

J. K. Johnson

PHYSIOLOGIC RACE SURVEY

REPORT

1973

NOT FOR PUBLICATION

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Physiologic Race Survey (Cereal Pathogens)

Secretary

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# PHYSIOLOGIC RACE SURVEYS - CEREAL PATHOGENS

REPORT FOR 1973

## SUMMARY

### General

1. In 1973 disease samples were again collected for race identification. The number of samples collected for each disease is shown in Table 1.

Table 1 Number of Samples Collected for Each Disease

Disease	Number of Samples				
	1969	1970	1971	1972	1973
Yellow Rust - Wheat	227	166	541	860	233
Yellow Rust - Barley	48	16	4	63	115
Brown Rust - Barley	289	369	131	97	39
Crown Rust - Oats	28	10	35	32	7
Mildew - Wheat	173	289	265	117	100
Mildew - Barley	359	469	361	285	223
Mildew - Oats	105	106	91	65	60
Rhynchosporium - Barley	512	54	30	219	47
TOTAL	1741	1479	1458	1738	824

2. Testing has been completed on nearly all samples received in 1973. Those which have not been identified are undergoing confirmatory tests

3. 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.

4. 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 either as a pure form or as a component in a race mixture from the 233 samples received in 1973, ie 32 E 32, 36 E 132, 37 E 132, 41 E 8, 41 E 136, 43 E 138, 45 E 140, 104 E 137, 108 E 9, 108 E 141 and 108 E 173. No new races were identified.

The most frequently identified race was 108 E 173 followed by 41 E 136 and 104 E 137. The frequency of race 108 E 173 has increased slightly since 1972 whereas that for race 104 E 137 has dropped considerably. The frequency of race mixtures was much greater in 1973 than in the previous seven years. The geographical distribution of races 108 E 173 and 104 E 137 was similar to that found in previous years with the majority of samples being from England. The distribution of samples of race 41 E 136 was different in 1973 from previous years; during the period 1967 - 1972 the race was most frequently identified from samples from Scotland whereas in 1973 it was most frequently identified from England. This was in part due to a decrease in the number of disease samples from Scotland, and in part due to an increase in the number of samples of race 41 E 136 from England.

#### YELLOW RUST OF BARLEY

Three races (23, 24, and 24VV) were identified from the 115 samples received. Race 24 was identified the most frequently (as in 1972), but race 24VV has slightly increased its frequency in 1973 compared with 1972. The samples were from scattered locations but about half of them came from Eastern England.

#### BROWN RUST OF BARLEY

The majority of the 39 samples received came from SW England and Wales. The widely virulent races E and F were most commonly identified whilst race B was identified only once. Two new races were identified from Cirencester, Glos and have been designated K and M.

#### BROWN RUST OF WHEAT

A preliminary investigation has revealed the presence of 4 races of *P. recondita* amongst disease samples collected in 1972.

#### CROWN RUST OF OATS

Six races were identified from the seven samples received. These were 234, 251 (twice), 265 (mixture only), 272, 289 (twice), and 471 (mixture only).

#### MILDREW OF WHEAT AND BARLEY

Mildew samples were obtained from a wide range of wheat and barley varieties with different resistance genes. No changes of any practical significance from previous years were observed amongst the wheat mildew samples.

Important changes in the barley mildew situation relate both to host resistance and to fungicide tolerance. With regard to the former, tests confirmed the occurrence of virulence for the variety Akka, which has mildew resistance derived from Monte Cristo. All isolates with this virulence were also virulent on a differential variety, HOR 1063. This latter characteristic is also common to all isolates virulent on varieties with resistance derived from Lyallpur 3645, such as Mazurka, Tern, Wing etc. This suggests that the occurrence of virulence for the Monte Cristo derivatives at a detectable level, was dependent on the increasing frequency of virulence for varieties derived from Lyallpur 3645, recorded in the last two or three years. It also reinforces the observations made by Dr. Wiberg in Sweden, that the two mildew resistance sources, Monte Cristo and Lyallpur 3645, although different, possess one mildew resistance gene in common, which is the same as that found alone in HOR 1063.

Different degrees of tolerance to the fungicide ethirimol were observed in a number of barley mildew populations. The frequency of tolerance was relatively high in populations from some treated crops, less so in others, and diminished with increasing distance from the source of treatment. The practical or potential importance of these observations in 1973 could not be determined.

Intensive surveys of mildew populations from selected sites involved the testing of about 5,000 isolates. Analysis of the data revealed the extent of some of the interactions between neighbouring fields of different varieties and confirmed previous observations, that the gene conditioning virulence for the variety Sultan occurs at an unexpectedly low frequency amongst mildew populations obtained from varieties such as Julia and Zephyr, which possess the Mlg resistance gene. This observation has important consequences in some of the varietal interactions observed.



#### MILDEW OF OATS

Four races (2, 3, 4 and 5) were identified from the 60 samples received. The frequency of race 2 has decreased over the last two years whilst race 4 has increased its frequency over this period and is now the most prevalent race. Race 3 was identified from samples from the West Midlands and South West England only, whereas race 5 was only identified from samples from Wales.

#### RHYNCHOSPORIUM OF BARLEY

Forty-seven samples were received and forty-one were identified as race UK 1. Four samples were identified as UK 2 and one failed to produce an infection.



# YELLOW RUST - WHEAT

NATIONAL INSTITUTE OF AGRICULTURAL BOTANY, CAMBRIDGE

R H PRIESTLEY and JULIA C SMITH

1. During 1973, 233 samples were received at the NIAB. The number of samples collected from winter wheat varieties is shown in Table 2, from spring wheat varieties in Table 3.

Table 2 Yellow Rust of Wheat - Samples Collected from Winter Varieties

Winter Wheat	No of Samples
Maris Templar	38
Maris Ranger	30
Cappelle Desprez	23
Maris Huntsman	17
Joss Cambier	16
Maris Nimrod	16
Maris Bilbo (TL365a/34)	10
Chalk	7
Cama	5
Champlein	5
Maris Freeman	5
Maris Beacon	3
Mega	3
Armentieres	2
Atou	2
Clement (Cebeco 143)	2
Flinor	2
Lincoln	2
Talent (Benoist 5780)	2
Benoist 10483	1
Maris Fundin (TL365a/37)	1
Maris Marksman	1
Maris Widgeon	1
MH 24-8-9	1
Pride (RPB 193/70)	1
TJB 54/224	1
TJB 155/21	1
West Desprez	1
TOTAL	199

Table 3 Yellow Rust of Wheat - Samples Collected from Spring Varieties

Spring Wheat	No of Samples
Maris Dove	9
Kolibri	4
Cardinal	2
Kleiber	2
Maris Butler	2
Sappo	2
Tilly	2
Maris Pinion	1
Rothwell Sprite	1
TOTAL	25

An additional 9 samples were received from the following varieties:- Breeding Line 105, Breeding Line 235, Coker 6815, Coker 6819, Heines VII, Mexipak 65, Selpek, Triticum spelta saharense and an unnamed variety.

## 2. Race Identification

Full results of all samples tested are given in Table 4. Those samples which failed to establish, were discarded on arrival, or were not tested have been omitted.

Table 4 Yellow Rust of Wheat - Race Identification

Location	NIAB Code No 73/-	Date of Reception 1973	Variety	Race
NORTHERN REGION	58	1/6	Maris Huntsman	41 E136
Co Durham	140	18/6	" "	41 E136
Longnewton, Stockton on Tees	145	20/6	Maris Nimrod	41 E136
Northumberland				
Cockle Park, Morpeth	215	27/7	Selpek	41 E136
	216	"	Mexipak 65	41 E136
YORKS AND LANCs REGION				
Yorkshire				
Barnston, Bridlington	78	7/6	Maris Ranger	108 E173
	179	6/7	Chalk	41E136+?
	180	"	Maris Nimrod	104E137+
				108E173
	181	"	Maris Bilbo	41E136 +
				108E173
Wansford, Drifffield	109	13/6	Maris Ranger	45E140+?
	110	"	Maris Huntsman	45E140+?
	111	"	Maris Nimrod	TIP
	112	"	Chalk	TIP

Table 4 (Cont'd)

Location	NIAB Code No 73/-	Date of Reception 1973	Variety	Race
Welton Wold, Welton	172	3/7	Maris Templar	41E136
EAST MIDLANDS				
Leicestershire				
Dunton Bassett	164	27/6	Kolibri	103E9
Lincolnshire				
Alford	198	12/7	Cappelle Desprez	104E137+?
Bilsby, Alford	131	13/6	Maris Ranger	103E173
	138	"	Maris Huntsman	104E137
Farlesthorne	228	30/7	Maris Templar	41E136
Frampton	77	4/6	Maris Huntsman	104E137+
				41E136
	108	12/6	" "	103E173
Friskney	126	18/6	Maris Ranger	103E173+
				41E136
	127	"	Maris Freeman	103E141
	129	"	Maris Bilbo	103E173+
				103E9+
				104E137
	141	19/6	Atou	103E173
	142	"	West Desprez	103E173
Grebly, Spilsby	79	7/6	Maris Huntsman	104E137+
				103E173
Havenhouse, Wainfleet	137	18/6	Maris Templar	41E136
Kirton	106	12/6	Maris Bilbo	103E173
	107		Maris Fundin	TIP
	116	"	Maris Ranger	103E173
Lincoln	175	4/7	Maris Dove	103E173
Moulton	104	12/6	" "	103E173
	105	"	Maris Ranger	103E173
North Coates, Grimsby	6	26/3	" "	103E173+
				104E137
	89	6/6	Coker 6815	103E173
North Willingham	182	5/7	Maris Templar	45E140
Sibsey, Boston	136	18/6	Maris Huntsman	104E137
Spalding	210	25/7	Maris Dove	103E173
Wainfleet	197	12/7	Maris Templar	41E136
	227	30/7	" "	41E136
Northamptonshire				
Fotheringhay, Oundle	27	16/5	Maris Huntsman	104E137+?
Moulton	25	3/5	Maris Ranger	104E137+
				103E173
	28	16/5	" "	103E173
	67	5/6	Maris Bilbo	103E173+?
EASTERN REGION				
Bedfordshire				
Stopsley, Luton	90	11/6	Maris Beacon	104E137

Table 4 (Cont'd)

Location	NIAB Code No 73/-	Date of Reception 1973	Variety	Race
Cambridgeshire				
Fitton End, Gorefield	18	1/5	Maris Ranger	108E173
Friday Bridge, Wisbech	39	24/5	" "	108E173
	41	"	Armentieres	104E137+?
	42	"	Cappelle Desprez	108E173
	43	"	Maris Huntsman	104E137
	44	"	Maris Templar	45E140
	45	"	Flinor	104E137
Gorefield, Wisbech	47	"	Maris Ranger	108E173
Knights End, March	17	1/5	" "	108E173
Lolworth	59	4/6	Cappelle Desprez	104E137+
				108E173
	121	15/6	Lincoln	41E136
Mepal, Ely	193	9/7	Maris Dove	108E173
NIAB, Cambridge	170	28/6	Maris Bilbo	TIP
	174	3/7	Cardinal	108E173+
				41E136
	176	4/7	"	108E173
Trumpington	98	11/6	Maris Bilbo	104E137
	103	12/6	Maris Ranger	108E173
Wisbech	1	25/1	Cama	41E8 +
				108E173
	46	24/5	Chalk	41E136
	83	5/6	Maris Templar	41E136+
				45E140
Essex				
Dedham	86	"	" "	41E136
Hatfield Peverel, Witham	146	21/6	" "	41E136
Terling, Witham	147	"	" "	41E136
	159	27/6	" "	41E136
White Notley, Witham	148	21/6	" "	41E136
Hertfordshire				
Rothamsted	207	24/7	" "	41E136
	203	"	Cappelle Desprez	108E173
Norfolk				
Attleborough	30	21/5	Maris Templar	41E136
	31	"	" "	41E136
	32	"	" "	41E136
Docking	12	24/4	Cappelle Desprez	104E137+
				108E173
	13	"	Breeding Line 325	108E173
Guestwick	81	5/6	Maris Templar	41E136
King's Lynn	16	1/5	Champlein	108E173
Morley	29	17/5	Maris Templar	41E136
	64	4/6	Cappelle Desprez	104E137+
				108E173
	65	"	Maris Ranger	108E173
	69	5/6	Maris Bilbo	108E173



Table 4 (Cont'd)

Location	NIAB Code No 73/-	Date of Reception 1973	Variety	Race
Narborough	60	5/6	Lincoln	41E136
	62	"	Maris Ranger	108E173
	63	"	Chalk	41E136+?
North Wootton Marsh, King's Lynn	139	19/6	Maris Dove	37E132
Terrington	9	24/4	Maris Ranger	108E173
	10	"	Cappelle Desprez	41E136+
				108E173
	11	"	Clement	104E137
	19	1/5	MH24-8-9	108E173
	20	"	TJB 155/21	108E173
	21	"	Flinor	104E137
	22	"	Maris Marksman	108E173
	23	"	Pride	104E137
	24	"	Maris Freeman	108E173
	71	5/6	Benoist 10483	108E173+?
	72	"	Talent	37E132+
				104E137
	73	"	Maris Templar	45E140+
				41E136
	74	"	Chalk	41E136+
				45E140+
				104E137
	75	"	Kolibri	108E173+
				41E136
Wiggenhall St Mary the Virgin, King's Lynn	2	19/2	Joss Cambier	104E137+?
Suffolk				
Cotton	84	5/6	Maris Templar	41E136
Gt Ashfield	85	"	" "	41E136
SOUTH EASTERN REGION				
Berkshire				
Ham, Hungerford	199	13/7	Maris Huntsman	108E173
Membury, Lambourn	54	29/5	Maris Nimrod	104E137+
				108E173
Buckinghamshire				
Stokenchurch	201	18/7	Talent	43E138
	202	"	Clement	45E140+
				41E136
	203	"	Cappelle Desprez	108E173
Hampshire				
Bridgets EHF, Winchester	160	26/6	Maris Freeman	104E137
Houghton, Stockbridge	118	13/6	Maris Templar	45E140
Sparsholt	91	8/6	Maris Huntsman	37E132+
				104E137

Table 4 (Cont'd)

Location	NIAB Code No 73/-	Date of Reception 1973	Variety	Race
Kent				
Ash, Sandwich	92	8/6	Maris Templar	41E136
Wye	167	27/6	Maris Ranger	108E9
	168	"	Maris Bilbo	TIP
	177	2/7	Maris Ranger	36E132+?
	178	"	Maris Bilbo	TIP
Yalding	70	5/6	Maris Huntsman	108E173+ 104E137
Oxfordshire				
Enstone	152	22/6	Maris Nimrod	108E173+ 41E136
	153	"	Maris Huntsman	104E137
	154	"	Mega	TIP
	155	"	Maris Freeman	108E173
	195	10/7	Mega	104E137
Kings Sutton, Banbury	200	12/7	Maris Templar	41E136
Kingston Blount	218	30/7	Maris Dove	TIP
Lewknor	171	26/6	Maris Nimrod	108E173+ 41E136
Merton, Bicester	50	25/5	Maris Ranger	104E137
Tackley	87	6/6	" "	41E136+?
Watlington	7	26/3	Joss Cambier	108E173
	206	23/7	Maris Ranger	108E173
Sussex	125	14/6	Maris Templar	108E173
Firle, Lewis	232	3/8	" "	41E136
Hoos	217	26/7	Maris Ranger	108E173
Lewes	231	3/8	Kolibri	108E173
SOUTH WESTERN REGION				
Dorset				
Tarrant Gunville	173	2/7	Maris Dove	108E173+ 104E137
Gloucestershire				
Longney	26	9/5	Cappelle Desprez	104E137
Somerset				
Bridgwater	94	7/6	Maris Widgeon	104E137+?
	95	"	Maris Nimrod	41E136+ 104E137
	96	"	Maris Ranger	108E173+ 41E136+ 108E9
	97	"	Cappelle Desprez	104E137+ 108E173
Fiddington	205	19/7	Maris Templar	41E136+ 104E137
Northover, Fiddington	52	30/5	Maris Nimrod	32E32
Otterhampton	8	12/4	Cappelle Desprez	104 E137

Table 4 (Cont'd)

Location	NIAB Code No 73/-	Date of Reception 1973	Variety	Race
Spaxton	51	30/5	Cappelle Desprez	104E137
Stogursey, Bridgwater	53	"	Maris Templar	TIP
	35	22/5	Cappelle Desprez	104E137
	36	"	Maris Ranger	104E137+
				108E173
Williton	37	"	Maris Nimrod	108E173
	80	6/6	"	104E137
Wiltshire				
Burbage	187	5/7	Maris Dove	45E140
	188	"	"	45E140+
				104E137
Lacock, Chippenham	190	9/7	Maris Freeman	TIP
	192	"	Maris Ranger	TIP
Woodcutts, Salisbury	100	11/6	Maris Templar	41E136
Swindon	102	"	Cappelle Desprez	104E137
WALES				
Glamorganshire				
Llancarfan	119	13/6	Maris Nimrod	108E173
Monmouthshire				
Penallt	120	"	"	104E137+
				108E173
SCOTLAND				
Angus				
Farnell	143	19/6	"	41E136
	230	1/8	"	41E136
Berwickshire				
Duns	194	8/7	<u>Triticum spelta</u>	TIP
			<u>saharensae</u>	
Swinton	213	27/7	Maris Templar	41E136
Midlothian				
Ingliston	166	27/6	"	41E136
Perthshire				
Scone	221	26/7	Maris Bilbo	41E136+
				104E137
	222	"	Maris Nimrod	TIP
	223	"	Cappelle Desprez	41E136
	224	"	Maris Huntsman	45E140
	225	"	Mega	104E137+
	226	"	Atou	104E137
EIRE				
Co Kildare				
Backweston	233	13/8	Sappo	41E136

TIP = Tests in Progress

Of the 233 samples received, 17 failed to establish, 14 were discarded on arrival, 13 are still being tested, and 32 have not been tested as they were from varieties not included in the sampling list.

Table 5(a) shows the frequency of the nine races found in pure form in 1973. The most frequently identified race was 108 E 173 (27%) followed by 41 E 136 (23%) and 104 E 137 (13%). None of the other six races had a frequency of more than 5%. The number of race mixtures (31%) was greater than any of the individual pure races. All of the races identified in 1973 had been identified in previous years.

Table 5(b) shows the frequency of the major races (identified from more than 10% of the total isolates tested in any year) for the years 1966-1973. The frequency of race 41 E 136 in 1973 (23%) is similar to that in 1972 (19%) and 1971 (21%). The frequency of race 104 E 137 in 1973 (13%) is considerably less than that in 1972 (42%) and 1971 (57%). The frequency of race 108 E 173 in 1973 (27%) has increased slightly over 1972 (20%).

Table 5(c) shows the components of race mixture identified in 1973. Two races (36 E 132 and 41 E 8) were found in 1973 only as mixture components. In some cases only one mixture component could be identified, whereas in others up to three components were identified. Race 104 E 137 was the most frequently identified component race (58% of mixtures), followed by 108 E 173 (54%) and 41 E 136 (40%). Thus the same three races were found to be the most frequently identified in both the pure isolates (Table 5(a)) and the mixed isolates (Table 5(b)). Race 104 E 137 was relatively much more frequently identified as a mixture component than as a pure race.

Table 5(d) shows the geographical distribution of the 1973 pure isolates compared with similar mean values for the period 1967-1972. The distribution of races 104 E 137 and 108 E 173 was similar in 1973 to that found in previous years with the large majority of isolates being found in England. In 1973 race 41 E 136 was found more frequently in England than Scotland, whereas in the previous six years the reverse occurred. This change is probably due to (i) a decrease in the number of samples received from Scotland in 1973, and (ii) an increase in the frequency of race 41 E 136 in England in 1973.

#### Summary for individual races

##### 108 E 173

The most frequently identified race in 1973 and widely distributed throughout East and South East England. First identified in 1972 and has increased its frequency in 1973. Has the ability to attack varieties with resistance derived from Yr 2, Yr 3, Yr 4 and Yr 6.

##### 41 E 136

Frequently identified in 1971, 1972 and 1973. This race was largely restricted to Scotland until 1973 when it was frequently identified in England. First identified in 1967 it has the ability to attack varieties with resistance derived from Yr 1, Yr 2 and Yr 3. This restricts it mainly to winter varieties.

##### 104 E 137

Less frequently identified in 1973 than in previous years, this race is being superseded by 108 E 173 in England. First identified in 1969 it was the cause of severe infections on Joss Cambier in 1971 and 1972 and has the ability to attack varieties with resistance derived from Yr 2, Yr 3 and Yr 4.

45 E 140

This race has increased its frequency slightly since 1972 but is still relatively uncommon. First identified in 1972 it has now been identified from 6 varieties at 11 sites in England and Scotland. Spores have been provided for field tests at NIAB and WPBS. This race has the ability to attack varieties with resistance derived from Yr 1, Yr 2, Yr 3 and Yr 6.

108 E 9

This race has been relatively uncommon since 1971 although it has been found in both subsequent years. First identified in 1969 it has the ability to attack varieties with resistance derived from Yr 3, Yr 4 and Yr 6.

43 E 138

This race is the only one identified in 1973 with the ability to overcome resistance derived from Yr 7. The race was first identified in 1971 and has remained relatively uncommon in 1973. It can also overcome resistance derived from Yr 1, Yr 2 and Yr 3.

32 E 32

Although identified by Manners (1950), this race has not previously been identified from PRS samples. It does not have the ability to overcome any of the resistance factors Yr 1, to Yr 8.

36 E 132, 37 E 132, 41 E 8 and 108 E 141

Identified infrequently in 1973, these races have all been previously found from PRS samples.

Table 5 Yellow Rust of Wheat - Occurrence of Races

(a) races identified in 1973

Race	Number of isolates	% frequency
32 E 32	1	1
37 E 132	1	1
41 E 136	36	23
43 E 138	1	1
45 E 140	5	3
104 E 137	20	13
108 E 9	2	1
108 E 141	1	1
108 E 173	42	27
mixture of races	48	31
TOTAL	157	102



(b) comparison with previous years (major races only)

Race	% frequency of races							
	1966	1967	1968	1969	1970	1971	1972	1973
37 E 132	43	42	25	13	7	1	0	1
41 E 136	0	1	4	7	2	21	19	23
104 E 9	33	41	68	53	20	5	0	0
104 E 137	0	0	0	9	38	57	42	13
108 E 9	0	0	0	4	22	2	1	1
108 E 173	0	0	0	0	0	0	20	27
other races	6(2)	2(2)	0(0)	5(3)	9(2)	5(6)	3(7)	6(4)
race mixtures	18	15	2	9	2	10	15	31

(c) components of race mixtures in 1973

Race	Number of times identified in mixtures	% frequency
36 E 132	1	2
37 E 132	2	4
41 E 8	1	2
41 E 136	19	40
45 E 140	7	15
104 E 137	28	58
108 E 9	2	4
108 E 173	26	54

(d) geographical distribution of pure isolates in 1973 and previous years

The values are % frequencies of races in different regions in 1973. Those in parentheses are the mean value for the years 1967-1972 inclusive.

Race	England*	Scotland*	Other
41 E 136	86 (17)	19 (81)	3 (3)
104 E 137	95 (94)	5 (4)	0 (3)
108 E 173	100 (92)	0 (5)	0 (3)

\* Northumberland has been included with Scotland and omitted from England.



# YELLOW RUST - BARLEY

NATIONAL INSTITUTE OF AGRICULTURAL BOTANY, CAMBRIDGE

R H PRIESTLEY and JULIA C SMITH

1. During 1973, 115 samples were received at the NIAB. The number of samples collected from winter barley varieties is shown in Table 6, from spring barley varieties in Table 7.

Table 6 Yellow Rust of Barley - Samples Collected from Winter Varieties

Winter Barley	No of Samples
Astrix	7
Mirra	3
Malta	2
Maris Otter	1
TOTAL	13

Table 7 Yellow Rust of Barley - Samples Collected from Spring Varieties

Spring Barley	No of Samples
Julia	15
Universe	9
Berac	8
Lofa Abed	7
Zephyr	6
Vada	5
SJ 678060	4
Tern	4
Deba Abed	3
Hanna (W273368)	3
Mazurka	3
Proctor	3
Abacus (RFB 11069)	2
Armelle	2
Becket	2
Clermont	2
Hornisse	2
Maris Mink	2
Midas	2
Gerkra	1
Lud (RFB 8269)	1
Miranda	1
Sultan	1
Wing	1
TOTAL	89

In addition, 13 samples were received from the following varieties:-  
Cambrinus (2), Carina, Cebeco 1018, Cl 11563, Cl 16968, Hebe, Nordal, Ruby, Villa, WPBS  
14289 Co and two from unnamed varieties.

## 2. Race Identification

Full results of all samples tested are given in Table 8(a). Those samples which failed to establish or were discarded on arrival have been omitted.

Table 8(a) Yellow Rust of Barley - Race Identification

Location	NLAB Code No B/73/-	Date of Reception 1973	Variety	Race
<b>NORTHERN REGION</b>				
<b>Northumberland</b>				
Cockle Park, Morpeth	100	24/7	Universe	24
	101	"	Deba Abed	24 VV
	102	"	Cambrinus	24
<b>YORKS AND LANCs REGION</b>				
<b>Yorkshire</b>				
Bishop Burton	19	11/6	Deba Abed	24
Headley Hall, Tadcaster	54	2/7	Hanna	24
High Mowthorpe	16	6/6	Zephyr	24
	38	26/6	"	24 VV
Kirkburn, Tibthorpe	26	20/6	Universe	24
Walkington	49	2/7	Julia	24
<b>EAST MIDLANDS</b>				
<b>Lincolnshire</b>				
Boston	9	22/5	Unknown	24
Branston Fen	103	25/7	Julia	24 + 23
Crowland	15	31/5	Zephyr	24
Kirkby Underwood, Spalding	60	4/7	Mazurka	24 VV
Kirton	1	27/3	Astrix	24
North Coates, Grimsby	17	6/6	Unknown	24 VV
Pode Hole, Spalding	8	22/5	Berac	24
Spalding	2	28/4	Astrix	24
	4	4/5	"	24
	10	30/5	Berac	24 VV
Swaton, Sleaford	37	27/6	Clermont	24
	58	4/7	"	24
	59	"	Berac	24
<b>Northamptonshire</b>				
Aldwinckle, Oundle	3	1/5	Astrix	24
Raunds, Wellingborough	46	27/6	Tern	24
Ringstead	47	"	"	24
<b>Nottinghamshire</b>				
Flawborough, Newark	6	17/5	Astrix	24
<b>WEST MIDLANDS</b>				
<b>Warwickshire</b>				
Maxstoke	67	6/7	Lofa Abed	24
	68	"	Universe	24

Table 8(a) cont.

Location	NIAB Code No B/73/3	Date of Reception 1973	Variety	Race
<b>EASTERN REGION</b>				
Hertfordshire				
Rothamsted	81	18/7	Vada	24
"	82	"	Julia	24
"	83	"	Berac	24
"	84	"	Lofa Abed	24
"	85	"	Gerkra	24
"	86	"	Universe	24 VV
Norfolk				
Morley	7	21/5	Mirra	24
"	31	27/6	Berac	24
"	32	"	Vada	24
"	33	"	Julia	24
"	34	"	Miranda	24
"	35	"	Lud	24
"	36	"	Hanna	24 VV
Terrington	21	18/6	Universe	24
"	22	"	Abacus	24
"	23	"	Becket	24
"	24	"	Lofa Abed	24
"	25	"	Julia	24
"	69	9/7	Deba Abed	24
Suffolk	44	27/6	Proctor	24
Eye	74	10/7	Tern	24
<b>SOUTH EASTERN REGION</b>				
Kent				
Rolvenden	20	13/6	Malta	24
Wye	39	25/6	SJ 678060	24
"	41	"	Zephyr	24 VV + 23
"	42	"	Julia	24
Oxfordshire				
Milton under Wychwood	5	7/5	Mirra	24
<b>SOUTH WESTERN REGION</b>				
Cornwall				
Padstow	65	4/7	WPBS 14289 Co	24
Gloucestershire				
Cirencester	51	2/7	SJ 678060	24 VV
Coates, Cirencester	87	19/7	Hornisse	24
"	88	"	Armelle	24
"	89	"	Julia	24
"	90	"	Lofa Abed	24 VV
Newent	91	"	Vada	24
"	92	"	Zephyr	24
"	93	"	Julia	24
"	94	"	Lofa Abed	24
Sevenhampton	45	28/6	Malta	23
Somerset				
Cannington	27	25/6	Hornisse	24 VV
Wiltshire				
Chiseldon, Swindon	11	29/5	Mirra	24

Table 8(a) cont.

Location	NIAB Code No B/73/-	Date of Reception 1973	Variety	Race
<b>WALES</b>				
Anglesey				
Bodedern	98	24/7	Universe	24
Cardiganshire				
Llanon	73	9/7	"	24
Flintshire				
Holywell	56	3/7	Vada	24
St Asaph, Holywell	95	24/7	Lofa Abed	24 VV
<b>SCOTLAND</b>				
Angus				
Inverkeilor	111	1/8	Nordal	24
Berwickshire				
Duns	99	25/7	Cambrinus	24 VV
Kincardineshire				
Pitarrow, Laurencekirk	75	11/7	Maris Mink	24
	76	"	SJ 678060	24
	77	"	" "	24
	78	"	Becket	24
	79	"	Abacus	24
<b>NORTHERN IRELAND</b>				
Co Armagh				
Castle Dillon, Loughgall	115	8/8	Julia	24
<b>EIRE</b>				
Co Kildare				
Backweston, Leixlip	104	2/8	Lofa Abed	24
	105	"	Mazurka	24
	106	"	Hanna	24 VV
	107	"	Cl 11536	24
	108	"	Cl 10968	24

Table 8(b) Yellow Rust of Barley - Occurrence of Races in 1973

values in parentheses refer to 1972

Race	Number of isolates	% frequency
23	1	1 (7)
24	68	81 (89)
24 VV	13	15 (4)
mixture of races	2	2 (0)
total	84	99 (100)

Of the 115 samples received, 20 failed to establish and 11 were discarded on arrival.

Table 8(b) shows the frequency of the three races found in pure form in 1973. The most frequently identified race was 24 (81%) followed by 24VV (15%) and 23 (1%). The relative frequencies of these races was similar to that found in 1972; race 24 was found slightly less frequently and race 24VV slightly more frequently in 1973 than 1972.

The samples were received from a wide range of geographical locations although about half the samples were from Eastern England.

#### Summary for individual races

##### 24

The most frequently identified race in 1973 and 1972, and has been the dominant race since at least 1968. Experiments at the NIAB have shown that the 1973 isolates of race 24 are more aggressive than those found in previous years.

##### 23

This race has been present since at least 1968 but has never reached a high percentage frequency. It has a more restricted host range than race 24.

##### 24VV

This race was first identified in 1972 and is virulent on the variety Varunda. It appears to be a derivation of race 24 but tests at the NIAB have shown that it is different from another variant of race 24 found in N W Europe. Spores have been provided for tests.





## BROWN RUST - BARLEY

WELSH PLANT BREEDING STATION, ABERYSTWYTH

R B CLOTHIER and B C CLIFFORD

1. During 1973, 39 samples were received at the W.P.B.S. Two samples were received from the winter variety Maris Otter and those received from spring barley varieties are shown in Table 9.

Table 9 Brown Rust of Barley - Samples Collected from Spring Varieties

Spring Barley	No of Samples
Julia	6
Proctor	5
Mazurka	4
Universe	3
Vada	2
Zephyr	2
Aramir	1
Becket	1
Deba Abed	1
Gerkra	1
Hornisse	1
Imber	1
Lofa Abed	1
Midas	1
SJ 678060	1
Sultan	1
Varunda	1
Total	33

In addition, four samples were received from the following varieties:- CI 1237, HB 795/41/5/7, HB 855 467/1 and 13192 Co.

2. Race Identification Full results are given in Table 10.

Table 10

## Brown Rust of Barley - Race Identification

Location	WPBS Code No BRS/73/	Date of Reception 1973	Variety	Race
EASTERN REGION				
Hertfordshire				
Rothamsted	17	18/7	Julia	E
	18	"	Lofa Abed	F
	19	"	Mazurka	E
	20	"	Universe	B
	21	"	Vada	E
Norfolk				
Morley	2	17/4	Maris Otter	E
Suffolk				
Bury St Edmunds	16	11/7	" "	E
SOUTH EASTERN REGION				
Hampshire				
Sutton Sootney	14	4/7	Julia	FTE
	15	"	Proctor	F
SOUTH WESTERN REGION				
Cornwall				
Truro	8	28/6	"	F
	9	"	Sultan	F
	10	"	Universe	F
Gloucestershire				
Cirencester	23	19/7	Aramir	F
	24	"	Becket	F
	25	"	Hornisse	F
	26	"	Julia	K
	27	"	Mazurka	K
	28	"	Proctor	M
	29	"	Varunda	E
	30	"	Zephyr	F
	31	"	SJ 678060	E
Somerset				
Frome	5	25/6	Julia	FTE
	6	"	Mazurka	FTE
	7	"	Vada	FTE
Wedmore	13	5/7	Julia	F

Table 10 (Contd)

Location	WPBS Code No BRS/73/	Date of Reception 1973	Variety	Race
WALES				
Breconshire				
Brecon	33	25/7	Deba Abed	E
	34	"	Gerkra	FTE
	35	"	Imber	F
	36	"	Mazurka	E
	37	"	Midas	E
	38	"	Proctor	F
	39	"	Zephyr	F
Glamorganshire				
Monknash	22	17/7	Universe	E
Cardiganshire				
Llanon	1	5/4	HB 855 467/1	E
	4	23/5	HB 795/41/5/7	F
	11	29/6	Julia	E
	12	"	Proctor	E
WPBS, Aberystwyth	3	2/5	13192 Co	F
SCOTLAND				
Berwickshire				
Duns	32	25/7	CI 1237	E

FTE - Failed to Establish

The majority of the samples came from S.W. England and Wales, the remainder coming from Eastern and Southern England except one sample from S. Scotland. Most of the samples were from recommended list varieties and varieties in N.I.A.B. trials.

Thirty four of the samples were successfully cultured and of these, fifteen were race E and fifteen were race F. These widely virulent races were the most common in the 1971 and 1972 surveys.

Race B was identified from one sample

Two new races were identified from material sent from Cirencester and have been designated race K and race M. Race K was identified from two samples and race M from one sample.

Races K and M are similar to the prevalent race E, being distinguished from it and from each other by the reactions of the varieties Quinn and Ricardo (Table 11).

Table 11 Brown Rust of Barley - Reactions of Differential Varieties.

Differential Variety	Race		
	E	K	M
Bolivia	S	S	S
Reka I	R	R	R
Quinn	S	R	S
Sudan	S	S	S
Gold	S	S	S
Egypt 4	S	S	S
Estate	R	R	R
Batna	S	S	S
Peruvian	S	S	S
Cebada Capa	R	R	R
Ricardo	S	S	R

amme.

Table 12

**Brown Rust of Wheat - Differential**  
**Reactions on a Range of Wheat Genotypes**

Genotype	Culture designation			
	WBR/72-1	WBR/72-3	WBR/72-9	WBR/72-11
Maris Nimrod	S *	S	S	S
Champlein	S	S	S	S
Maris Ranger	S	S	S	S
Cappelle Desprez	S	S	S	S
West Desprez	S	S	S	S
Maris Widgeon	S	S	S	S
Maris Huntsman	S	S	S	S
Atou	S	S	S	S
Bouquet	S	S	S	S
Maris Dove	S	S	S	S
Kleiber	S	S	S	S
Kolibri	S	S	S	S
Sirius	S	S	S	S
Maris Butler	S	S	S	S
Cardinal	S	S	S	S
Rothwell Sprite	S	S	S	S
Maris Ensign	S	S	S	S
Troll	S	S	S	S
Janus	S	S	S	S
Opal	S	S	S	S
Maris Halberd	R	S	R	R
Sappo	R	S	R	R
Sterling	S	S	S	S
Flameks	R	R	R	R
Ca 1306	R	S	S	R
Ca 1308	S	S	S	S
Ca 1309	R	S	S	R
Ca 1310	R	R	R	R
Ca 1311	R	R	R	S
Ca 1313	R	R	R	R
Atle	S	S	S	S
Cama	S	S	S	S
Tommy	S	S	S	S

\* R = Reaction types 0, 1 or 2

S = Reaction types 3 or 4



CROWN RUST - OATS  
WELSH PLANT BREEDING STATION, ABERYSTWYTH

R B CLOTHIER and B C CLIFFORD

1. Seven samples were received at the WPBS in 1973, one from each of the following varieties:-  
Maris Osprey (winter oat), Condor (spring oat), Selma (spring oat),  
Arkansas 674, CI 4763, Condor x Sceptre and Avena fatua.

2. Race Identification

Full results are given in Table 13

Table 13                      Crown Rust of Oats - Race Identification

Location	WPBS Code No CRS/73/	Date of Reception 1973	Variety	Race
SOUTH WESTERN REGION				
Devon				
Newton Abbot	2	23/7	Condor	251
	3	"	Selma	289
Plymouth	6	30/7	<u>Avena fatua</u>	234
WALES				
Cardiganshire				
WPBS. Aberystwyth	1	17/7	Maris Osprey	289
	4	24/7	Arkansas 674	272
	5	"	CI 4763	471 + 265
NORTHERN IRELAND				
Co. Armagh				
Loughgall	7	8/8	Condor x Sceptre	251

Three samples were from Cardiganshire, three from Devon, and one from N Ireland.

Six races have been identified; race 289 (Devon and Cardiganshire), race 251 (Devon and N Ireland), race 234 (Devon) and race 272 (Cardiganshire). The remaining sample has yielded a mixture of race 471 (Manod virulent) and race 265 (Nelson virulent).



# MILDEW - WHEAT

PLANT BREEDING INSTITUTE, CAMBRIDGE

M. S. WOLFE and SUSAN E. WRIGHT

1. During 1973, 100 samples were received at the PBI. The number of samples collected from winter wheat varieties is shown in Table 14, from spring wheat varieties in Table 15.

Table 14 Mildew of Wheat - Samples collected from Winter Varieties

Winter Wheat	No of Samples
Maris Nimrod	11
Chalk	9
Maris Bilbo (TL 365a/34)	9
Clement (Cebeco 148)	4
Maris Huntsman	4
FD 2813/55	3
Maris Fundin (TL 365a/37)	2
SR 185/461	2
Atou	1
Maris Freeman	1
Maris Ranger	1
Maris Widgeon	1
Val	1
TOTAL	49

Table 15 Mildew of Wheat - Samples collected from Spring Varieties

Spring Wheat	No of Samples
Kolibri	13
Kleiber	12
Rothwell Sprite	11
Cardinal	7
Maris Dove	6
Sappo	1
WR 112/79/14/20	1
TOTAL	51

## 2. Race identification

Unfortunately, many of the isolates were lost during testing, so that only tests relating to Triticum timopheevi resistance have been completed.

As in previous years isolates received from Maris Huntsman (includes T. timopheevi resistance) have been found to be avirulent when inoculated back onto Maris Huntsman.

A set of isolates from previous years but including some from 1973 is being used to investigate the differentiation of mildew resistance in varieties with mildew resistance derived from T. timopheevi.

Isolates from Cardinal and WR 112/79/14/20 have been found to be virulent on differentials with resistance derived from T. carthlicum.

Isolate	No. of samples
Isolate 11	11
Isolate 12	12
Isolate 13	13
Isolate 14	14
Isolate 15	15
Isolate 16	16
Isolate 17	17
Isolate 18	18
Isolate 19	19
Isolate 20	20
Isolate 21	21
Isolate 22	22
Isolate 23	23
Isolate 24	24
Isolate 25	25
Isolate 26	26
Isolate 27	27
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Isolate 469	469
Isolate 470	470
Isolate 471	471
Isolate 472	472
Isolate 473	473
Isolate 474	474
Isolate 475	475
Isolate 476	476
Isolate 477	477
Isolate 478	478
Isolate 479	479
Isolate 480	480
Isolate 481	481
Isolate 482	482
Isolate 483	483
Isolate 484	484
Isolate 485	485
Isolate 486	486
Isolate 487	487
Isolate 488	488
Isolate 489	489
Isolate 490	490
Isolate 491	491
Isolate 492	492
Isolate 493	493
Isolate 494	494
Isolate 495	495
Isolate 496	496
Isolate 497	497
Isolate 498	498
Isolate 499	499
Isolate 500	500
Isolate 501	501
Isolate 502	502
Isolate 503	503
Isolate 504	504

# MILDEW - BARLEY

PLANT BREEDING INSTITUTE, CAMBRIDGE

M.S. WOLFE and SUSAN E WRIGHT

1. During 1973, 223 samples were received at the PBI. Three samples were received from the winter barley variety Maris Otter. Table 16 shows the number of samples collected from spring barley varieties.

Table 16 Mildew of Barley - Samples collected from Spring Varieties

Spring Barley	No of Samples
Julia	24
Mazurka	24
Maris Mink	23
Midas	17
Vada	15
Lofa Abed	14
Universe	14
Wing	12
Abacus (RPB 11069)	10
Varunda	9
SJ 678060	7
Tern	7
Hornisse	6
Becket	4
Golden Promise	4
Aramir	3
Pauline	3
Akka	2
Ansgar	2
Ark Royal	2
CIV 344	2
CIV 345	2
Hanna (W273368)	2
Harkra (K282)	2
Lud (RPB 8269)	2
Rif (RPB 14670)	2
Armelle	1
Deba Abed	1
Gopal	1
Proctor	1
Sultan	1
Union	1
Zephyr	1
<b>TOTAL</b>	<b>218</b>

An additional two samples were received from unnamed varieties.

## 2. Race Identification

Results of all samples which have been tested are given in Table 17. This includes the reaction of the sample to ethirimol. Many samples failed to establish, while tests are still in progress on others.

Table 17 Mildew of Barley - Race Identification

Location	PBI Code No.B73/-	Date of Reception 1973	Variety	Race	Ethirimol Reaction
NORTHERN REGION					
Cumberland					
Langwathby	131	4/7	Mazurka		S
YORKS AND LANCS REGION					
Yorkshire	81	26/6	Akka		S
Headley Hall, Tadcaster	146	5/7	Rif	99,15	S
	149	"	Akka	243,9	S
	153	"	Ark Royal	99,15	S
EAST MIDLANDS					
Derbyshire					
Eastwell	33	14/6	Lofa Abed	17,2	S
	34	"	Vada	17,10	S
	35	"	Mazurka	99,9	S
	36	"	Wing		
	37	"	Maris Mink		S
	38	"	Universe	27,11	
	39	"	Abacus	3, 14	S
Lincolnshire					
Rothwell	72	20/6	Julia		S
	73	"	Abacus	17,10	S
	75	"	Maris Mink		S
	76	"	Mazurka	99, 15	S
	78	"	Tern		S
	79	"	Wing	227,15	S
	156	5/7	Tern	115, 15	
Scampton	56	20/6	Becket	19, 11	S
	60	"	Abacus		S
WEST MIDLANDS					
Cheshire					
Kelsall	61	"	Julia	3,10	I
	62	"	Lofa Abed	17, 0	S
	63	"	Vada		S
	64	"	Midas		S
	65	"	Universe		S
Herefordshire					
Rosemaund	8	15/5	Julia	31,11	S
	9	"	Maris Mink	15,11	S
	11	"	Hornisse		S
	14	"	Mazurka	99,15	S
	15	"	Varunda		
	16	"	Lofa Abed	3,11	S
	17	"	Vada	23,11	S
	18	"	Midas	7,11	S

Table 17 Continued

Location	PBI Code No.B73/-	Date of Reception 1973	Variety	Race	Ethirimol Reaction
Shropshire					
Harper Adams, Newport	67	20/6	Julia	7,11	S
	68	"	Universe		S
	70	"	Maris Mink		S
	102	26/6	Mazurka		S
EASTERN REGION					
Bedfordshire					
Bedford	128	28/6	Wing	115, 11	S
Cambridgeshire					
Dry Drayton	22,53	31/5,19/6	Tern (25 isolates)	97, 10(1) 99, 9(4) 99,11(6) 99,15(2) 103, 9(1) 107,13(2) 115,9(2) 115,15(2) 123,13(1) 4NYT	S(1) S(4) I(1)S(5) S(2) S(1) S(2) S(2) S(2) - S(2)
NIAB, Cambridge	5	1/5	Tern	99, 9	S
NSDO, Newton	20	31/5	Maris Mink(4 isolates)		S(4)
PBI, Trumpington	129	3/7	Gopal (8 isolates)	99,15(2) 115,15(1) 121, 9 (1) 4 NYT	S(1) S(1) S(1) S(4)
	161	5/7	Mazurka		
	161/1	"	"		
	161/2	"	"	115,11	S
	161/3	"	"	107,15	S
	167	"	Vada	17, 2	S
	168/1	"	Zephyr		S
	168/2	"	"		T
Huntingdonshire					
Conington	26/1	5/6	Julia(ethirimol treated)		S
	26/2	"	" "	3,9	S
	26/3	5/6	" "	7,11	S
	26/4	"	" "	7,15	S
	26/5	"	" "	3,11	
Norfolk					
Morley	86	26/6	Lud		
	87	"	Ark Royal		S
	88	"	Harkra		S
	90	"	Ansgar		T
	93	"	Wing	115,11	S
Terrington	43	18/6	Julia	15, 14	S
	44	"	Abacus		T
	45	"	Becket	31,14	
	46	"	SJ 678060		S
	47	"	Varunda	2, 15	S
	48	"	Aramir	11, 9	T
	49	"	Vada	119, 13	S
	51	"	Midas	7, 11	S



Table 17 Continued

Table 17 Continued

Location	PBI Code No. B73/-	Date of Reception 1973	Variety	Race	Ethirimol Reaction
Suffolk	4	21/3	Maris Otter		
Depden	6	9/5	(ethirimol treated) Maris Otter	99,13 23, 12	S S
SOUTH EASTERN REGION					
Kent					
Wye	116 118	27/6	Julia Universe	3,10	S S
SOUTH WESTERN REGION					
Devon					
Seale Hayne, Newton Abbot	177/4	3/7	Mazurka		S
Kingswear	205	12/7	"	115, 15	S
WALES					
Cardiganshire					
Morfa Maws	1	7/12/72	Maris Otter (ethirimol treated)	15, 8	S
WPBS, Aberystwyth	27 28 29 30 31 32	13/6 " 14/6 " 13/6 "	Julia Lofa Abed Maris Mink Midas Mazurka Vada	11, 15 7,15 99,9 25, 6	S S S S
Flintshire					
Holywell	157 158	5/7 "	Julia Mazurka	23,15 227,9	S S
Glamorganshire					
Monknash	123 124 126	29/6 " "	Wing Universe Maris Mink		S S S
SCOTLAND					
Midlothian					
Edinburgh	7	11/5	Mazurka		S
Ross-shire					
Evanton	71	20/6	Midas	7,15	S
NORTHERN IRELAND					
Co. Down					
Ardglass	40 41	15/6 "	Julia Midas	7,11	I I

Ethirimol Reaction: S - Sensitive  
I - tolerant to 200ppm applied to seed.  
T - tolerant to 400ppm applied to seed.

Table 18 Mildew of Barley - Differentials Attacked

The isolates are grouped according to host resistance sources.

(a) Vada derivatives

Resistance Source Decanery value	Akka 128	Wing 64	H1063 32	Vada 16	Sultan 8	Maris Concord 4	CP127422 2	41/145 1	No of isolates	Variety and Location
Race No.										
2,15 /							X		1	Varunda (Terrington)
3,10 /							X	X	1	Universe (Wye)
3,11 *							X	X	1	Lofa Abed (Rosemaund)
3,14 *							X	X	1	Abacus (Eastwell)
8,2 *					X				1	SJ 678060 (Terrington)
17, 0				X				X	1	Lofa Abed (Kelsall)
17, 2				X				X	3	Lofa Abed (Eastwell)
17, 10				X				X	2	Universe (Harper Adams)
19,11				X			X	X	1	Vada (PBI)
23,11				X			X	X	1	Vada (Eastwell)
25, 6				X	X	X	X	X	1	Abacus (Rothwell)
27,11				X	X		X	X	1	Becket (Scampton)
31, 9				X	X	X	X	X	1	Vada (Rosemaund)
31, 14				X	X	X	X	X	1	Vada (WPBS)
119,13	X	X	X	X	X	X	X	X	1	Universe (Eastwell)
									1	Varunda (Rosemaund)
									1	Becket (Terrington)
									1	Vada (Terrington)
Virulence total	0	1	1	13	5	4	8	14	16	
%	0	6	6	81	31	25	50	88		

\* avirulent on Vada.

/ intermediate on Vada.

Table 18 Continued

(b) Lyallpur derivatives

Resistance Source	Akka	Wing	H1063	Vada	Sultan	Maris Concord	CP 127422	41/145	No of isolates	Variety and Location
Decanery value	128	64	32	16	8	4	2	1		
Race No.										
97,10		X	X	X				X	1	Tern (Dry Drayton)
99, 9		X	X	X			X	X	7	Tern (NIAB,1, Dry Drayton 4)
										Mazurka (WPBS, Eastwell)
99,11		X	X				X	X	5	Tern (Dry Drayton)
99,15		X	X				X	X	8	Tern (Dry Drayton 2)
										Ark Royal (Morley, Headley Hall)
										Mazurka (Rothwell, Rosemaund)
										Gopal (PBI)
										Rif (Headley Hall)
103, 9		X	X			X	X	X	1	Tern (Dry Drayton)
107, 13		X	X		X		X	X	1	Tern (Dry Drayton)
107, 15		X	X		X		X	X	1	Mazurka (PBI)
115, 9		X	X	X			X	X	2	Tern (Dry Drayton)
115, 11		X	X	X			X	X	4	Harkra, Wing (Morley)
										Wing (Bedford)
										Mazurka (PBI)
115, 15		X	X	X			X	X	4	Tern (Dry Drayton,2)
										Mazurka (Kingswear)
										Gopal (PBI)
123,13		X	X	X	X		X	X	1	Tern (Dry Drayton)
227, 15	X	X	X				X	X	1	Wing (Rothwell)
243, 9	X	X	X	X			X	X	1	Akka (Headley Hall)
Virulence total	2	36	36	12	3	1	35	36	36	
%	6	100	100	33	8	3	97	100	100	

Table 18 Continued

(c) Mlg derivatives

Resistance Source Decanery value	Akka 128	Wing 64	H1063 32	Vada 16	Sultan 8	Maris Concord 4	CP127422 2	41/145 1	No of isolates	Variety and location
Race No										
3, 9							X	X	1	Julia (Connington)
3, 10							X	X	1	Julia (Kelsall)
3, 11							X	X	1	Julia (Connington)
7, 11						X	X	X	2	Julia (Connington)
7, 15										Julia (Harper Adams)
15, 14						X	X	X	1	Julia (Connington)
23, 10				X	X	X	X	X	1	Julia (Terrington)
23, 11				X		X	X	X	1	Zephyr (PBI)
31, 11				X	X	X	X	X	1	Julia (Rothwell)
									1	Julia (Rosemaund)
Virulence total	0	0	0	3	2	7	10	10	10	
%	0	0	0	30	20	70	100	100		

(d) Mla<sub>6</sub> Derivatives

Resistance Source Decanery Value	Akka 128	Wing 64	H1063 32	Vada 16	Sultan 8	Maris Concord 4	CP127422 2	41/145 1	No of isolates	Variety and Location
Race No										
7, 11						X	X	X	3	Midas (Ardglass)
										Midas (Rosemaund)
7, 15						X	X	X	2	Midas (Terrington)
										Midas (Evanton)
15, 13					X	X	X	X	1	Midas (WPBS)
										Midas (Codford)
Virulence total	0	0	0	0	1	6	6	6	6	

Table 18 Continued

(e) Arabische derivitives

Resistance source	Akka	Wing	H1063	Vada	Sultan	Maris Concord	CP127422	41/145	No. of isolates	Variety and Location
Decanery value	128	64	32	16	8	4	2	1		
Race No										
11, 9					X		X	X	1	Aramir (Terrington)
15, 11					X	X	X	X	1	Maris Mink (Rosemaund)
Virulence total	0	0	0	0	2	1	2	2	2	

(f) No resistance

Resistance source	Akka	Wing	H1063	Vada	Sultan	Maris Concord	CP127422	41/145	No. of isolates	Variety and Location
Decanery value	128	64	32	16	8	4	2	1		
Race No										
15, 8					X	X	X	X	1	Maris Otter (Cards)
23, 12				X		X	X	X	1	Maris Otter (Depden)
99, 13		X	X				X	X	1	Maris Otter (Suffolk)
Virulence total	0	1	1	1	1	2	3	3	3	



Table 18 shows the virulence patterns of the mildew isolates. They have been grouped according to common resistance sources in the host varieties from which the isolates were collected.

The known resistance sources (and alleles) in the differential varieties are:-

<u>Differential variety</u>	<u>Resistance source (allele)</u>
Akka	Monte Cristo (Ml-a <sub>9</sub> ) + (Jm1-nz)(?)
Wing	Lyallpur (Ml-a <sub>7</sub> ) + (Jm1-nz)
H.1063	H.1063 (Jm1-nz)
Vada	H. laevigatum
Sultan	Arabische (Ml-a <sub>12</sub> )
Maris Concord	H. spontaneum (Ml-a <sub>6</sub> )
CP 127422	Pflugs Intensiv (Ml-g)
41/145	Ragusa (Ml-h)

(i) The frequency of isolates with virulence on Wing (Ml-a<sub>7</sub> + Jm1-nz) has increased since 1972. This virulence is still found infrequently on varieties other than those with resistance derived from Lyallpur.

(ii) The data agrees with the results of previous surveys that virulence on Sultan (Ml-a<sub>12</sub>) is most frequent on varieties derived from Arabische, less frequent on varieties with non of the above resistance sources and varieties derived from Vada, and least frequent on those derived from Lyallpur and Pflugs Intensiv.

(iii) Isolates from Midas (Ml-a<sub>6</sub>) are all virulent on both Maris Concord (Ml-a<sub>6</sub>) and CP 127422 (Ml-g), suggesting that the mildew population on Midas derives directly from that formerly common on Impala and Inis (both Ml-a<sub>6</sub> + Ml-g), since virulence on CP 127422, although essential for virulence on Impala and Inis, is not necessary for virulence on Midas.

(iv) With the exception of isolates from varieties derived from Lyallpur (Ml-a<sub>7</sub>) and H.spontaneum (Ml-a<sub>6</sub>), the ratio of virulence on Maris Concord (Ml-a<sub>6</sub>) to virulence on CP 127422 (Ml-g) is about 1 : 2. This ratio for isolates from varieties derived from H. spontaneum (Ml-a<sub>6</sub>) is 1 : 1 but for isolates from varieties derived from Lyallpur (Ml-a<sub>7</sub>) it is grossly different, being of the order of 1 : 35.

Since isolates from varieties derived from Lyallpur (Ml-a<sub>7</sub>) have a very low frequency of virulence on Maris Concord (Ml-a<sub>6</sub>), they are unlikely to have developed from isolates from Impala (Ml-a<sub>6</sub> + Ml-g) (see note (iii)). It is therefore likely that they have developed from that part of the population avirulent on Maris Concord (Ml-a<sub>6</sub>) but virulent on CP 127422 (Ml-g), such as occur most commonly on Julia, Zephyr and related varieties.

(v) Isolates virulent on Akka (Ml-a<sub>9</sub>) and Gopal (Ml-a<sub>5</sub>) (Gopal data unpublished) were identified and were found to possess additional virulence on H. 1063 (Jm1-nz) and Wing (Ml-a<sub>7</sub> + Jm1-nz). This supports the findings of Dr Wiberg in Sweden and indicates that the resistance of H. 1063 (Jm1-nz) is present in Akka and Gopal.

The occurrence of isolates virulent on Akka (Ml-a<sub>9</sub> + Jm1-nz) has been dependent on the increase in the mildew population of virulence on varieties derived from Lyallpur (Ml-a<sub>7</sub> + Jm1-nz) which have acted as a stepping stone in the accumulation of virulence on H.1063 (Jm1-nz) into the pathogen population.

### 3. Intensive survey

The intensive survey of the barley mildew population was greatly increased in size during 1973 and more than 10,000 isolates were collected. About 5,000 isolates have been inoculated on to host and ethirimol differentials and the data are being analysed.

The frequencies of the virulence genes on particular host varieties follow the pattern established in previous surveys, but the 1973 data demonstrates an interaction between adjacent fields of different barley varieties. The population structure close to a field boundary may be different from that found 50 m within the crop, and this relative difference can alter substantially within three weeks.

A consistent, large effect noticed in all populations obtained from Ml-g varieties (Julia, Zephyr etc.) is that the isolates which, additionally, possess virulence for Sultan (V-a<sub>12</sub>) seem less fit than those which do not, in that they invariably occur at a low frequency.

This effect probably plays a part in two phenomena:

(i) The mildew resistance of Maris Mink is probably due in part to the resistance gene combination in this variety (Ml-a<sub>12</sub> + Ml-g) which will select for a virulence gene combination in the pathogen (V-a<sub>12</sub>+V-g) which is relatively unfit compared with other pathogen forms.

(ii) The frequency of isolates with ethirimol tolerance appears to decline more quickly on Julia (Ml-g) than Maris Mink (Ml-a<sub>12</sub> + Ml-g). This is probably because the source of ethirimol tolerant mildew contains a relatively high proportion of isolates which are both ethirimol tolerant and virulent on Sultan (Ml-a<sub>12</sub>). As there is a disaffinity between the virulence genes V-a<sub>12</sub> and V-g, populations on Julia (Ml-g) have a relatively low initial frequency of ethirimol tolerance.

### 4. Fungicide tolerance

During 1973 a differential test for ethirimol tolerance has been developed and used to screen about 2,000 isolates including those sent to the Physiologic Race Survey. Most of the PRS isolates were ethirimol sensitive although intermediate and tolerant isolates were found:-

intermediate isolates were found on Julia (Kelsall)  
Tern (Dry Drayton)  
Julia (Ardglass, Co Down)  
Midas (Ardglass, Co Down)

tolerant isolates were found on Zephyr (PBI)  
Abacus (Terrington)  
Aramir (Terrington)

The majority of the tested isolates were obtained from intensive surveys of fields in East Anglia. A preliminary analysis of this data has been published (Wolfe, M S & Dinooor, A (1973). The problem of fungicide tolerance in the field. Proc. 7th Brit. Insec. & Fungic. Conf. 1, 11 - 19).



##### 5. Mobile nurseries

Initial results with mobile nurseries in 1973 were encouraging. The system involves exposure in a field crop of seedlings from ethirimol treated and untreated seed of a range of differential varieties. The seedlings are then incubated and examined for infection. Ethirimol tolerance and isolates virulent on Akka were discovered using mobile nurseries even though these factors occurred at too low a frequency to be detected by normal sampling methods.

Experiments on this form of sampling will be continued and extended in 1974.



MILDEW - OATS

WELSH PLANT BREEDING STATION, ABERYSTWYTH

R B CLOTHIER and I T JONES

1. During 1973, 60 samples were received at the W.P.B.S. The number of samples collected from winter oat varieties is shown in Table 19, and from spring oat varieties in Table 20.

Table 19 Mildew of Oats - Samples Collected from Winter Varieties

Winter Oat	No. of Samples
Peniarth	3
Maris Quest	1
04435 Cn	1
TOTAL	5

Table 20 Mildew of Oats - Samples Collected from Spring Varieties

Spring Oat	No. of Samples
Condor	10
Maris Tabard	9
Nelson	9
Mostyn	8
Maris Oberon	5
03004	3
Maris Titan	2
04336 Cn	2
Leanda	1
AJ 20/61	1
W 16840	1
02994	1
TOTAL	52

A further three samples were received from the varieties Pontif, 05247 Cn and S. 172.

2. Race Identification

Full results are given in Table 21.

Table 21 Mildew of Oats - Race Identification

Location	WPBS Code No.OMS/73/-	Date of Reception 1973	Variety	Race
<b>NORTHERN REGION</b>				
Northumberland Morpeth	32	10/7	Condor	2
	33	"	Maris Quest	2
	34	"	Mostyn	FTE
	35	"	Nelson	FTE
	36	"	Peniarth	2
<b>WEST MIDLANDS</b>				
Herefordshire Kington	54	2/8	Maris Tabard	3
	55	"	Maris Titan	3
	56	"	Nelson	3
Shropshire Newport	11	25/6	Condor	2+4
	12	"	Maris Oberon	3
	13	"	Maris Tabard	3
	14	"	Mostyn	4
	15	"	Nelson	3
	43	25/7	Maris Tabard	3
	44	"	Nelson	3
<b>SOUTH EASTERN REGION</b>				
Hampshire Sutton Scotney Whitchurch	18	4/7	Peniarth	FTE
	19	"	Condor	4
	20	"	Peniarth	FTE
<b>SOUTH WESTERN REGION</b>				
Devon Newton Abbot Starcross	42	23/7	Condor	FTE
	7	25/6	"	4
	8	"	Maris Tabard	4
	9	"	Mostyn	4
	10	"	Nelson	3
Somerset Englishcombe	16	5/7	Condor	4
	17	"	Mostyn	4
Wiltshire Warminster	37	10/7	Condor	4
	38	"	Mostyn	4
<b>WALES</b>				
Cardiganshire Llanon	2	23/5	"	4
	3	"	Pontif	4
	21	9/7	Maris Oberon	4
	22	"	Maris Tabard	5
	23	"	Nelson	5

Table 21 Cont.

Location	WPBS Code No.OMS/73/-	Date of Reception 1973	Variety	Race
Trawscodd	24	10/7	Condor	4
	25	"	Maris Oberon	4
	26	"	Maris Tabard	5
	27	"	Maris Titan	5
	28	"	Mostyn	4
	29	"	Nelson	5
	30	"	03004	5
	31	"	"	4
	45	2/8	Maris Oberon	4
	46	"	Maris Tabard	5
	47	"	Nelson	5
	48	"	AJ 20/61	4
	49	"	W16840	4
	50	"	02994	5
	51	"	03004	5
	52	"	04336	5
	1	2/5	S172	2+4
	4	14/6	04435 Cn	4
	5	"	05247 Cn	4
	6	"	04336 Cn	4
WPBS, A berystwyth	40	17/7	Maris Tabard	5
	41	"	Nelson	5
SCOTLAND				
Kincardineshire				
Laurencekirk	39	11/7	Condor	2
NORTHERN IRELAND				
Co. Armagh				
Loughgall	57	8/8	Condor	FTE
	58	"	Maris Oberon	FTE
	59	"	Maris Tabard	FTE
	60	"	Mostyn	FTE
EIRE				
Co. Kildare				
Leixlip	53	2/8	Leanda	2
FTE - Failed to Establish				

The majority of the 60 samples received came from the Western areas of Britain (Wales, S.W.England and W.Midlands). The remaining 25% came from other areas including S.England, N. England, Scotland, N.Ireland and Eire: Nine of the samples failed to culture.

In this year's survey over half the samples were from varieties or breeders' lines in which resistance is claimed to be derived from either 9065 Cn e.g. Mostyn, or from Cc 4146 e.g. Maris Tabard and Nelson, these newer varieties now becoming more widely grown.

Consequently, Race 2, which was the most frequently detected race 2 years ago and is avirulent on these resistance sources, was identified only in 5 samples, these being obtained from varieties such as Condor and Leanda with no known major genes for resistance. Race 2 was identified in samples received from Northumberland, Scotland and Ireland, and so far, no other race has been identified in material obtained from Ireland.



RHYNCHOSPORIUM - BARLEY  
WELSH PLANT BREEDING STATION, ABERYSTWYTH  
R.B. CLOTHIER

1. During 1973, 47 samples were received at the WPBS. The number of samples collected from winter barley varieties is shown in Table 22, and from spring barley varieties in Table 23.

Table 22. Rhynchosporium of Barley - Samples Collected from Winter Varieties

Winter Barley	No. of samples
Maris Otter	4
Malta	2
Senta	2
Alpha	1
Astrix	1
Maris Trojan (HB609/36)	1
TOTAL	11

Table 23. Rhynchosporium of Barley - Samples Collected from Spring Varieties

Spring Barley	No. of samples
Julia	7
Lofa Abed	4
Proctor	4
Zephyr	4
Maris Mink	3
Vada	3
Aramir	1
Becket	1
Clermont	1
Golden Promise	1
Hornisse	1
Maris Yak	1
Mazurka	1
SJ 678060	1
Universe	1
Varunda	1
TOTAL	35

One further sample was received from an unnamed variety.



## 2. Race Identification

Full results are given in Table 24.

Table 24 Rhynchosporium of Barley - Race Identification

Location	WPBS Code No RS/73/-	Date of Reception 1973	Variety	Race
<b>EAST MIDLANDS</b>				
Lincolnshire				
Rothwell	16	18/6	Maris Mink	1
	17	"	Maris Otter	1
Spalding	7	22/5	Astrix	2
<b>WEST MIDLANDS</b>				
Herefordshire				
Rosemaund	3	1/5	Malta	2
	4	"	Maris Otter	1
	5	"	Senta	FTE
Warwickshire				
Alcester	6	23/5	Unknown	1
<b>EASTERN REGION</b>				
Norfolk				
Morley	1	17/4	Maris Otter	1
	9	4/6	Proctor	1
<b>SOUTH EASTERN REGION</b>				
Hampshire				
Basingstoke	45	4/7	Julia	1
Sutton Scotney	43	"	"	1
	44	"	Zephyr	1
Up Sanborne	15	15/6	Golden Promise	1
<b>SOUTH WESTERN REGION</b>				
Gloucestershire				
Cirencester	30	2/7	Aramir	1
	31	"	Becket	1
	32	"	Hornisse	1
	33	"	Julia	1
	34	"	Proctor	1
	35	"	Varunda	1
	36	"	Zephyr	1
	37	"	SJ 678060	1
Somerset				
Frome	24	25/6	Lofa Abed	1
Wiltshire				
Burbage	42	5/7	" "	1
Yatesbury	10	13/6	Malta	1
	11	"	Maris Otter	1
	12	"	Senta	2
<b>WALES</b>				
Anglesey				
Brynsiencyn	25	26/6	Julia	1
	26	"	Lofa Abed	1
	27	"	Proctor	1
	28	"	Vada	1
	29	"	Zephyr	1

Table 24 Cont'd

Location	WPBS Code No. RS/73/-	Date of Reception 1973	Variety	Race
Cardiganshire				
Llanon	8	5/6	Maris Trojan	1
	22	25/6	Maris Mink	1
	23	"	Universe	1
WPBS, Aberystwyth	2	2/5	Alpha	2
Flintshire				
Holywell	38	3/7	Julia	1
	39	"	Lofa Abed	2
	40	"	Proctor	1
	41	"	Vada	1
Pembrokeshire				
Martlebury	20	21/6	Julia	1
	21	"	Vada	1
SCOTLAND				
Inverness				
Dalcross	13	15/6	Clermont	1
	14	"	Mazurka	1
NORTHERN IRELAND				
Co. Londonderry				
Coleraine	18	19/6	Julia	1
	19	"	Zephyr	1
EIRE				
Co. Kildare				
Leixlip	46	2/8	Maris Mink	1
	47	"	Maris Yak	1

FTE - Failed to Establish

Of the forty seven samples that were received, nine were from winter varieties and thirty six were from spring barley varieties. Only one sample failed to produce an infection.

Five samples gave race UK 2 reactions, four of those coming from winter varieties resistant to race UK 1. The remaining forty one samples were race UK 1.

The isolates giving race UK 2 reactions came from the WPBS, Herefordshire, Lincolnshire, Wiltshire and Flintshire.

Four samples from Ireland gave race UK 1 reactions. So far race UK 2 has not been identified from Ireland.





