	78	"	Manod	2
	79	"	Maris Quest	2
	80	"	Pendrwm	2
	81	"	Peniarth	2
	91	17/8	Mostyn	4
<u>Yorks & Lancs Region</u>				
Yorkshire				
Tadcaster	24	29/6	Condor	2
	25	"	Maris Quest	2
	26	"	Mostyn	4
	27	"	Pendrwm	2
	28	"	Peniarth	2
<u>West Midlands</u>				
Cheshire				
Farndon	9	9/6	Pendrwm	2 & 4
	10	"	Peniarth	4
	11	"	Maris Quest	2 & 4
	12	"	Condor	2 & 4
Herefordshire				
Rosemaund	3	12/5	Peniarth	4
	5	"	Padarn	2
	6	"	Maris Quest	4
	88	2/8	Nelson	4
	89	"	Mostyn	4
	90	"	AJB 4/51/B1	2
Shropshire				
Newport	19	22/6	Condor	4
	20		Mostyn	4
<u>Eastern Region</u>				
Cambridgeshire				
NIAB	35	2/7	Manod	2
	36	"	Mostyn	4
	37	"	Selma	2
Hertfordshire				
Harpenden	22	28/6	Manod	2 & 4
	23	"	Maris Quest	2 & 4
Norfolk				
Morley	43	5/7	Condor	2
	44	"	Manod	2
	45	"	Mostyn	4
	46	"	Maris Titan	4
	47	"	Peniarth	4
	48	"	Pendrwm	4
	49	"	Maris Quest	4
<u>South Eastern Region</u>				
Kent				
Wye	29	29/6	Condor	3
	30	"	Manod	4
	31	"	Maris Quest	2
	32	"	Mostyn	4
	33	"	Pendrwm	4
	34	"	Peniarth	2
Oxfordshire				
Norton Stoke	14	16/6	Padarn	2

Table 28 continued

Location	WPBS Code No. OMS 71/-	Date of Reception 1971	Variety	Race
<u>South Western Region</u>				
Bristol	1	3/6	Peniarth	2
Cornwall	70	19/7	Mostyn	4
	71	"	Condor	2
	72	"	Manod	4
	73	"	Maris Quest	2
	74	"	Pendrwm	2
	75	"	Peniarth	4
<u>Devon</u>				
Starcross	7	8/6	Condor	2
	8	"	Manod	2
	64	14/7	Manod	2
	65	"	Condor	2
	66	"	Maris Quest	2
	67	"	Peniarth	2
	68	"	Pendrwm	2
<u>Wales</u>				
Anglesey	13	16/6	Astor	2
<u>Cardiganshire</u>				
Llanon	21	24/6	Mostyn	4
	50	7/7	Peniarth	3 & 4
	51	"	04435 Cn n/24/88	4
	53	"	8786 Cn 25/10/154	3 & 4
	54	"	04434 Cn 31/6/159	4
	55	"	04435 Cn 8/56/1	4
	56	"	W1010	2
	57	"	03314 Cn	4
Trawscoed	60	11/7	Mostyn	2 & 4
	61	"	Condor	4
	62	"	AJB 4/51/B1	3 & 4
	63	"	Manod	2
	69	15/7	Peniarth	2
	83	28/7	AJ 13/11	4
	84	"	AJB 4/51/B1	3 & 4
	85	"	Maris Titan	2
	86	"	Nelson	3
WPBS, Aberystwyth	2	2/5	Unknown	2
	39	5/7	Nelson	4
	40	6/7	Maris Titan	3
	41	"	7718 Cn	2
	42	"	Cc 4146	3 & 4
<u>Iire</u>				
Co. Kildare	38	2/7	Condor	2

Five samples failed to establish and three races, 2, 3 and 4, were identified from the remaining 86 samples. These are shown in Table 29.

Table 29

Race	No. of Samples
2	43
3	3
4	29
2 & 4	6
3 & 4	5

Oat mildew R.S. mildew

Race 4, which is capable of attacking three of the differentials viz Milford, 9065 Cn 6/3/74 and Manod, has been identified for the first time on varieties other than Mostyn. The twenty-nine samples found to be race 4 came from a number of locations in England and Wales. Mostyn-virulent isolates have not been identified in samples received from Scotland and Ireland.

Five samples were at first thought to be race 5 but have finally been identified as mixtures of races 3 and 4.

One sample (OMS/71/13) was sent from a crop of Astor in Anglesey which had been treated with ethirimol. Seedling tests confirm previous experience at the WPBS that isolates of oat mildew are able to grow on plants grown from treated seed and on plants sprayed with ethirimol. This isolate was identified as race 2 and did not differ from other race 2 isolates from untreated crops.

RHYNCHOSPORIUM - BARLEY

WELSH PLANT BREEDING STATION - ABERYSTWYTH

R.B. CLOTHIER

1. Thirty samples of Rhynchosporium were received by the WPBS during 1971.

The number of samples collected from winter varieties is shown in Table 30,
spring varieties in Table 31.

Table 30

Winter Barley	No. of Samples
Maris Otter	9
Malta	1
Mirra	1
Senta	1
Vulcan	1
TOTAL	13

Table 31

Spring Barley	No. of Samples
Proctor	6
Universe (139/251)	2
Berac	1
Gerkra	1
Golden Promise	1
Mazurka	1
Vada	1
Zephyr	1
TOTAL	14

Two samples were received from unknown varieties and one from the variety Jet.

2. RACE IDENTIFICATION

Full results of samples successfully tested are given in Table 32.

Table 32 RHYNCHOSPORIUM OF BARLEY - RACE IDENTIFICATION

Location	WPBS Code No. R 71/-	Date of Reception 1971	Variety	Race
<u>Yorks. & Lancs. Region</u>				
Yorkshire				
Flixton	28	8/7	Vada	UK.1
Tadcaster	22	29/6	Proctor	UK.1
West Riding	19	18/6	Maris Otter	UK.1
<u>West Midlands</u>				
Herefordshire				
Rosemaund	9	12/5	Maris Otter	UK.1
Shropshire				
Newport	10	18/5	Maris Otter	UK.1
Warwickshire	11	"	Proctor	UK.1
Alcester	26	2/7	Unknown	UK.1

Con'td.

Cont'd.

Location	WPBS Code No. R 71/-	Date of Reception 1971	Variety	Race
<u>South Eastern Region</u>				
Hampshire				
Broughton	20	21/6	Golden Promise	UK1
Sparsholt	7	27/4	Maris Otter	UK1
	8	"	Proctor	UK1
Kent				
Wye	16	9/6	Maris Otter	UK1
	18	"	Proctor	UK1
<u>South Western Region</u>				
Gloucestershire				
Coates	4	5/4	Maris Otter	UK1
Leighterton	6	"	" "	UK1
Wales				
Anglesey	27	7/7	Proctor	UK1
Cardiganshire				
WPBS, Aberystwyth	13	4/6	Jet	UK1
	14	"	Maris Otter	UK1
	15	"	Vulcan	UK1
<u>Northern Ireland</u>				
Co. Armagh				
Loughgall	30	20/7	Mazurka	UK1
Co. Down				
Ardglass	23	29/6	Berac	UK1
	24	"	Gerkra	UK1
	25	"	Universe	UK1
Eire				
Co. Kildare				
Loixlip	29	7/7	Universe	UK1

Seven samples failed to establish. All of the remaining twenty three samples were identified as race UK.1. Two samples from varieties with resistance to race UK.1 failed to establish.

