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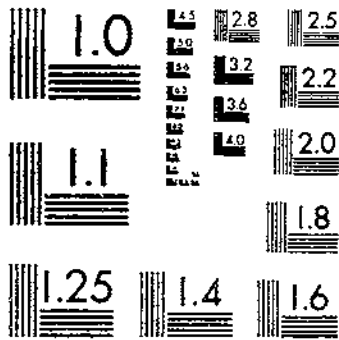
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SUSCEPTIBILITY OF BARLEY TO LEAF RUST (*PUCCINIA ANOMALA*) AND TO POWDERY

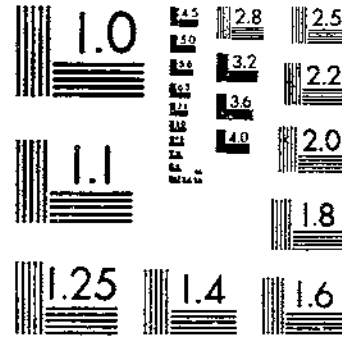
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MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A



UNITED STATES DEPARTMENT OF AGRICULTURE  
WASHINGTON, D. C.

# SUSCEPTIBILITY OF BARLEY TO LEAF RUST (*PUCCINIA ANOMALA*) AND TO POWDERY MILDEW (*ERYSIPHE GRAMINIS HORDEI*)<sup>1</sup>

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### INTRODUCTION

Since very little information was available concerning varietal susceptibility of barley to leaf rust (*Puccinia anomala* Rostr.), a survey of barley varieties has been made as part of the cooperative investigations between the department of botany of the Purdue University Agricultural Experiment Station and the Division of Cereal Crops and Diseases, Bureau of Plant Industry. Early in these studies abundant infection with powdery mildew (*Erysiphe graminis hordei* Marchal) developed, and it was noted that there were marked differences in the relative susceptibility of varieties. Studies on both fungi were continued on seedlings in the greenhouse, and leaf rust also was studied in field plantings at La Fayette, Ind.

### LEAF-RUST STUDIES

In 1924, through the kindness of H. V. Harlan and M. N. Pope, of the Division of Cereal Crops and Diseases, more than 600 varieties and selections of barley were received for investigation. All these were studied in the seedling stage in the greenhouses of the agricultural experiment station of Purdue University. Each variety and selection was inoculated when in about the second or third leaf. The plants were inoculated the first year by the scalpel method, as has been reported for similar studies of leaf rust of wheat.<sup>2</sup> In the following years the seed of varieties was sown in rows in the greenhouse bed. When the plants had reached the proper size they were inoculated by shaking heavily rusted barley over the seedlings.

<sup>1</sup> Cooperative investigations between the department of botany, Purdue University Agricultural Experiment Station, and the Division of Cereal Crops and Diseases, Bureau of Plant Industry, U. S. Department of Agriculture.

<sup>2</sup> MAINS, E. B., and JACKSON, H. S. PHYSIOLOGIC SPECIALIZATION IN THE LEAF RUST OF WHEAT, *PUCCINIA TRITICINA* ERIKSS. Phytopathology 16: [89]-120, illus. 1926.

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After being given a fine spray of water, they were covered with muslin held up from the plants by 12-inch pot labels placed at intervals in the bed. The muslin was then wetted, and the plants were left covered 12 to 24 hours. A high humidity was obtained in this way, and a very uniform and severe infection developed. This method greatly reduces the labor of inoculation and has been employed by the senior writer in all cases where large numbers of varieties have been studied. Only one culture of the rust was allowed in the greenhouse, thus obviating possible complications from a mixture of physiologic forms.

The reaction of seedlings in the greenhouse was classified according to types of reaction. Highly resistant was denoted by 0, very resistant by 1, moderately resistant by 2, moderately susceptible by 3, and very susceptible by 4. In the field the rust reaction was indicated by the percentage of uredinia on the variety.

In the spring of 1924 the complete set of varieties was sown in short rows in the field at La Fayette, Ind. The rust was started in this nursery by dusting the rows with heavily inoculated plants from the greenhouse. In subsequent years the number of varieties was reduced, only those showing some promise of value because of resistance or outstanding agronomic value being retained.

As has been described elsewhere,<sup>3 4</sup> it was found during the course of these studies that at least two physiologic forms of the rust occurred in the United States. These are distinguished by the reaction of a number of varieties of barley. In Table 1 are shown the reaction of varieties to physiologic form 1 in the seedling stage in greenhouse studies during the winters of 1924 and 1925, and the field reaction of the maturing plant in 1924. It is evident that there is considerable difference in the reaction of varieties. The majority of them were very susceptible (type 4) in the seedling stage.

TABLE 1.—Reaction of barley varieties to physiologic form 1 of the leaf rust of barley (*Puccinia anomala*) in greenhouse and field studies, 1924-25

Variety *	C. I. No. †	Probable origin	Ecological group	Reaction to † physiologic form 1 in greenhouse		Field † reaction, 1924
				1924	1925	
<i>Hordeum vulgare</i> pallidum:						
Abed July.....	1390	.....	.....	4	4	10-24
Abundio.....	1412	Persia.....	.....	2	.....	85
Abyssinia.....	361	Ethiopia.....	.....	4	4	25-49
Do.....	849	do.....	.....	.....	.....	50-84
Do.....	950	do.....	.....	3	.....	25
Do.....	951	do.....	.....	4	.....	60-84
Abyssinian.....	1216	do.....	.....	4	4	25-49
Do.....	1217a	do.....	.....	4	.....	25
Do.....	1217b	do.....	.....	4	.....	T-6
Do.....	1218	do.....	.....	4	.....	25-49
Do.....	1219	do.....	.....	4	.....	25-49

\* Varieties classified according to the following publication: HARLAN, H. V., THE IDENTIFICATION OF VARIETIES OF BARLEY. U. S. Dept. Agr. Bul. 822, 32 p., illus. 1918.

† C. I. denotes accession number of the Division of Cereal Crops and Diseases, Bureau of Plant Industry, U. S. Department of Agriculture.

0=Highly resistant, no uredinia produced, infection evident as necrotic spots without uredinia; 1=very resistant, uredinia few, small infection mostly evident as necrotic spots without uredinia; 2=moderately resistant, uredinia moderately abundant, moderate in size, in necrotic spots, necrotic or chlorotic spots often without uredinia; 3=moderately susceptible, uredinia moderate to large, moderately prevalent, usually accompanied by some chlorosis; 4=very susceptible, uredinia large, abundant, with little or no chlorosis. Percentage of uredinia compared with the number possible. T=trace.

‡ Field reaction given as percentage of uredinia as compared with the amount possible.

1 MAINS, E. B. STUDIES IN RUST RESISTANCE. Jour. Heredity 17:313-325, illus. 1928.

2 MOST SPECIALIZATION OF BARLEY LEAF RUST, PUCCINIA ANOMALA. Phytopathology 20: 873-882, illus. 1930.

TABLE 1.—Reaction of barley varieties to physiologic form 1 of the leaf rust of barley (*Puccinia anomala*) in greenhouse and field studies, 1924-25—Continued

Variety	C. I. No.	Probable origin	Ecological group	Reaction to physiologic form 1 in greenhouse		Field reaction, 1924
				1924	1925	
<b>Hordeum vulgare pal-</b>						
<b>lidum—Continued.</b>						
Abysynian	1221	Ethiopia		4		25-64
Do.	1223	do		4		25-34
Do.	1220	do		3		65-74
Do.	1227	do		3		60-64
Do.	1228	do		3		50-64
Do.	1231	do		2	3	25
Do.	1233	do		4		100
Do.	1237	do		4		35
Do.	1241	do		4		50
Do.	1243	do		1	0	T
Acanthus	1095	Sweden	Manchuria	4		100
Alcazar	1096	do	do	4		75
Alaxis	908		Hybrid	4		65
Amarillo	1073	China		4	4	75
Apalan	1347			0	0	10-24
Arabal	896		Tennessee Winter X Black Arabian	4		100
Argentine	223	North Africa	Coast	4	4	5-9
Azov	1028			4		15
Baker	976	Asiatic Turkey		4		
Barbary	695	North Africa	Coast	4	3	5-14
Bashaw	1018			4		65-74
Blue Ribbon	611	Manchuria	Manchuria	4	3	25-34
Caballero	1006	Russia	do	4		50-64
Cadmus	1054	China		4	4	75
California Mariout	1455	North Africa	California Mariout	4	3	25-49
Calks	2440	Peru	Coast	2	1	T-9
Canada Winter	713	Europe	Tennessee Winter	4	4	65-74
Canadian Lake Shore	2515		Manchuria	4		65
Cape	557	do		2	1	15
Do.	1268		Coast	3		25-49
Do.	1387		North Africa	4	4	15
Cerytid	1108	Switzerland	Manchuria	4	4	50
Cebada	1055	China		3	4	75
Champeau	990	Siberia	Manchuria	4		100
Cheliff	1074	North Africa	Coast	4	2	T
Chevron	1111	Switzerland		4		100
Chile	663	North Africa	Coast	0	0	T-9
Chiga Arpa	744	China		1	0	25-49
Clancy	1002	Russia	Manchuria	4	4	25
Club Mariout	261	Egypt	Club Mariout	3	2	T
Coast	276	North Africa	Coast	1	0	T
Do.	626	do	do	3	1	5-14
Do.	690	do	do	3	1	T
Do.	691	do	do	1	0	T
Do.	2369	do	do	4		65
Consul	1061	China		2+	4	25-49
Cortile	1123		Smooth X Indian Head	4		25-49
Crocket	1094	Sweden	Manchuria	3		75
Cusado	895		Tennessee Winter X Black Arabian	2	4	75
Czar	1005	Russia	Manchuria	4	4	50
Daniels	971	Manchuria	do	1	0	50-64
Dinar	729	North Africa		3		25-49
Duplex	2433	Russia		2	5	25-49
Eagle	913	Manchuria	Manchuria	4		60-64
Do.	1325	do	do	4		65
Do.	1324	Manchuria	do	4		50
Featherston	911	do	do	4		50-64
Do.	954	do	do	3	4	25
Do.	1118	do	do	2+	4	T-14
Do.	1119	do	do	4		65
Do.	1120	do	do	0	0	50-64
Fengsefn	1040	China		4	4	50-64
Finland	581	Finland	Arctic Manchuria	4		25-49
Fische	1263	South Russia		4	4	75
Galwan	2343	Central Asia		4		65-74
Gabangir	1089	India		1	2	T
Gool	1058	China		4	4	75-100
Greece	221	Greece	Coast	4	4	T-9

TABLE 1.—Reaction of barley varieties to physiologic form 1 of the leaf rust of barley (*Puccinia anomala*) in greenhouse and field studies, 1924-25—Continued

Variety	C. I. No.	Probable origin	Ecological group	Reaction to physiologic form 1 in greenhouse		Field reaction, 1924
				1924	1925	
<i>Hordeum vulgare pallidum</i> —Continued.						
Qurov	1099	Russia		4		65
Han River	206a	China		4		75-100
Do	206b	do		4		75-100
Harem	1019	North Africa		4		50
Haus	734	India		4		T
Eldeigo	1020			1	0	15
Elsoin	1053	China		2		50-64
Hodge	932	Turkestan		3		50-64
Judith	1038	China		4	4	100
July	1082	Denmark		4	4	60
Kaosen	1042	China		4	4	25-49
Khanaka	743	Chinese Turkestan		4	4	75
Khartum	2367	North Africa		2	2	25-49
Koepck	860	do	Coast	3	2	T-9
Korsbyg	918	do		2	3	25-34
Kumfide	730	China		3		25-49
Kunshan	1045	do		4	3	25
Kusan	1315	Egypt		4		100
Kwan	1016	India		3	2	T-24
Ladrone	696	Palestine		1	3	T-14
Lake City	1126	Manchuria	Manchuria	4		76
Large-Grained Winter	408	Europe	Tennessee Winter	4	2	T-14
Leh	700	India		2	2	35-40
Lland	1323		Manchuria	4		65
Losain	1070	China		4	4	50
Lubin	2435	Russia		4		65
Luth	903	Manchuria	Manchuria	4		65
Do	972	do	do	2	2	5-14
Maister	1025			4		50-64
Mammoth Winter	220	Europe	Tennessee Winter	3		
Manchuria	244	Manchuria	Manchuria	2		26-34
Do	354	do	do	4		50
Do	576	do	do	4	4	15-24
Do	643	do	do	4		50-64
Do	956	do	do	4		50-64
Do	1251	do	do	4		75
Do	1397	do	do	4		60
Manchuria Pedigree	1244	do	do	4		60
Mannoy	2450	North Africa	Coast	4	4	T-5
Mecca	1051	China		3	2	25
Macknos Maroc	1379		Coast	1	0	T
Michung	1160	China		4		25-49
Mignon	992	Russia	Manchuria	4		100
Monte Cristo	1017	India		2-3	2+	5-9
Nani Tai	1087	do		4	4	T
Nancock	1329	Manchuria	Manchuria	4		65
Niver	737	China		3	4	65
Notherson	1093	Sweden	Manchuria	3		75
Oderbrucker	940	Manchuria	do	1	0	50-64
Do	957	do	do	1	0	50-64
Do	969	do	do	4		50
Do	1137	do	do	4	4	75-100
Do	1396	do	do	4		50
Odessa	182	Russia	Odessa	4		50
Do	916	do	do	2	2	25-49
Do	927	do	do	4		65-74
Do	934	do	do	2		50
Do	974	do	do	4		25-34
Olonets	198	Russia	Arctic	4		50
Pannier	1330			0		75
Peru	653	North Africa	Coast	3	2	5-24
Peruvian	935	do	do	1	1	T
Petchora	2425			4		65
Pldor	901		Tennessee Winter	3	4	75
Podá	652	North Africa	Coast	4	2	5-14
Pontius	731	China		2	3	50
Quinn	1024	North Africa	Coast	2	0	T
Rasput	906	Russia	Manchuria	4		100
Red River	973	Manchuria	do	4		50-64
Rival	2345			3	2	T
Royal	1252		Swedish x Baxter	3		75

TABLE 1.—Reaction of barley varieties to physiologic form 1 of the leaf rust of barley (*Puccinia anomala*) in greenhouse and field studies, 1924-25—Continued

Variety	C. I. No.	Probable origin	Ecological group	Reaction to physiologic form 1 in greenhouse		Field reaction, 1924
				1924	1925	
<i>Hordeum vulgare pallidum</i> —Continued.						
Rubard	2434	Russia		3		59
Ruble	870			4	3	5-14
Sagina	1269	North Africa	Coast	4		25
Salamanca	689	Spain		3		25-34
Sandrol	937	North Africa	Coast	4		50-64
Scottish Pearl	277	Europe	Tennessee Winter	4	4	25-49
Servian	915	Serbia		4		50
Shale	2430	Russia		4		50
Shorthed	2364	North Africa		3	2	T
Silver King	2374	Manchuria	Manchuria	4		50-64
Squarehead Winter	252	Europe	Tennessee Winter	4		0-T
Sultan	997	Russia	Manchuria	3		100
Salu	1022			3	0	T
Summit	929		Swedish X Baxter	3	3	15-34
Do.	1136			3		50
Sumson	1062			4		50-64
Surprise	171		Swedish X Baxter	3-4		65-100
Tall	194	North Africa	Coast	3	2	0-T
Tankow	646		Tennessee Winter X Hankow	1-4		35-49
Tennessee Winter	257	Europe	Tennessee Winter	4	4	65
Do.	876	do.	do.	4		65-74
Texas Winter	554	do.	do.	4		65-74
Tonot	1012	North Africa	Coast	2	3	T-14
Trebi	936	Asiatic Turkey	Trebi	4		25
Turkestan	711	Turkestan		1	1	T-14
Tystolte	1322	Denmark		4		10-24
Unnamed	497	Egypt		2		25
Do.	1383			2	2	T
Do.	2346			4	4	T
Do.	2350			4	4	T
Do.	2368	Siberia	Manchuria	4		65
Do.	2371			4		65
Do.	2372			4		35-49
Do.	2373			4		50-64
Do.	2380	Ethiopia		4		65-74
Do.	2394	do.		4		10-14
Do.	2410	do.		2	3	25-49
Do.	2411	do.				25
Do.	2412	do.		3		65
Do.	2418	do.		4		25-49
Do.	2420	do.		2		15-24
Do.	2421	do.		4		50
Venus	736	China		3	4	75
Victor	1411	Asia Minor (Persia)		4		75
Wansnipe	1050	China		3		50-64
Welder	1021			1	0	T
White Gatami	920	Manchuria		4	4	65-74
White Russian	706	Russia		4	4	15-24
Winter	667	Turkestan		4	4	50-64
Wisconsin Winter	519	Europe	Wisconsin Winter	4	4	15-24
Woodrow	986	Russia	Manchuria	4		50
Wusein	1044	China		4		65-74
Youshan	1063	do.		2		75-100
Yuwan	1071	do.		4		50
Zond	1138	Asiatic Turkey	Trebi	4		50
<i>Hordeum vulgare pallidum parallelum</i> :						
Abyssinia	943	Ethiopia		3		50-64
Do.	946	do.		4		15-24
Abyssinian	2193		Abyssinia	4		65
Gambrius	1086	China		2		25-60
<i>Hordeum vulgare pallidum pyramidatum</i> :						
Abacus	1088	India		0	0	T
Abyssinia	2192	Ethiopia		1	1	T
Abyssinian	2194	do.		4		65
Do.	2195	do.		4		65
Do.	2195	do.		1		5-24
Chile Brewing	657				1	25
Club Marlout	932	North Africa	Club Marlout	3	3	T
Do.	2334	do.	do.	3	3	T
Console	1112	Switzerland		2	3	T-4



TABLE 1.—Reaction of barley varieties to physiologic form 1 of the leaf rust of barley (*Puccinia anomala*) in greenhouse and field studies, 1924-25—Continued

Variety	C. I. No.	Probable origin	Ecological group	Reaction to physiologic form 1 in greenhouse		Field reaction, 1924
				1924	1925	
<i>Hordeum vulgare pallidum pyramidatum</i> —Continued.						
Czech	1023			2	2	T-14
Filer	1039	China		4	4	75-100
Xobeck	2436	Russia		4		50
Loehink	2460	China		2	3	5-24
Malwet	2459	do.		3	4	50-64
Moy Wah	1064	do.		4		100
Mulyan	2453	do.		3	3	25-49
Pasha	984	Russia		4	4	75
Pegan	2454	China		4	4	25-49
Rakoff	2432	Russia		4	4	25-49
Russia	1371	do.		4	4	50-64
Scarab	995	Russia		2		100
Welcome	2439	do.		4		65
Winter Club	592	Europe	Winter Club	4		75
<i>Hordeum vulgare pallidum rikotense</i> :						
Andrew	1351		Leiorrhynchum × Mariout.	4		35
Blarney	1303		Lion × Manchuria	4		25
Catts	1233		Bay Brewing × Lion	4		65
Cheddar	1307		do.	4	4	5-9
Costes	1349		Leiorrhynchum × Mariout.	4		65
Feline	1284		Lion × Featherston	4		65
Fergel	1360		Mariout × Leiorrhynchum.	4		65
Glette	1359		do.	4		25
Hero	1286		Club Mariout × Lion	3	3	10-24
Heron	1299		Manchuria × Lion	4		65
Hopper	1285		Bay Brewing × Lion	4		65
Hurst	1304		Featherston × Lion	4		65
Jusborne	1355		Lion × Manchuria	4		75
Lariout	1350		Leiorrhynchum × Mariout.	3		25
Leader	1282		Bay Brewing × Lion	4		25-49
Limerick	1302		Manchuria × Lion	2		50
Louden	1308		Bay Brewing × Lion	4		25-49
Lyman	1358		Lion × Manchuria	4		50
Minorca	1357		do.	4		35
Morrison	1361		do.	4		25-49
Newcomb	1668		Mariout × Leiorrhynchum.	3	4	25
Nigger	1301		Manchuria × Lion	2		75
Norbec	1363		Bay Brewing × Lion	3		50
Olman	1534		Featherston × Leiorrhynchum.	4		65
Osborn	1364		do.	4		50
Phoebe	1305		Bay Brewing × Lion	4	4	5-9
Plymoth	1356		do.	4		50
Preston	1348		Leiorrhynchum × Mariout.	4		15
Ramsey	1366		Mariout × Leiorrhynchum.	4	4	5-24
Theodore	1300		Manchuria × Lion	4	4	25
Unnamed	1352		Leiorrhynchum × Mariout.	3		65
Do.	1353		Bay Brewing × Lion	2		65
Do.	2331		Smooth Awn × Manchuria.	4		65
Vaughn	1367		Mariout × Leiorrhynchum.	4	3	25
Vitz	1306		Bay Brewing × Lion	4		65
<i>Hordeum vulgare pallidum coarulescens</i> :						
Abyssinian	1235	Ethiopia		4		50-64
Do.	1242	do.		4		75
Albacete	1128	Spain		4		65
Algerian	1179	North Africa	Coast	4	4	15-24
Araquipa	1256	do.	do.	0	0	0
Do.	2329	do.	do.	2	1	0
Barquis	1076	do.	do.	4	2	T
Blubak	2445	China		4		25-49

SUSCEPTIBILITY OF BARLEY

TABLE 1.—Reaction of barley varieties to physiologic form 1 of the leaf rust of barley (*Puccinia anomala*) in greenhouse and field studies, 1924-25—Continued

Variety	C. I. No.	Probable origin	Ecological group	Reaction to physiologic form 1 in greenhouse		Field reaction, 1924
				1924	1925	
<i>Hordeum vulgare pallidum coeruleus</i> —Continued.						
Holivia	1267	North Africa	Coast	1	0	0
Do	1365	do	do	3	4	T
Brutus	1011	North Africa	do	3	2+	25
Buchang	1643	China		4	4	65-74
Cabern	1437	North Africa	Coast	1	1	T-14
Canadian Malt- ing No. 2	1034	North Europe		4	4	75
Cape	1028	do	Coast	4	4	75
Do	1386	do	do	4	4	25
Do	1461	North Africa	Coast	2	3	T
Cartouch	1107	Switzerland	Manchuria	3	4	50
Chilean C	1432	North Africa		0	0	T-14
Chilean D	1433	do	do	1	0	T
Coast	1430	North Africa	Coast	4	4	T-14
Do	2332	do	do	4	3	25
Do	2333	do	do	3	3	25
Do	2335	do	do	2	3	25
Do	1075	do	do	2	4	25
Coventry	1037	India		3	3	50
Cromlech	1215	North Africa	Coast	4	2	T
Crypt	1050	India		4	4	T
Cyrena	1258	do	do	4	4	100
Julifaca	1114	North Africa	Coast	2	0	T-4
Kimberly	1382	do	do	2	2	T-14
Koran	1063	China		4	4	60-64
Lynch	919	North Africa	Coast	1	0	15-24
Malting	1129	do	Manchuria	1	0	50
Manchuria	1178	Manchuria		3	3	65
Do	1435	do	do	2	3	25-34
Do	2330	do	do	0	0	25-49
Do	1436	do	do	1	1	T-9
Maxima	392	Rumania	Coast	3	3	T-4
Moldavia	1362	Hybrid		4	4	50
Norton	1174	Manchuria	Manchuria	3	3	60-64
Oderbrucker	1438	Russia	Odessa	2	3	25
Odessa	1372	do	do	4	4	25
Persia	707	North Africa	Coast	3	3	50-64
Peru	1131	do	do	2	1	T
Peruvian	994	Russia		3	3	50-64
Petro	2362	North Africa		2	4	50
Roseworthy	1439	do	do	2	4	66
Roseworthy Ore- gon						
Sabbaton	1266	China		4	4	75
Sanook	1395	do	do	4	4	5-14
Shorthed	1441	North Africa		4	4	50
Squarehead	1417	do	Coast	2	4	25
Squarehead Win- ter	1267	do	do	3	2	25
Tripoli	1115	North Africa		2	2	75-100
Turbat	1254	Asia		4	4	50
Wanfai	2461	China		4	4	50-64
<i>Hordeum vulgare pallidum subviolaceum</i> :						
Abyssinian	1238	Ethiopia		3	3	65
Chusein	1039	China		3	4	100
Coolie	1060	do	do	4	4	75-99
Envoy	1045	do	do	4	4	100
Fesan	2463	do	do	4	4	25-49
Hiangshan	1047	do	do	3	4	75
Leopold	1057	do	do	4	4	75
Milsein	1062	do	do	3	3	50
Soochow	857	do	do	3	3	25-49
Squiers	1072	do	do	4	4	50-64
Yatlong	2444	do	do	4	4	25-49
<i>Hordeum vulgare pallidum eurylopis</i> :						
Wensnipe	2356	China		4	4	75
<i>Hordeum vulgare nig- rum</i> :						
Abyssinian	1220	Ethiopia		4	4	T-14
Do	1222	do	do	3	3	T-14
Do	1230	do	do	2	2+	25
Do	1232	do	do	4	4	25

TABLE 1.—Reaction of barley varieties to physiologic form 1 of the leaf rust of barley (*Puccinia anomala*) in greenhouse and field studies, 1924-25—Continued

Variety	C. I. No.	Probable origin	Ecological group	Reaction to physiologic form 1 in greenhouse		Field reaction, 1924
				1924	1925	
<i>Hordeum vulgare</i> nigrum—Continued.						
Barbican	1265			4		25
Do.	2338			3	3	25
Black Russian	705	Caucasus		3	3	T-14
Danjon	1264			3	4	25
Gatami	575	Manchuria		2	3	25-49
Do.	1413	do		4	4	25
Ghest	979	Russia		3	2	T
Oswang	697	India		2	3	5-14
Unnamed	2349			2	3	T
Wafat	1009	Russia		4	4	T-24
<i>Hordeum vulgare</i> nigrum leiorhynchum:						
Black Algerian	708	North Africa		4		100
Chorny	575	Russia		4	4	50-64
Lion	923	do		4	2	50-64
Nekludovi	1000	do		4		100
<i>Hordeum vulgare</i> horsfordianum:						
Diana	1345		Nepal X	0	0	75
Hooded Spring	716		do	0	1	65-74
Horsford	507		Nepal	0	0	15-24
Do.	610		Nepal X	0	0	25-34
Do.	1375		Nepal	4	4	25-49
Do.	2324		Nepal X	4	4	50
Kipper	1291		do	0	0	65
McFadden	1398		Horsford X Hanna	0	0	50
Do.	1399		Horsford X Manchuria	0	0	50
Do.	1401		Hybrid	0	0	100
Do.	1402		Horsford X Manchuria	1	0	65
Do.	1404		Horsford X Hanna	0	0	65
Do.	1406		do	0	0	65
Do.	1408		Horsford X Manchuria	1	0	50
Do.	1409		do	0	0	50
Nuerts	741	China		2	4	100
Sirroche	1289		Nepal X	4		25
Wilder	1346		do	4		35
<i>Hordeum vulgare</i> coeleste:						
Ak Arpa	747	China	Turkestan	2		65-74
Barley Wheat	1384			4		50
Black Hull-less	735	China	Turkestan	4		65
Do.	1097	Central Asia	Black Hull-less	2	2	25
Chilga Arpa	2351	China	Turkestan	4		65
Comju	2358	Japan		4		50
Dehra	1085	India		4	4	65
Eremo	1014	do		4		75
Galangatch	727	China		4		75
Gorak	1086	India		4		75
Hankow	197	China	Central Asia	4	4	50-64
Hansoo Hull-less	703		Horsford X Hankow	4	4	100
Himalaya	254		Himalaya	4	4	5-9
Hull-less	609	India		4		65
Do.	745	China	Turkestan	4	4	100
Huskless	722	Central Asia		4		100
India	698	India		4	4	75-100
Do.	2318	do		4		65
Do.	2319	do		3		25
Iris	988	Russia		4	4	100
Ivory	865	China		2	3	25-34
Kama-ore	624	Japan		4		65
Kharilla	733	China		2	4	50
Kok Arpa	746	India	Turkestan	4	4	50-64
Lokiang	2457	do		4		25-49
Maynang	2429	do		4	4	25-49
Memesh	693	do		4		50
McFadden	1406		Nepal X	4		25-49
Nangmay	2428	China		4	4	50-64
Orkoe	2465	do		2	3	65-74
Pingpong	1056	do		2		50
Pingyan	1067	do		4		25

TABLE 1.—Reaction of barley varieties to physiologic form I of the leaf rust of barley (*Puccinia anomala*) in greenhouse and field studies, 1924-25—Continued

Variety	O. I. No.	Probable origin	Ecological group	Reaction to physiologic form I in greenhouse		Field reaction, 1924
				1924	1925	
<i>Hordeum vulgare</i> coeleste—Contd.						
Foree.....	2428	Japan.....		4		50-64
Robln.....	901	Russia.....		4		85
Saggia.....	1316	Ethiopia.....		4		100
Sangatsuka.....	78	Japan.....		2	4	50-64
Santizo.....	1049	China.....		4	4	50-64
Semet.....	1314	Ethiopia.....		4		100
Swedish Hull-less.....	623			4		50-64
Tatten.....	665	Asia.....		4		50
Thomas.....	1041	China.....		4		25
Unnamed.....	671	Ethiopia.....		4	4	25
Watho.....	2458	do.....		4	4	T-14
Yanahadaka.....	580	Japan.....		4		50-64
Zunpakoi.....	692	do.....		2	4	65-74
<i>Hordeum vulgare</i> coeleste nudipyramidalatum:						
Kamamugi.....	577	Japan.....		4		65-74
Taihu.....	868	China.....		4	4	50-64
Tanbashi.....	578	Japan.....		4		65-74
<i>Hordeum vulgare</i> coeleste himalayense:						
Ederle.....	1014	India.....	Himalaya.....	4	4	65
Himalaya.....	620	Central Asia.....	Coeleste X Coast.....	4	4	25-34
Do.....	1312			3	4	25-34
Do.....	2448	China.....		4	4	T-25
<i>Hordeum vulgare</i> coeleste violaceum:						
Black Hull-less.....	596	Central Asia.....	Black Hull-less.....	4	3	5-14
Do.....	618	do.....	do.....	2		65
Do.....	666	do.....	do.....	4	4	25-34
Do.....	1027			4		75
Do.....	2320	Central Asia.....	Black Hull-less.....	4		10-23
Do.....	2449	China.....		4		50
Mochi-Hadaka.....	2423	Japan.....		4		50
Do.....	2424	do.....		3		35
Purple Hull-less.....	1415			4	4	25
Spain.....	1370			3	4	25-49
<i>Hordeum vulgare</i> trifurcatum:						
Black Hull-less.....	1032			4	4	50
Skinless.....	1414	India.....	Nepal.....	3	4	25
Lilbor.....	806	China.....	do.....	2		T-9
Nepal.....	247	India.....	do.....	4	3	5-14
Do.....	250	do.....	do.....	4	3	5-14
Do.....	262	do.....	do.....	4	3	T-14
Do.....	475	do.....	do.....	4	3	15-34
Do.....	489	do.....	do.....	4	3	T-14
Do.....	533	do.....	do.....	4	3	5-24
Do.....	595	do.....	do.....	4	3	T-24
Do.....	598	do.....	do.....	2	4	T-14
Do.....	1290	do.....	do.....	3	3	T-14
Do.....	1292	do.....	do.....	4	4	25-34
Do.....	1385	do.....	do.....	4		50
Do.....	2322	do.....	do.....	4		10-24
Purple Nepal.....	1373	do.....	do.....	2	1	T
Subnepal.....	2321	do.....	do.....	4		25-49
Unnamed.....	2365	do.....	do.....	4		25
China.....	616	China.....	Awnless.....	4		25
<i>Hordeum intermedium</i> haytoni Famesh:						
<i>Hordeum intermedium</i> haytoni tonsum:						
Arlington Awnless.....	702		Tennessee Winter X Black Arabian.....	4	4	75-100
Bozru.....	753	Japan.....		4	5	25-34
Bozru.....	749	do.....		4	4	100
Huwan.....	1080	China.....		3	4	100
McFadden.....	1443			4		65
Nakano Wase.....	754	Japan.....	Awnless.....	3	3	25-49
Saitama-Nisbiki.....	752	do.....		4	3	50
<i>Hordeum intermedium</i> mortoni nigritosum:						
Chinermu.....	1079	China.....		3	3	100
Nigrate.....	2444	do.....		2		25-49

TABLE 1.—Reaction of barley varieties to physiologic form 1 of the leaf rust of barley (*Puccinia anomala*) in greenhouse and field studies, 1924-25—Continued

Variety	C. I. No.	Probable origin	Ecological group	Reaction to physiologic form 1 in greenhouse		Field reaction, 1924
				1924	1925	
<i>Hordeum intermedium nudihaxtoni</i> : Unnamed	2352	-----	-----	4	-----	65-74
<i>Hordeum intermedium cornutum</i> : Cornutum	724	India	-----	2	4	25-49
Do.	1317	South Africa	-----	4	-----	100
Do.	2356	-----	-----	4	-----	65
<i>Abyssinia intermedia</i> : Abyssinia	676	Ethiopia	-----	4	3	25
<i>Abyssinian intermediate</i> : Do.	2326	do.	-----	4	-----	65
Do.	2377	do.	-----	4	-----	50
Do.	2379	do.	-----	4	-----	50-64
Do.	2381	do.	-----	4	-----	50
Do.	2382	do.	-----	4	-----	75
Do.	2407	do.	-----	4	4	25
Do.	2409	do.	-----	4	-----	50
Do.	2415	do.	-----	2	3	25
Do.	2514	do.	-----	4	-----	75
Black Abyssinian	2383	do.	-----	4	-----	10-14
Black Abyssinian intermediate	2416	do.	-----	4	4	25
Mandarin	981	do.	-----	4	4	25
<i>Hordeum distichon palmella</i> : Alpha	959	-----	Manchuria X Champion of Vermont.	4	4	25-34
Archer	2360	England	-----	4	-----	25
Bolton	177	-----	Swedish X Baxter	4	-----	75-100
Do.	922	-----	do.	3	-----	65-69
Cleroff	935	Russia	-----	4	4	25
Esdra	1262	South Russia	-----	4	4	25-49
Fidel	1445	Persia	-----	4	4	75
Golden Grain	2363	England	Thorpe	4	-----	65
Goldthorpe	1424	do.	do.	4	-----	50
Hanchamout	1121	-----	Hanna X Champion of Vermont.	4	4	25
Khayyam	1117	-----	Tennessee Winter X Black Arabian.	4	4	25
Kinver	2361	England	-----	4	-----	25-49
Nawby	2437	Russia	-----	4	-----	50
Norlut	1007	do.	-----	4	-----	50
Odessa	981	do.	-----	4	-----	15-24
Omar	898	-----	Tennessee Winter X Black Arabian.	4	4	75
Do.	898	-----	do.	2	-----	25-49
Orel	351	Russia	Orel	4	4	5-54
Palestine	939	Palestine	-----	2	2	T-9
Pandora	1077	Persia	-----	4	-----	100
Pasvolski	1103	Russia	-----	4	-----	75
Fryer	2359	England	-----	2	1	25-49
Rex	1398	-----	Svanhals	4	4	15
Roshal	1344	-----	do.	4	4	50
Semlr	1255	Asia	-----	3	-----	50
Shale	688	Russia	Hanna	3	-----	75
Shiraz	1078	Persia	-----	4	-----	25
Silacie	976	-----	-----	4	-----	25-49
Svanson	1342	-----	Smyrna X Svanhals	4	-----	65
Syria	1259	Asia Minor	-----	3	3	T-14
Theda	1293	-----	Moravian X deficiens.	4	-----	75
White Smyrna	658	Asia Minor	Smyrna	4	-----	65
<i>Hordeum distichon palmella nutans</i> : A bed	1389	-----	-----	4	4	25
A bed Binder	1031	-----	Denmark	4	-----	100
Do.	2444	Russia	-----	4	-----	65-74
Do.	2447	do.	-----	4	-----	65-74
Abyssinia	355	Ethiopia	-----	4	-----	25
Abyssinian	1229	do.	-----	4	-----	100
Do.	1234	do.	-----	4	-----	75
Archer	1418	England	-----	2	4	35
Australian White	925	Germany	Hanna	4	-----	50
Bander	2354	Russia	-----	4	4	25

TABLE 1.—Reaction of barley varieties to physiologic form 1 of the leaf rust of barley (*Puccinia anomala*) in greenhouse and field studies, 1924-25—Continued

Variety	C. I. No.	Probable origin	Ecological group	Reaction to physiologic form 1 in greenhouse		Field reaction, 1924
				1924	1925	
<i>Hordeum distichon</i> <i>palmella nutans</i> — Continued.						
Bema.....	1109	Russia.....	.....	4		65
Benito.....	1444	Persia.....	.....	4		75
Benny.....	1288	Russia.....	.....	4		50-64
Bohemian.....	32	Germany.....	Hanna.....	4		50
Do.....	204	Bohemia.....	Bohemia.....	4		35-68
Do.....	933	Germany.....	Hanna.....	4		65
Do.....	1148	Austria.....	Chevalier.....	4		65
Broach.....	1101	Russia.....	.....	4		65
Calette.....	1102	do.....	.....	4		75
Canadian Battle- ders No. 1.....	1033	England.....	.....	4		50-64
Caucasian.....	714	Caucasia.....	Caucasia.....	4	4	25-34
Chalet.....	1110	Switzerland.....	Hanna.....	4		60
Chevalier.....	156	England.....	Chevalier.....	4		65-74
Do.....	278	do.....	do.....	4		60-64
Do.....	1245	do.....	do.....	3	4	100
Do.....	1419	do.....	do.....	2	1	T-14
Do.....	2317	do.....	do.....	4		65
Do.....	2375	do.....	do.....	4		25
Chevalier II.....	530	do.....	do.....	4	4	25-49
Creel.....	1298	.....	Moravian X deficiens.....	4		100
Danish Gold.....	1301	Germany.....	Hanna.....	2	3	10-24
Eider.....	893	Russia.....	do.....	2		65
Ernest.....	2443	Persia.....	.....	4		25-49
Forsythe.....	2432	do.....	.....	4		25-49
Franconian.....	679	Germany.....	Hanna.....	4		65-74
Do.....	680	do.....	do.....	4		65-74
Frankish.....	953	do.....	do.....	4		75
Gisborne.....	1030	do.....	do.....	4		100
Gold.....	1146	do.....	do.....	3	3	25-49
Goldfoil.....	923	do.....	do.....	4	4	65-74
Goldthorpe.....	2357	do.....	do.....	4		75
Gond Gerst.....	1393	do.....	do.....	1	1	15-24
Hanna.....	30	Germany.....	Hanna.....	4		50-64
Do.....	24	do.....	do.....	4		75
Do.....	34	do.....	do.....	4		75-99
Do.....	203	Moravia.....	do.....	4	4	25-49
Do.....	966	Germany.....	do.....	4	4	75-99
Do.....	942	do.....	do.....	4		65
Do.....	966	do.....	do.....	4		100
Do.....	1122	do.....	do.....	4	4	75
Hannchen.....	531	Sweden.....	do.....	4		65-74
Do.....	602	do.....	do.....	4		65-74
Do.....	1425	do.....	do.....	4		50
Hell Hanna 1.....	681	Germany.....	do.....	4	4	75-100
Hell Hanna 2.....	678	do.....	do.....	4	3	25-49
Hell Hanna 3.....	682	do.....	do.....	1	1	T-4
Horn.....	926	England.....	Chevalier.....	4		100
Italian.....	914	Germany.....	Hanna.....	4		75-99
Kinver.....	1029	England.....	Chevalier.....	4	4	25
Do.....	1434	do.....	do.....	4		25-49
Kinver Chevalier.....	587	do.....	do.....	4		50
Kirgiz.....	1253	Asia.....	.....	4		60
Kirgizian.....	1426	.....	.....	4		60
Kite.....	992	Russia.....	Hanna.....	4		65
Klitzing.....	189	Germany.....	do.....	4		65
Kolter.....	987	Russia.....	do.....	4		65
Kurall.....	2450	do.....	do.....	4		25-49
Kurof.....	1098	do.....	Hanna.....	4		50
Lonhals.....	1343	do.....	Smyrna X Svanhois.....	4		65
Mahrtscho.....	912	Germany.....	Hanna.....	4		50
Moravian.....	965	do.....	do.....	3	4	75-100
Nesbit.....	2451	Russia.....	.....	3		25-49
Paulina.....	963	Germany.....	Hanna.....	4		75
Prentice.....	917	England.....	Chevalier.....	4	3	25-34
Pride of Dakota.....	218	.....	.....	2	4	25-49
Princess.....	529	Sweden.....	Hanna.....	3	4	T-4
Do.....	503	do.....	do.....	4	3	T-14
Do.....	1428	do.....	do.....	4		25
Princessegert No. 18.....	1584	.....	.....	4		25
Proskowetz.....	893	Czechoslovakia.....	Hybrid.....	4		25-49

TABLE I.—Reaction of barley varieties to physiologic form 1 of the leaf rust of barley (*Puccinia anomala*) in greenhouse and field studies, 1924-25—Continued

Variety	C. I. No.	Probable origin	Ecological group	Reaction to physiologic form 1 in greenhouse		Field reaction, 1924
				1924	1925	
<i>Hordeum distichon palmella autans</i> —Continued.						
Pryor	1429	England		2	3	T-14
Sealand Prentice	1292			4	4	T-4
Selco	2452	Russia		4		25-49
Shala	2431	do.		4		35-74
Steigum	907	Germany	Hanna	4		100
Do.	931	do.	do.	4		75
Stilegum	47	do.	do.	4		75-100
Surprise X Primus	1124		Surprise X Primus	3		65
Tivannes	1109	Switzerland		4		65-74
White Moravian	977	Germany	Hanna	4		25
White Smyrna	195	Asia Minor	Smyrna	4		50-64
Wibley	2438	Russia		2	4	T-24
Zero	1287	do.		4		50
<i>Hordeum distichon palmella erectum</i> :						
Anthony	1341		Smyrna X Svanbals	4		50
Archer	1031	England		2	4	10-24
Canadian Thorpe	740	do.	Thorpe	4		75-100
Duckbill	1420	do.	do.	4		35
Garton 986	645a	do.	do.	2		50-64
Do.	645b	do.	do.	4		50
Garton Regenerated Malster	1421		Hybrid	4		35-49
Gisborne	1422	England	Thorpe	4		35
Golden Grain	1423	do.	do.	4		65
Golden Melon	958	do.	do.	4		75-100
Goldthorpe	1340	do.	do.	4		65
Imperial	617	do.	do.	4		50-64
Invincible	590	England	Cheveller X Golden X Standard Melon	4		65-74
Nesblan	647		Tennessee Winter X Black Arabian	4		50-64
Pickett	1004	Russia		4		75-100
Primus	532	Sweden	Thorpe	4		65-100
Do.	1427	do.	do.	2		65
Svanbals	187	do.	do.	2		65-74
Tanchang	1164	China		4		75
Thorpe	921	England	Thorpe	4		75-100
Unnamed	2355			4		55-74
Do.	2370			4		75
<i>Hordeum distichon palmella zeocriton</i> :						
Fan	1380	Asia	Zeocriton	4	4	50-64
Do.	1381	do.	do.	4		50
<i>Hordeum distichon palmella hyplanthium</i> : Abyssinian.	1239	Ethiopia		4		65
<i>Hordeum distichon palmella subviolaceum</i> : Abyssinia.	672	do.		4	4	25-40
<i>Hordeum distichon nigricans</i> :						
Black Arabian	202		Asia Minor	4	2	15-24
Black Egyptian	1245	Egypt		3	4	100
Black Smyrna	191	Asia Minor		3		65
Caifh	983	do.		2		25
Dantil	1260	do.		4		65
<i>Hordeum distichon nigricans persicum</i> : Irak.	1003	Russia		4	3	5-14
<i>Hordeum distichon angustispicatum</i> :						
Childs	1326			4		65
McFadden	1400		Horsford X Hanna	0	0	100
Do.	1403		Horsford X Gold	0	0	65
Do.	1407		Horsford X Hanna	1	0	65
<i>Hordeum distichon nudum</i> :						
Baku	253	Central Asia	Baku	4	4	25-49
Do.	709	do.	do.	4		50
Citmean Hull-less	326	do.	do.	4	4	25-49
Evans	031	do.	do.	4	3	35-49

TABLE I.—Reaction of barley varieties to physiologic form 1 of the leaf rust of barley (*Puccinia anomala*) in greenhouse and field studies, 1924-25—Continued

Variety	C. I. No.	Probable origin	Ecological group	Reaction to physiologic form 1 in greenhouse		Field reaction, 1924
				1924	1925	
<i>Hordeum distichon nudum</i> —Contd.						
Gopal	1691	India		4		50
Mesa	2327			4		25-49
Milan	424	Central Asia	Baku	4		65-74
Poppenheim	314	do	do	4	4	25-34
<i>Hordeum distichon nudum</i> s. <i>anthinum</i> : Irisaka	1083	India		4	4	75
<i>Hordeum distichon nigrinudum</i> : Jet	967	Ethiopia		4	4	75
<i>Hordeum deficiens</i> deficiens:						
Abyssinia	2376	do		4		65
Abyssinian	1224	do		3		65
Do	1225	do		2		50-64
Do	1236	do		4		65
Do	1240	do		4		50
Burley	1294		Moravian × deficiens	4		80
Claudia	1297		do	4		75-100
Deficiens	2325	Ethiopia		4		25-49
Kitchin	1296		Moravian × deficiens	4		75
Redfield	1295		do	3		75
<i>Hordeum deficiens steudellii</i> :						
Abyssinia	382	Ethiopia		2		25-49
Blackhall	873			4	4	75-100
<i>Hordeum deficiens nudifolium</i> : Buland	1084	India		3		50

In the group *Hordeum vulgare*, 447 varieties were studied. Twenty-nine varieties of *H. vulgare* were outstanding for resistance in both greenhouse and field. These were as follows: In the variety *pallidum*, Abyssinian, C. I. No. 1243, Apalan, C. I. No. 1347, Callas, C. I. No. 2440, Chile, C. I. No. 663, Coast, C. I. Nos. 276 and 691, Gehangir, C. I. No. 1089, Hidalgo, C. I. No. 1020, Mecknos Moroc, C. I. No. 1379, Peruvian, C. I. No. 935, Quinn, C. I. No. 1024, Turkestan, C. I. No. 711, and Weider, C. I. No. 1021; in the subvariety *pyramidatum*, Abacus, C. I. No. 1088, Abyssinia, C. I. No. 2192, and Chile Brewing, C. I. No. 657; in the subvariety *coerulescens*, Arequipa, C. I. Nos. 1256 and 2329, Barquis, C. I. No. 1076, Bolivia, C. I. No. 1257, Cabeza, C. I. No. 1437, Chilean C, C. I. No. 1432, Chilean D, C. I. No. 1433, Juliaca, C. I. No. 1114, Lynch, C. I. No. 919, Maxima, C. I. No. 1436, and Peruvian, C. I. No. 1131. For the variety *horsfordianum*, the strain Horsford, C. I. No. 507, was outstanding for resistance in both greenhouse and field. In the variety *trifurcatum*, Purple Nepal, C. I. No. 1373, was outstanding.

In *Hordeum intermedium*, 14 varieties were studied. None of them showed marked resistance to physiologic form 1 in the seedling stage in the greenhouse. In the field 5 showed 25 to 49 per cent of rust. In the group of Abyssinian intermediates 13 varieties were studied. None of these showed marked resistance in the greenhouse studies. One, Black Abyssinian, C. I. No. 2383, showed less than 25 per cent of leaf rust in the field in 1924. One, C. I. No. 2415, was moderately resistant (2 to 3) in the greenhouse studies. In the field 5 showed 25 to 49 per cent.



In *Hordeum distichon*, 171 strains were studied. Of these, 7 were rather resistant (0 to 1, 2) in the greenhouse studies. Three showed considerable resistance. In the 1924 field test 17 showed less than 25 per cent of rust. Of these, 2 were highly resistant in both the greenhouse and field, i. e., in the subvariety *palmella nutans*, Gond Gerst, C. I. No. 1393, and Heil Hanna 3, C. I. No. 682, and in the variety *palmella*, Odessa, C. I. No. 961, were highly resistant in the field.

In *Hordeum deficiens*, 13 strains were studied. None of these showed marked resistance in either greenhouse or field.

Resistance to physiologic form 1 as manifested in the seedling stage in the greenhouse was more prevalent in *Hordeum vulgare* than in *H. distichon*. No variety was outstanding for resistance in the *H. intermedium*, Abyssinian intermediates, and *H. deficiens* groups. Too few varieties, however, were studied in these latter groups to justify comparison. Resistance as manifested in the field in 1924 was also much more prevalent in *H. vulgare* than in *H. distichon*.

A few varieties proved far more susceptible in the field than in the greenhouse-seedling test. Thus, in 1924, Chilga Arpa, C. I. No. 744, was classed as 1 in the greenhouse, while it had 25 to 49 per cent of rust in the field. Daniels, C. I. No. 971, showed type 1 in the greenhouse and 50 to 64 per cent in the field. Featherston, C. I. No. 1120, was 0 in the greenhouse and 50 to 64 per cent in the field. Oderbrucker, C. I. Nos. 940 and 957, were type 1 in the greenhouse and 50 to 64 per cent in the field. Pannier, C. I. No. 1330, was type 0 in the greenhouse and 75 per cent in the field. This was especially noticeable in *Hordeum vulgare horsfordianum*, where a number of varieties were highly resistant in the greenhouse and more or less susceptible in the field, notably Hooded Spring, C. I. No. 716, which was type 0 in the greenhouse and 65 to 74 per cent in the field, and McFadden, C. I. No. 1401, which was type 0 in the greenhouse and 100 per cent in the field. A similar situation also occurred in *H. distichon angustispicatum*.

In 1926 a second physiologic form of the leaf rust was discovered.<sup>5</sup> From 1926 to 1929 a selected series of varieties was studied for reaction in the seedling stage in the greenhouse. The results are presented in Table 2. The most resistant varieties belonged to *Hordeum vulgare pallidum*. Such varieties as Abyssinia, C. I. No. 2192, Abyssinian, C. I. No. 1243, Arequipa, C. I. Nos. 1256 and 2329, Bolivia, C. I. No. 1257, Callas, C. I. No. 2440, Juliaca, C. I. No. 1114, Mecknos Moroc, C. I. No. 1379, Peruvian, C. I. No. 935, Quinn, C. I. No. 1024, and Weider, C. I. No. 1021 were outstanding for marked resistance to both physiologic forms in all the tests. Such varieties as Abacus, C. I. No. 1088, Chile, C. I. No. 663, Chile Brewing, C. I. No. 657, Chilean C, C. I. No. 1432, Coast, C. I. Nos. 276 and 690, Danish Gold, C. I. No. 1391, Gond Gerst, C. I. No. 1393, Heil Hanna 3, C. I. No. 682, Kwan, C. I. No. 1016, Luth, C. I. No. 972, Lynch, C. I. No. 919, Peru, C. I. No. 653, Peruvian, C. I. No. 1131, and Turkestan, C. I. No. 711 showed considerable resistance to both physiologic forms. In the other botanical varieties of *H. vulgare* only one agronomic variety, Purple Nepal, C. I. No. 1373, in *H. vulgare trifurcatum*, approached these in general resistance.

<sup>5</sup> MAINS, E. B. Op. cit. See footnote 4.

TABLE 2.—Reaction of barley varieties to physiologic forms 1 and 2 of leaf rust of barley (*Puccinia anomala*) in greenhouse studies, 1926-1929<sup>1</sup>

Variety	C. I. No.	Reaction to physiologic form 1				Reaction to physiologic form 2			
		1926	1927	1928	1929	1926	1927	1928	1929
<i>Hordeum vulgare pallidum</i> :									
Abyssinia.....	949		4				4		
Do.....	2410	4	3	4		4	4	4	
Do.....	2411	3	4			3	4		
Abyssinian.....	1243	1	0	0	0-2	0	0		0-2
Apalan.....	1347	0	0	1		4	4	4	
Blue Ribbon.....	811	4	4				4		
California Marlot.....	1465	3	3				3		
Callas.....	2440	1	0-1	0+	0-1	1	1	1	0-1
Cape.....	557	1	1-3	3+			2	3	
Chlle.....	603	0-1	0-1	3	1-2+		2-3		1
Chilga Arpa.....	744	0		0+	0-2+	3	4	3+	4
Clancy.....	1002		4		4		4		4
Club Marlot.....	281	2-3	2-3		3		3		3
Coast.....	276	0	0-2		1-2+	0	1-2		2+
Do.....	628		4		4		4		4
Do.....	690	2	1-2	3	2	0	0-3	2+	1-2
Consul.....	1061	4	3-4		4	4	4		4
Cusado.....	895		3-4				4		4
Daniels.....	971	0	0	1	0-2+	4	4	4-	3-4
Duplex.....	2433	4	3	4	4	3	3	3+	4
Eagle.....	913	4	4	3+	4		4		4
Do.....	1320	4	4				4		
Do.....	1324	4	4				4		
Featherston.....	911	4	4		4		4		4
Do.....	954	4	4		4		4		
Do.....	1118	4	4		4		4		
Do.....	1119	4	4		4		4		
Do.....	1120	0	0-1	0-1	0-1	4	4	4	3-4
Gebangir.....	1089	2	3		3		3		3
Hilda,go.....	1026	1				0			
Hitselu.....	1053	4	3-4		4	4	4		4
Khartum.....	2367	4	2	4			3	4	
Korsbyg.....	918	4	3-4			4	4		
Kwan.....	1016		0-1	1	0+		2	2	2
Ledrons.....	696	4	2-3				4		
Lch.....	700	0	0-1	1	0-1	2+	3	3	3-4
Luth.....	972	2	2	2-2+	2+	0	2-3	2	3
Manchuria.....	244	4			4				4
Do.....	354	4	3-4				4		
Do.....	643	4							
Do.....	956	4	4				4		
Do.....	1251	4	4				4		
Do.....	1397	4	4				4		
Mecknes Maroc.....	1379	0	0	0+	0-2	0	0-1	1	0-1
Oderbrucker.....	940	0-1	0	0	0+1	4	4	3-4	4
Do.....	957	0	1	0	0-1	4	4	4	3-4
Do.....	969	4	4		4		4		4
Do.....	1137	3-4	4				4		
Do.....	1396	4	4				4		
Odessa.....	182	4	4				4		4
Do.....	916	3	2-3	3	3		2-3	3+	4
Do.....	927	4	2-4		3		3		4
Do.....	934	3	4				4		
Do.....	974	4	4				4		
Pannier.....	1330	0	0-1	1	0+3	4	4	4	3-4
Paru.....	653	1	0-2	2+	3		3	2	3
Do.....	707	1-3							
Peruvian.....	935	0-1	0-1	1	0-2	0-1	1-2	1-2	0-1
Poda.....	652	2-3	4		3		3		4
Pontius.....	731	4	3		4	3			4+
Quizz.....	1024	0	0	0-1	0-0+	0	0	0	0+
Red River.....	973	4	4				3-4		
Sandrei.....	937	4	4				4		
Shorthhead.....	2364			2+				3+	
Squarehead.....	1417	3	2-3	3		3	3	2+	
Sulu.....	1022			1-				0	
Tell.....	194	1							
Tankow.....	646	3-4	3				4		
Tonot.....	1012	2+	3	2+	4	1	3	3	4
Turkestan.....	711	2	2-3	2+	2-3	2-3	2	2	2
Unnamed.....	1383	3	2	2+	3		2-3	2	3
Weider.....	1021	0	0	0	0-2	0	1	0	0-1
White Gatami.....	920	4	4		3		4		4
Winter.....	667	4							
Wisconsin Winter.....	519	4	4	4	4		4	4	4
Youshan.....	1008	4	3-4			4	4		

<sup>1</sup> See footnotes a, b, and c to Table 1.

TABLE 2.—Reaction of barley varieties to physiologic forms 1 and 2 of leaf rust of barley (*Puccinia anomala*) in greenhouse studies, 1926-1929—Continued

Variety	C. I. No.	Reaction to physiologic form 1				Reaction to physiologic form 2			
		1926	1927	1928	1929	1926	1927	1928	1929
<b>Hordeum vulgare pallidum pyramidatum:</b>									
Abacus.....	1068			1+		2		2+	
Abyssinia.....	2192	1-	0-1	1	1-2		1		0-1
Chile Browing.....	657	0	0-1	0-2	1-2+	0-1	1	0-1	0-1
Club Marabout.....	932	2-3	3-4			2-3	1-3	1-2+	2+3
Czech.....	1023	2	1-2	3	3		3		3
Lochink.....	2460	4	3-4		4			2+	4
Pegon.....	2454		4						4
Scarab.....	955	4	4						
<b>Hordeum vulgare pallidum rikotense: Unnamed.</b>									
	1353		2-3	4	0	4	4-	4	4
<b>Hordeum vulgare pallidum coeruleosus:</b>									
Arequipa.....	1256	0	0	0-1	0+2	0	0	0	0
Do.....	2329	1-	0-1	0+	0-1	0	0	0+	0-1
Barquis.....	1076	2	2	1	2-3	1	2	2	3
Bollvia.....	1257	0	0	0+	0	0	0	0	0
Cabeza.....	1437	0	0-1	3+	0-2+	0	0	0	0
Cape.....	1431	4	3	3+		2-3	2	2+	3-4
Chilean C.....	1432			0-3+	3	2-3	3	3	3
Chilean D.....	1433	0-1	0	3	0-3	2+3		2+	2+3
Coast.....	2335	2	2	3	0-3+		2-3	2+	2-3+
Jullaca.....	1114	0-1	0	4		4	2-3	3+	3+
Kimberly.....	1382	3	3	0-1	0-2	0	0-1	0	0-0+
Lynch.....	919	0-1		0-3	3	2	3	0-2	4
Malting.....	1129	0	0-1+	0-0+	0-2+	2	2	2-3	2-3
Manchuria.....	1178	4	4	0-0+	0+	3-4	4	3-4	2-3
Do.....	1435	4	3-4			4			
Do.....	2330	0	0	3+			4-	4	
Maxima.....	1436	3	2	1		4	4	3+	
Oderbrucker.....	1174	4	4	3+	2	2+	3	2+	2
Odessa.....	1438	3	3	4			4	4	
Peruvian.....	1131	1	0-1	1	1-2	0	1-2	2	1
Roseworthy.....	2362	3	3-4	4		4	4	4	
Roseworthy Oregon.....	1439	4	4	4		4	4	4	4
Tripoli.....	1115	2	2	3	3	3	3	3	4
<b>Hordeum vulgare nigrum:</b>									
Gatani.....	575	4	4		3		4		4
Do.....	1413	3	4	4			4		
Oswong.....	697	4	2	3	4	3-4	2-3	3	3
<b>Hordeum vulgare horsfordianum:</b>									
Diana.....	1345			0				4	
Hooded Spring.....	716	0-1	0-1	0-1	0+	3-4	4	3-4	3-4
Horsford.....	507	0	0-1+	0	0+	4	4	4	3-4
Do.....	610	0	0-1	0+	0	4	4	4	3-4
Do.....	877	0	0-1	0+	0+	4	3-4	3-4	3-4
Do.....	1375	4	4	3		4	4	4	4
Do.....	2324				4		4		4
Kipper.....	1291	0	0	0		4	4	3+	
McFadden.....	1388	0	0	1		4	4	4	
Do.....	1389	0	0	0		4	4	3+	
Do.....	1401	0	0	1		4	4	4	
Do.....	1402	0-1	0	0+		4	4	4	
Do.....	1404	0	0			4	4	4	
Do.....	1406					4	4		
Do.....	1408	0	0	1				4	
Do.....	1409	0	0	0+	0-1	4	4	3+	4
<b>Hordeum vulgare coeleste:</b>									
Ak Arpa.....	747	4	3			3	4		
Black Hull-less.....	735	4	4						
Do.....	1097	4	3		4		4		4
Hanse Hull-less.....	703	4	4	4			4		4
Himalaya.....	254	4	3-4		4		4	4	
Hull-less.....	699	4	4		4		4		3
Do.....	745	4	4				4		
Ivory.....	865	4	4				4		
Kharsila.....	733	4	4				4		
McFadden.....	1405		4			4	4		
Orkoe.....	2465	4		0+				4	
Pingpong.....	1056	4				3			
Pingyan.....	1067	4				4			
Sangatsuka.....	78	4	4				4		
Zunpakei.....	692	4	4				4		
<b>Hordeum vulgare coeleste himalayense: Himalaya.....</b>									
	620	3-4	4		4		4		4

TABLE 2.—Reaction of barley varieties to physiologic forms 1 and 2 of leaf rust of barley (*Puccinia anomala*) in greenhouse studies, 1926-1929—Continued

Variety	C. I. No.	Reaction to physiologic form 1				Reaction to physiologic form 2			
		1926	1927	1928	1929	1926	1927	1928	1929
<i>Hordeum vulgare coeleste</i>									
violaceum:									
Black Hull-less	596	3-4	4		4		4		4
Do.	618	3	4				4		
Do.	668	4	4		4		4		4
<i>Hordeum vulgare trifurcatum</i> :									
Black Hull-less	1032	4	4		4		3-4		4-
Lihor	866	2-4	2	1+	2-3	2+	3-4		3
Nepal	247	4	4				4		
Do.	250	4	4				3		
Do.	262	4	4				4		
Do.	476		3-4		4		3		3
Do.	489	3-4	4	4			3	3-4	3
Do.	533	4	3-4				4		
Do.	596	4	4		4		4		4
Do.	598	4	3		4		4		4
Do.	1290	4	4		4		3		4
Do.	1292	4	4		4		3-4		4
Do.	1386	4	4				2		
Do.	1373	0-1	0	1	1-2+	2	2	2	0-1
<i>Hordeum intermedium haxtoni</i> tonsum:									
Arlington Awnees	702	4	4	3-4	4	4	4	4	4
Huwan	1080	4	4		4	4	4		4
Nakann Wase	764	3							
<i>Hordeum intermedium mortoni</i> nigritonsum; Nigrata:	2444		4		4	3			4
<i>Hordeum intermedium cornutum</i> ; Nepal:	724	4	4		4		4		4
Abyssinian Intermediate:									
Abyssinian Intermediate	2415	3	3	4		2+	3	4	
Black Abyssinian Intermediate	2416	3	3	4	4		3	4	3
<i>Hordeum distichon palmella</i> :									
Alpha	959			4				4	
Cleroff	985		3-4				4		
Goldthorpe	1424	4	4				4		
Odessa	961	1-2	1	2	2		1	2	2-3
Omar	898				4				3
Palestine	939	3	2	3	3	2+	4	3	4
Fryor	2359	3	3				2-3		
Syria	1259	3	3	4			2	3+	
Wibley	2433	4							
<i>Hordeum distichon palmella nutans</i> :									
Abed	1389		3-4				4		
Archer	1415	4	3	4		4	4	4	
Bohemian	32	4	4				4		
Do.	204	3	4		4		4		4
Do.	933	4	4				4		
Do.	1148	4	4				4		
Chevalier	150	4	4		4		4		4
Do.	278	4	4		4		4		4
Do.	1345	4	4	4	4		4	3+	4
Do.	1419	2	2-3	4			3	4	
Do.	2317	4	4		4		4		4
Chevalier II	530	4	4		4		4		4
Danish Gold	1391	2	0-3	2+	1-2+	0	1	2	1-2+
Elder	933	4	4	4	4	2-3	4	4	4
Goldfoil	923	4	4	4	4	4	4	4	4
Gond Gerst	1393	1-2	0-1	2+	0-2	0	1	1+	2
Hanna	24		3-4				4		
Do.	30		4	3+	4		4	3+	4
Do.	263	4	3-4		4		4		4
Do.	906	4	4	4	4	4	4	4	4
Do.	942	4	3		4		4	4	4
Do.	966	4	4		4		4		3
Do.	1122	4	4		4		4		4
Hanna Pedigree	34		3-4				4		
Hannchen	531	4	3-4		4		4		4
Do.	602	4	3-4				4		
Hannchen (Hanschen)	1425	4	4		4		4		4
Heil Hanna 1	681	4	4		4		4		4
Heil Hanna 2	678	2-3	2	3	2		3	2+	3
Heil Hanna 3	682	0	0-1	1-2	0-1		1	2	2-3

TABLE 2.—Reaction of barley varieties to physiologic forms 1 and 2 of leaf rust of barley (*Puccinia anomala*) in greenhouse studies, 1926-1929—Continued

Variety	C. I. No.	Reaction to physiologic form 1				Reaction to physiologic form 2			
		1926	1927	1928	1929	1926	1927	1928	1929
<b>Hordeum distichon palmella nutans—Continued.</b>									
Horra.....	926	4	4		4		4		4
Kinver Chevalier.....	587	4	4				4		
Klitzcan.....	1426						4		
Mährische.....	912	4	4				4		
Moravian.....	935	4	4				4		
Princess.....	529	4	4				4		
Do.....	603	4	4		4		4		4
Do.....	1428	4	4				4		
Proskowetz.....	593	4	4	4	4	4	4	4	4
Fryor.....	1429	3	3-4	4		3	3	3-4	
Steigum.....	907	4	4				4		
Do.....	931	4	4				4		
Strigum.....	47	4	4		4		4		4
<b>Hordeum distichon palmella erectum:</b>									
Archer.....	1031	4	4			4	4		
Goldthorpe.....	1340	4	4						
Primus.....	1427	4	4						
Svanhals.....	187	4	3-4		4				4
<b>Hordeum distichon nigricans: Black Arabino</b>									
	202	3							
<b>Hordeum distichon angustispicatum:</b>									
McFadden.....	1400	0	0	0+		4	4	4	
Do.....	1403	0	0	0		4	4	3+	
Do.....	1407	0-1	0	1		4	2	3+	
<b>Hordeum distichon nudum:</b>									
Baku.....	253		4		4		4		
Evans.....	621	4	4		4		4		4
<b>Hordeum deficiens deficiens:</b>									
Abyssinian.....	1225	4	4			4	4		
<b>Hordeum deficiens stoddell:</b>									
Abyssinia.....	362	4	4	4	4	4	4	4	
Blackbull.....	878	4	4		4		4		4

The few varieties of *Hordeum intermedium* were more or less susceptible to both physiologic forms. In *H. distichon*, in the group *palmella*, Danish Gold, C. I. No. 1391, Gond Gerst, C. I. No. 1393, Heil Hanna 3, C. I. No. 682, and Odessa, C. I. No. 961 were the most resistant, although not equaling varieties in *H. vulgare pallidum*. The few varieties in *H. deficiens* were all susceptible to both physiologic forms.

The varieties Apalan, C. I. No. 1347, Featherston, C. I. No. 1120, Leh, C. I. No. 700, Malting, C. I. No. 1129, Oderbrucker, C. I. Nos. 940 and 957, and Pannier, C. I. No. 1330, in *Hordeum vulgare pallidum*; Diana, C. I. No. 1345, Hooded Spring, C. I. No. 716, Horsford, C. I. Nos. 507, 610, and 877, Kipper, C. I. No. 1291, and McFadden, C. I. Nos. 1398, 1399, 1401, 1402, 1404, 1406, 1408, and 1409, in *H. vulgare horsfordianum*; McFadden, C. I. No. 1405, in *H. vulgare coeleste*; and McFadden, C. I. Nos. 1400, 1403, and 1407, in *H. distichon angustispicatum* were outstanding for difference in reaction to the two physiologic forms, being highly resistant to physiologic form 1 and highly susceptible to physiologic form 2.

After 1924 a selected series of varieties was studied for susceptibility under field conditions at La Fayette, Ind. Only a slight percentage of rust developed in 1925 and 1926, and it was impossible to draw conclusions concerning susceptibility. In 1927, 1928, and 1929 abundant rust developed. Marked differences between vari-

eties were noted. The varieties outstanding for their rust resistance are Abacus, C. I. No. 1088, Abyssinia, C. I. No. 2192, Abyssinian, C. I. No. 1243, Arequipa, C. I. Nos. 1256 and 2329, Bolivia, C. I. No. 1257, Cabeza, C. I. No. 1437, Callas, C. I. No. 2440, Chile, C. I. No. 663, Chile Brewing, C. I. No. 657, Coast, C. I. Nos. 276 and 690, Gehangir, C. I. No. 1089, Juliaca, C. I. No. 1114, Luth, C. I. No. 972, Maxima, C. I. No. 1436, Mecknos Moroc, C. I. No. 1379, Peru, C. I. No. 653, Peruvian, C. I. No. 935, Quinn, C. I. No. 1024, Tonot, C. I. No. 1012, Turkestan, C. I. No. 711, Weider, C. I. No. 1021, and an unnamed variety, C. I. No. 1383, in *Hordeum vulgare pallidum*, and Danish Gold, C. I. No. 1391, Gond Gerst, C. I. No. 1393, Heil Hanna 2, C. I. No. 678, and Heil Hanna 3, C. I. No. 682, in *H. distichon palmella*.

A number of varieties showed in their seedling stage considerable variation in reaction. This was specially noticeable in the reactions to physiologic form 1 of Chilean C, C. I. No. 1432, Chilean D, C. I. No. 1433, and Lynch, C. I. No. 919, which varied in reaction from 0 to 3+. Chile, C. I. No. 663, Chilga Arpa, C. I. No. 744, and Coast, C. I. No. 276, varied from 0 to 2+, while several others varied from 1 to 3, 2 to 4, etc. This probably is in correlation with environmental conditions, since such varieties showed the greatest resistance during the late fall and winter months, when light conditions were poor, and the most susceptibility in the late spring and early summer.

As can be seen by consulting Tables 1, 2, and 3, a number of varieties showed more or less resistance under all conditions. The varieties outstanding for resistance in the seedling stage to physiologic forms 1 and 2 and also for resistance in the field tests at La Fayette, Ind., are Abacus, C. I. No. 1088, Abyssinian, C. I. No. 1243, Callas, C. I. No. 2440, Chile, C. I. No. 663, Chile Brewing, C. I. No. 657, Coast, C. I. Nos. 276 and 690, Luth, C. I. No. 972, Mecknos Moroc, C. I. No. 1379, Quinn, C. I. No. 1024, Sulu, C. I. No. 1022, and Weider, C. I. No. 1021, belonging to *Hordeum vulgare pallidum*; Abyssinia, C. I. No. 2192, in *H. vulgare pallidum pyramidatum*; Arequipa, C. I. Nos. 1256 and 2329, Bolivia, C. I. No. 1257, and Juliaca, C. I. No. 1114, in *H. vulgare pallidum coeruleum*; Purple Nepal, C. I. No. 1373, in *H. vulgare trifurcatum*; and Danish Gold, C. I. No. 1391, Gond Gerst, C. I. No. 1393, and Heil Hanna 3, C. I. No. 682, in *H. distichon palmella nutans*. It is to be noted that 16 of these belong to *H. vulgare pallidum*, 1 to *H. vulgare trifurcatum*, and 3 to *H. distichon palmella*. Not only are there considerable differences within the botanical groups, but even within the agronomic varieties there are marked differences in reaction. Thus, Featherston, C. I. No. 1120, is very resistant to physiologic form 1, while Featherston, C. I. Nos. 911, 954, 1118, and 1119, are very susceptible. Oderbrucker, C. I. Nos. 940 and 957, are very resistant to physiologic form 1, while Oderbrucker, C. I. Nos. 969, 1137, and 1396, are very susceptible. Manchuria, C. I. No. 2330, is very resistant to physiologic form 1, while Manchuria, C. I. Nos. 1178 and 1435, are highly susceptible.

TABLE 3.—Percentage of leaf rust of barley, *Puccinia anomala*, in field tests at La Fayette, Ind., 1927, 1928, and 1929<sup>1</sup>

Variety	C. I. No.	Percentage of rust			Variety	C. I. No.	Percentage of rust		
		1927	1928	1929			1927	1928	1929
<b>Hordeum vulgare pallidum:</b>					<b>Hordeum vulgare pallidum riko-</b>				
Abed July.....	1360			T-14	tense—Contd.				
Abyssinia.....	949	25-49			Oilette.....	1359			65-74
Do.....	850			25-49	Jusborne.....	1385			75-100
Do.....	2380			75-90	Leader.....	1282			65-100
Do.....	2410			50-74	Lyman.....	1368			75-100
Do.....	2418			75-100	Minorca.....	1387			75-100
Abyssinian.....	1223			50-74	Norbec.....	1303			50-64
Do.....	1228			50-64	Plymoth.....	1396			50-64
Do.....	1243	T-1	0-4	0-14	Unnamed.....	1362			50-64
Do.....	1023			25-49	Do.....	1353			50-74
Azov.....					Do.....	1306			50-64
California Mari-					<b>Hordeum vulgare pallidum riko-</b>				
out.....	1455	50-64			rulescens:				
Callas.....	2440	0-T	0-T	0-T	Abyssinian.....	1235			65-100
Chavron.....	1111			25-34	Do.....	1242			75
Chile.....	683	0-T	0-4		Albacete.....	1123			25-49
Chilga Arpa.....	744	50-64	T-14	50-64	Algerian.....	1179			15-24
Club Mariout.....	261	50-64			Arcquipa.....	1256	0	0-T	0-T
Const.....	276	0-T	0-T		Do.....	2329			0-T
Do.....	890	T-4	0-T		Barquis.....	1076	15-24	0-T	0-T
Do.....	691			50-64	Bolivia.....	1257	0	0-T	0-14
Do.....	2369			50-64	Do.....	1305			T-4
Consul.....	1061			50-64	Cabaza.....	1437	0-T	0-T	T-14
Daniels.....	971	50-64	50-74	50-64	Canadian Malt-				
Eagle.....	913	75-100	75-100		ing No. 2.....	1034			35-49
Featherston.....	1118	25-34			Cape.....	1386			50-64
Do.....	1120	50-64	50-74	50-64	Do.....	1431	15-24	25-34	
Flecho.....	1263			65-100	Coast.....	2392			50-64
Gehanglr.....	1689		T-1		Cromlech.....	1215			0-T
Kumbida.....	730			50-64	Crypt.....	1660			50-64
Kwan.....	1016	0-T		50-64	Cyna.....	1258			50-64
Leh.....	700	25-40	T-14	25-49	Juliana.....	1114	0-T	0-T	
Luth.....	972	T-24	0-T		Kimberly.....	1362	T-14		
Manchuria.....	244	75-100			Lynch.....	019	T-4	0-T	25-34
Manmoy.....	2456			50-64	Maltng.....	1129	15-24	50-100	50-64
Mecknos Moroc.....	1379	0	0-T	0-T	Marima.....	1486	0-T	5-14	
Mignon.....	998			50-64	Persia.....	1372			100
Monte Cristo.....	1017			25-40	Peruvian.....	1131	0-T	50-64	0-14
Monte Cristo.....	1017			50-64	Roseworthy Ore-				
Nani Tal.....	1087				gon.....	1430	15-34	T-14	
Oderbrucker.....	940	25-49	T-14	15-40	Squarehead Win-				
Do.....	957	25-34	0-T		ter.....	1267			25-40
Do.....	1137			50-64	Tripoli.....	1115	25-40		
Odessa.....	918	50-64	T-14		<b>Hordeum vulgare pallidum subv-</b>				
Pannior.....	1330	50-74			lacuum: Soochow.....	867			65
Peru.....	653	T-14	0-T		<b>Hordeum vulgare pallidum riko-</b>				
Peruviana.....	936	0-T	T-4		tense—Contd.				
Quinn.....	1024	0-T	0-T	0-4	Barbican.....	1285			25-49
Rubard.....	2434			50-64	Galami.....	1413			50-64
Sulu.....	1022			T-4	Osvong.....	697	T-14		15-24
Tonot.....	1012	T-4	0-T		<b>Hordeum vulgare nigrum:</b>				
Trobl.....	936			75-100	nigrum leior-				
Turkistan.....	711	T-4	0-T		rhynchum:				
Unnamed.....	1353	5-14	0-T		Black Algerian.....	703			50-74
Weider.....	1021			T-14	Chorny.....	875			50-74
White Gataral.....	920			50-64	Lion.....	923			15-64
Wisconsin Winter	519	50-64	50-74		Nektadowi.....	1000			50-64
<b>Hordeum vulgare pallidum pyra-</b>					<b>Hordeum vulgare nigrum:</b>				
<b>midatum:</b>					Black Algerian.....	703			50-74
Abacus.....	1058			T-4	Chorny.....	875			50-74
Abyssinia.....	2192	0	0-T		Lion.....	923			15-64
Chile Brewing.....	657	0-T	0-14	0-T	Nektadowi.....	1000			50-64
Club Mariout.....	932	25-49			<b>Hordeum vulgare horsfordianum:</b>				
Czech.....	1023	15-24		15-24	Hooded Spring.....	716	15-24		50-64
Do.....	2439				Horsford.....	607	25-34	50-100	35-40
Malwet.....	2439			50-64	Do.....	510	15-24	25-34	50-74
Mulvan.....	2453			65-100	Do.....	877	25-40	50-100	
Pasha.....	984			50-74	Do.....	2482			50-64
Pegan.....	2454			50-64	Kipper.....	1201			25-49
Do.....	2454			50-64	McFadden.....	1438	15-24	50-74	50-64
Do.....	2439			75-100	Do.....	1409	15-24	50-100	50-64
<b>Hordeum vulgare pallidum riko-</b>					<b>Hordeum vulgare coeleste:</b>				
<b>tense:</b>					Dehra.....	1085			74
Catts.....	1283			50-64	Hanse Huhl-less.....	703			55-74
Felise.....	1284			50-64					

<sup>1</sup> See footnotes a, b, and c to Table 1.

TABLE 3.—Percentage of leaf rust of barley, *Puccinia anomala*, in field tests at La Fayette, Ind., 1927, 1928, and 1929—Continued

Variety	C. I. No.	Percentage of rust			Variety	C. I. No.	Percentage of rust		
		1927	1928	1929			1927	1928	1929
Hordeum vulgare coeleste—Con.					Hordeum distichon palmella nutans—Con.				
India	2319			100	Creel	1238			100
Kbarsila	733		50-74		Danish Gold	1391	0-T	5-24	T-49
Robin	991		50-64		Elder	993	25-49	T-4	
Unnamed	671			50	Goldfol	928	25-49		50-64
Waho	2458			75-100	Gond Gerst.	1393	0-T	5-14	T-34
Hordeum vulgare coeleste himalayense:					Hanna	30	50-64	15-21	50-64
Ederia	1015			15	Do	203	50-64		
Himalaya	620		35-49		Do	906	50-100		50-74
Do	1312			35-49	Hannchen	502	100		
Hordeum vulgare coeleste violaceum:					Hell Hanna 2	678	T-24	5-14	
Black Hull-less	860			15-40	Hell Hanna 3	682	0-T	0-T	
Spain	1370			25-49	Moravian	965	75-100		
Hordeum vulgare trifurcatum:					Princess	529			25-49
Black Hull-less	1032			65-74	Proskowetz	893	15-24	0-T	
Libor	866	50-54			Pryor	1429	T-14		
Nepal	247			50-64	Steigum	907	100	65-100	
Do	698	25-49			Hordeum distichon palmella zeoriton: Fan	1381			50-74
Purple Nepal	1373	0	0	50-64	Hordeum distichon palmella hypanthinum: Abyssinian	1239			50-74
Hordeum intermedium hartoni: Famesh	616			75-100	Hordeum distichon palmella subviolaceum: Abyssinia	872			50
Hordeum intermedium hartoni tonsum:					Hordeum distichon nigricans: Black Egyptian	1246			75-100
Arlington Awnless	702	100	75-100		Hordeum distichon nigricans persicum: Erak	1003			T-14
Bodai	753			50-74	Hordeum distichon angustispicatum:				
Huwan	1086			100	McFadden	1400			25-49
Nakano Wase	754			75	Do	1403			50-64
Hordeum intermedium mortoni nigritonsum: Chinerme	1079			75-100	Hordeum distichon nudum:				
Hordeum intermedium cornutum:					Crimean Hull-less	320			25-49
Cornutum	2366			100	Gopal	1091			50-64
Abyssinian intermediate:					Milan	424			50-64
Abyssinian Intermediate	2377			50-74	Poppenheim	314			15-24
Do	2379			75-100	Hordeum distichon nudum: Irisaka	1083			100
Do	2409			50-64	Hordeum distichon nigricatum: Jet	907			100
Black Abyssinian Intermediate	2416			50-74	Hordeum deficiens:				
Hordeum distichon palmella:					Abyssinia	2376			50-100
Alpha	959		50-64		Abyssinian	1225			25-49
Exadra	1262			T-74	Do	1236			25-49
Forsythe	2442			65-74	Burley	1294			65-100
Nortus	1307			25-49	Claudia	1297			75-100
Odess	961	0-T	5-14	50-64	Redfield	1295			65-74
Palestine	939	25-34		T-74	Unnamed	2325			50-64
Pandora	1077			05-100	Hordeum deficiens steudeli:				
Pryor	2359	0	0-T	50-64	Abyssinia	362			50-100
Hordeum distichon palmella nutans:					Blackhull	878	100	100	50-100
Baite	1444			100					
Chevalier	1245	75-100	75-100	65-100					
Chevalier II	530	75-100	50-100						

POWDERY MILDEW STUDIES

Studies on powdery mildew were made in a manner similar to those on leaf rust, except that no data were obtained in the field, since powdery mildew is not usually severe at La Fayette, Ind.



As has been reported elsewhere,<sup>6</sup> five physiologic forms of the powdery mildew of barley have been recognized in cooperative studies with the Iowa Agricultural Experiment Station. Of these, physiologic forms 1, 2, and 3 have been studied in the greenhouses of the Purdue University Agricultural Experiment Station on the barley varieties used in the leaf-rust investigations. The results of these studies are given in Table 4.

TABLE 4.—Reaction of barley varieties to physiologic forms 1, 2, and 3 of the powdery mildew of barley (*Erysiphe graminis hordei*) in greenhouse studies in stated years<sup>a</sup>

Variety	C. I. No.	Reaction to physiologic form —					
		1		3		2	
		1924	1925	1927	1929	1929	1930
<b>Hordeum vulgare pallidum:</b>							
Abed July	1380	4			4	2+	2+
Abundis	1412	2					
Abyssinia	361	1			1		
Do	949	4		3-4	4	4	
Do	950	2			2	1	3
Do	951	3					
Do	2380	2					1+
Do	2410	2		2	1		1-
Do	2411	3		4	2+	2	
Do	2418	4				2	
Abyssinian	1216	2					
Do	1217a	4					
Do	1217b	3			4	4	4
Do	1218	4					
Do	1219	4					
Do	1221	4			3	4	
Do	1223	2			2	1	2+
Do	1226	1			2	3+	
Do	1227	1			T	3+	
Do	1228	3			1+	3+	2-3
Do	1231	2					
Do	1233	2			2+	2	
Do	1237	3					
Do	1241	2			2+	2	
Do	1243	1		0-1	1+	2	1
Acanthus	1095	4			4	4	
Alcazar	1096	4			4	4	
Alexis	968	4			4	3	
Amarillo	1073	1					
Apalan	1347	4		2-3	3	4	
Arabel	896	3					
Argentine	223	4					
Azov	1328	1			4	T	2
Baker	975	4			4	4	
Barbary	695	3			3	4	
Bushaw	1018	3			4	4	
Blue Ribbon	611	3	4	4	4	4	
Caballero	1006	4			4	4	
Cadmus	1054	1					
California Marlout	1455	3					
Callas	2440	3				3	
Canada Winter	713	1			2	2	
Canadian Lake Shore	2515	4			4	4	
Cape	557	3	2-3	3	2	4	
Do	1208	4			3	4	
Do	1387	4			4	3	
Caryfid	1178	2					
Cebada	1035	2					
Champcan	990	4			4	4	
Chellif	1074	4			4	4	
Chevron	1111	0			0	0	0-1

<sup>a</sup> See footnotes a and b to Table 1.

<sup>b</sup> 0—Highly resistant, very slight development of mycelium accompanied by slight flecks or necrotic spots; 1—very resistant, slight development of mycelium and very slight sporulation; 2—moderately resistant, moderate development of mycelium and slight sporulation; 3—moderately susceptible, moderate development of mycelium and sporulation; 4—very susceptible, abundant development of mycelium and sporulation.

<sup>6</sup> MAINS, E. B., and DITZ, S. M. PHYSIOLOGIC FORMS OF BARLEY MILDEW, *ERYSIPIHE GRAMINIS HORDEI* MARCHAL. *Phytopathology* 20:229-239, illus. 1930.

TABLE 4.—Reaction of barley varieties to physiologic forms 1, 2, and 3 of the powdery mildew of barley (*Erysipha graminis hordei*) in greenhouse studies in stated years—Continued

Variety	C. I. No.	Reaction to physiologic form—					
		1		3		2	
		1924	1926	1927	1929	1929	1930
<b>Hordeum vulgare pallidum—Continued.</b>							
Chile	663	1	0-1	0-1	2+	1+	1-2
Chilga Arpa	744	4		3-4	3	4	
Clancy	1002	4			0+	3+	3-4
Club Marabout	261	4	3	4	2-3	3-4	
Coast	278	1	0-1	0-1	1	1-2	1-3
Do.	623	3				3	4
Do.	690	3		2-4	2+	3+	2-3
Do.	691	2			4+	1+	2
Do.	2369	2			2+	1	1+
Do.	1091	1		1	0	1	0+
Consul	1123	4			3	4	
Cortile	1094	4			4	4	
Crocket	855	3			0-2	3+	
Cusado	1005	2-4					
Czar	971	4		3	4	3	
Daniels	729	4			4	3	
Dinar	2433	0		T-1	0	0	0
Duplex	913	3	4	4	2	3	3
Eagle	1320	3	3-4	2-3	3	4	
Do.	1324	4	4	2-3	4	4	
Do.	1324	4	4	4	4	4	
Featherston	911	4	3	4	2+	4	
Do.	954	4	3-4	4	4	4	
Do.	1118	4		3-4	4	4	
Do.	1119	4	3-4	3	4	3	
Do.	1120	3	3-4	3-4	4	4	3-4
Fengsolin	1040	1					
Finland	531	4			3	4	
Finland	1263	0			T	0	0
Fleche	2348	2			2+	3	
Galwan	1089	1		1	0	1+	
Gebangir	1058	1				2+	
Gobi	221	1					
Groeco	1099	4			2	2	
Gurov	206a	4			3	4	
Han River	206b	4					
Do.	1019	4			4	4	
Harem	734	3			3	4	
Hsua	1020	4					
Hidalgo	1053	2		2	0+	2	
Hlsain	982	4			3	4	
Hodge	1038	1					
Judith	1082	3			3	4	
July	1042	1					
Kaesch	743	4			3	4	
Khaaka	2367	4		2-3	2	2	
Khartam	869	2			3	2+	
Kopeck	918	4		4	3+	4	
Korsbyrg	730	2			T	2	3
Kumilde	1065	1					
Kunshan	1315	3			3-4	3	
Kusan	1016	0		T-1	0	0	0
Kwan	696	4		3	2+	4	4
Ladrome	1126	4		3	4	4	4
Lake City	408	3			2+	4	4
Large-Grained Winter	700	2		2	2	2	2
Leh	1322	4			4	4	4
Liland	1970	1			4	3	
Losein	2435	4			4	2+	
Lubin	905	4					
Luth	972	1		(-1)	3	T-1	1
Do.	1025	4			4	4	
Malster	220	3					
Mammoth Winter	244	4	3-4	3	2+	3-4	
Manchuria	354	4	3-4	4	3	4	4
Do.	578	4			2+	4	4
Do.	643	4	3-4	4	4	4	4
Do.	956	4	3-4	3	4	4	4
Do.	1251	4	3-4	4	4	4	4
Do.	1397	4	3	4	4	4	4
Manchuria Pedigree	1244	3	3	2-3	3	4	
Manmoy	2458	1			4	1	2
Mecca	1051	1					

TABLE 4.—Reaction of barley varieties to physiologic forms 1, 2, and 3 of the powdery mildew of barley (*Erysiphe graminis hordei*) in greenhouse studies in stated years—Continued

Variety	C. I. No.	Reaction to physiologic form—					
		1		3		2	
		1924	1926	1927	1929	1929	1930
<b>Hordeum vulgare pallidum—Continued.</b>							
Mecknus Maroc.....	1379	2		2-3	1+	3	
Milchung.....	1120	4			3	4	
Mignon.....	992	4			2+	2	
Monte Cristo.....	1017	0			0-7	0	0
Nanni Tal.....	1087	1			1	1	0-1
Nanook.....	1329	2			2	2+	
Niver.....	737	1				1	
Notherson.....	1093	4			4	4	
Oderbrucker.....	940	4	3-4	4	4	4	4
Do.....	957	4	2-4	3	4	4	
Do.....	969	4	4	3	3-4	4	
Do.....	1137	4	3-4	4	4	4	
Do.....	1396	3	4	4	4	4	
Odessa.....	182	3	4	4	4	4	4
Do.....	918	4		4	3-2	3	
Do.....	927	4	4	4	4	4	
Do.....	934	4	3	3	3	4	
Do.....	974	4	4	3	4	4	
Olonets.....	198	4			4	4	
Pannler.....	1330	2		2	4	3+	
Peru.....	653	1		0-2	1+	1-2	1-2
Peruvian.....	935	1	1	0-1	3-4	1	1
Petchors.....	2425	3-4			4	4	
Pider.....	901	0					
Poda.....	652	1	1-2	1-2	2-3	2+	
Pontius.....	731	0		1-2	2	2	
Quinn.....	1024	3		2	2+	3+	4
Rasput.....	966	3			4	4	
Red River.....	973	4	3	4	4	4	
Rival.....	2345	4			3	4	
Royal.....	1252	4			4	4	
Rubard.....	2434	2			0-1	1	
Rubia.....	870	4			4	3+	
Saguna.....	1259	4				4	
Salamanca.....	685	3			3	3	
Sandrel.....	937	4	3-4	3	3	4	
Scottish Pearl.....	277	4					
Servian.....	915	4			4	4	
Shale.....	2430	4			3	2+	
Shorthead.....	3364	4			4	4	
Silver King.....	2374	3			4	4	
Squarehead Winter.....	252	2					
Sultan.....	937	2			4	3+	
Sulu.....	1022	1			0	0	1
Summit.....	929	4			4	4	
Do.....	1136	4			4	4	
Sumson.....	1092	4			4	4	
Surprise.....	171	4			4	4	
Tell.....	194	4	3-4				
Tenkow.....	646	3	2-3	3	3	4	
Tennessee Winter.....	257	3					
Do.....	876	3					
Texas Winter.....	554	4					
Tonot.....	1012	2		1-2	2	1+	
Trebi.....	936	4			4	2+	
Turkestan.....	711	1		0-1	2-3	T-1	1
Tystofte.....	1322	3					
Unnamed.....	497	2			4	4	
Do.....	1383	4		3-4	2+	3	
Do.....	2346	3			3+	4	
Do.....	2350	1					
Do.....	2368	2					1
Do.....	2371	4			4	3	
Do.....	2372	2-3			3	4	
Do.....	2373	4			4	4	
Do.....	2420	4					
Venus.....	736	1				2	
Victor.....	1411	2					
Wausnpe.....	1050	2					
Weider.....	1021	1		0-1	0	0	0-1
White Gambia.....	920	1	T-1		0-1	1+	1
White Russian.....	706	3					

TABLE 4.—Reaction of barley varieties to physiologic forms 1, 2, and 3 of the powdery mildew of barley (*Erysiphe graminis hordet*) in greenhouse studies in stated years—Continued

Variety	C. I. No.	Reaction to physiologic form—					
		1		3		2	
		1924	1926	1927	1929	1929	1930
<b>Hordeum vulgare pallidum—Continued.</b>							
Winter	667	0			3	4	
Wisconsin Winter	519	2	1	1	1-4	1-2	3
Woodrow	983	3	1	1	4	2	
Wusein	1044	1			2	2+	
Youshan	1068	2		3	2+	2+	
Yuwán	1071	1			3	3+	
Zond	1138	3			4	3	
<b>Hordeum vulgare pallidum parallelum:</b>							
Abyssinia	943	3			3	4	
Do.	948	4					
Abyssinian	2193	2					
Gambrius	1068	2					
<b>Hordeum vulgare pallidum pyramidatum:</b>							
Abacos	1088	1-0			1	0	
Abyssinia	2192	2		1	1	1	
Abyssinian	2194	1					
Do.	2195	2				2	
Chile Brewing	657	1	T-1	1	1+	1-2	
Club Marlout	932	3	3-4	2	1+	3+	4
Do.	2334	3			4	3	
Czech	1023	3		3	3-4	3	
Eiler	1059	1					
Kobeck	2436	3			8	2+	
Lochink	2460	0		1	3	3	
Malwet	2459	0			0-1	T	0-1
Moy Wah	1064	1					
Mulyan	2453	0			1	1	0
Pasha	994	1			T	0	0-2
Pegan	2454	0			0	0	0
Russia	1371	3			3	3+	
Scarab	995	4		3	2+	4	
Welcome	2439	1			1	0	2
Winter Club	592	3					
<b>Hordeum vulgare pallidum rikotense:</b>							
Andrew	1351	3			2-3	4	
Blarney	1303	3			2+	2+	
Catts	1293	2			2	2	
Cheddar	1307	2			3	2+	
Coates	1249	2			2+	2	
Felina	1284	2			1+	2+	1+
Fergel	1360	2			2	2+	
Gillette	1359	1			2	2+	
Hero	1286	3			3	3	1
Heron	1290	3			3+	3+	
Hopper	1285	4			3	4	
Hurst	1394	4			4	4	
Jusborne	1355	1				1+	1+
Larlout	1350	3			3	4	
Leader	1292	2			2	2	
Limerick	1302	3		2	2-3	3	
Lowden	1308	4			3	4	
Lyman	1358	2				1	2
Minorca	1357	3			2	1	1
Morrison	1361	2			2	2	
Newcomb	1368	2			1+	2	
Nigger	1301	3			2+	2+	
Nordec	1363	3			2+	1+	2
Olman	1354	3			2+	2	
Osborn	1364	3			3	3	
Phoebe	1365	2			2	4	
Plymoth	1356	2			2+	1+	2
Preston	1348	4			4	3+	
Ramsay	1366	2			2	2	
Theodore	1300	2			2+	3	
Unnamed	1352	3			2	1+	1+
Do.	1353	3		2-3	2	1+	2-3
Do.	2331	2-4			2-3	3	
Vaughn	1367	2			3	2+	
Vitz	1306	2			1	2	2
<b>Hordeum vulgare pallidum coerulescens:</b>							
Abyssinian	1235	2			1+	T	
Do.	1242	2			1+		
Albacete	1128	1			0	T	1-2

TABLE 4.—Reaction of barley varieties to physiologic forms 1, 2, and 3 of the powdery mildew of barley (*Erysiphe graminis hordei*) in greenhouse studies in stated years—Continued

Variety	C. I. No.	Reaction to physiologic form—					
		1		3		2	
		1924	1926	1927	1929	1929	1930
<b>Hordeum vulgare pallidum coeruleum—Continued.</b>							
Algerian	1179	0			0		0
Arequipa	1256	2		0-2	3-4	1	1-2
Do.	2329	1		0-1	2	1-	1
Barquis	1076	3		2-3	2+	3	
Biubak	2445	3			2-3	4	
Bolivia	1257	1	0-1	0-1	1+	1	1
Do.	1385	4			2	1	3
Brutus	1011	3			4		
Buchiang	1043	2					
Cabera	1437	2		1-2	1	1+	
Canadian Malting No. 2	1034	1			4	1	3
Cape	1028	4			4	2+	
Do.	1386	4			4	1	2
Do.	1431	3		2	2+	2+	
Cartouch	1107	4					
Chilean C.	1432	0	0-1		1+	1+	1-2
Chilean D.	1433	1		0-1			1
Coast	1430	3			2	4	
Do.	2332	1			4	1	2+
Do.	2343	1			4	4	
Do.	2335	4		3	4	4	
Colorado	1075	2					
Coventry	1037	2			1	4	2
Cromlech	1215	2			2	1	3
Cyma	1258	3					
Julica	1114	2		2-3	1+	2+	1-2
Kimberly	1382	1		1	2+	1	
Koran	1063	1					
Lynch	919	1	1	0-1	4	T-1	1
Malting	1129	4	3	3	4	3	4
Manchuria	1178		3	2-3	4	4	
Do.	1435	4	4	4	4	4	
Do.	2330	4	4	3-4	4	4	1-2
Maxima	1436	4		4	4	3	
Moldavia	392	4		4	2+	4	
Norton	1362	4			4	3+	
Oderbrucker	1174	3	4	3-4	4	4	
Odessa	1438	4	4	3	4	4	
Parla	1372	1			2+	1	1+
Paru	707	3	1				
Paruvian	1131	1		0-1	2+	T-1	1
Petro	994	3			2+	2+	
Roseworthy	2352			2-3	4	4	
Roseworthy Oregon	1439	3		3	3	2	
Sabbaton	1266	0					
Sancock	1395	2			3	2	
Shorthed	1441	4			4	3	
Squarehead	1417	4		3	4	4	
Squarehead Winter	1267	2			3	1	1+
Tripoli	1115	4		2-3	4	3	
Turbat	1254	3			3	4	
Wanfai	2461	1					
<b>Hordeum vulgare pallidum subviolaceum:</b>							
Abyssinian	1238	1			1	2+	
Chusain	1039	2					
Coole	1360	2					
Euvoy	1045	2					
Fesan	2463	2					
Hiangshan	1047	4					
Misein	1062	2					
Scotch	867	1				T	1
Squiers	1072	1					
Yatlong	2464	3					
<b>Hordeum vulgare pallidum eurylepis:</b>							
Egerle	1015	0			0	0	
Himalaya	1312	1			2+		
Do.	2448	4			3+		
Wassnipe	2355	0					
<b>Hordeum vulgare nigrum:</b>							
Abyssinian	1220	0					
Do.	1222	3					
Do.	1230	2					
Do.	1232	1					

TABLE 4.—Reaction of barley varieties to physiologic forms 1, 2, and 3 of the powdery mildew of barley (*Erysiphe graminis hordei*) in greenhouse studies in stated years—Continued

Variety	C. I. No.	Reaction to physiologic form—					
		1		3		2	
		1924	1926	1927	1929	1929	1930
<b>Hordeum vulgare nigrum—Continued.</b>							
Barbican	1285	1			T	0	0-1
Do.	2398	1			0	0	
Black Russian	705	2					
Doajon	1284	0					
Gatami	575	2	1-2	1-2	2	3	2-3
Do.	1413	1	2	2-3			
Ghest	979	4					
Oswong	697	1		1	3-4	3	3
Unnamed	2349	0					
Wofut	1600	0					
<b>Hordeum vulgare nigrum leiorrhynchum:</b>							
Black Algerian	708	2			1	1+	
Chorny	875	1			1	1+	
Llon	923	1			1+	1+	2
Nekhudowl	1000	1			1	1	0-1
<b>Hordeum vulgare horfordianum:</b>							
Diana	1345	4			3+	4	
Hooded Spring	716	3	4	3-4	4	3-4	4
Horsford	507	3	3-4	3	3	4	
Do.	810	4	3-4	3	3+	4	
Do.	877	4	3-4	3	4	4	4
Do.	1375	3	3-4	3	3	2+	3
Do.	2324	1			2	2	2
Do.	2482	2			4	1+	2+
Kipper	1291	4		3-4	3	4	
McFadden	1398	3		2-3	3	2-3	
Do.	1399	4		3	3	3	
Do.	1401	4		4	4	4	
Do.	1402	4		4	4	4	
Do.	1404	4		2-3	3	4	
Do.	1406	4			4	4	
Do.	1408	4		2-3		2+	
Do.	1409	4		3	4	2+	
Nuerta	741	1					
Siroche	1289	1			3	4	
Wilder	1346	4			4	4	
<b>Hordeum vulgare coeleste:</b>							
Ak Arpa	747	4		3	4	4	
Barley Wheat	1384	2			4	4	
Black Hull-less	735	3			3	4	
Do.	1097	4	3	2	4	4	
Chliga Arpa	2351	4			4	4	
Comju	2358	3					
Debra	1085	0			1	4	
Eremo	1014	2					
Galangatch	727	3					
Gorak	1086	3			4	4	
Hankow	197	1					
Hansees Hull-less	703	3	1-3	2			
Himalaya	254	2	2	2	2-3	3-4	2-3
Hull-less	745	3	2-3	2-3	3+	3	
Do.	699	4		2-3	3+	3+	
Huskless	722	3					
India	695	3			3		
Do.	2318	1			2		
Do.	2319	1			0-1	2	
Iris	998	0					
Ivory	865	4		3-4	4	4	
Kama-ore	694	2			2	2	
Kharifa	783	0		0	0	0	
Kok Arpa	746	1			4	3+	
Maynaug	2429	1					
McFadden	1405	4					
Memesb	593	2					
Orkoe	2485	3					
Pingpong	1055	3					
Pingyan	1067	4		3	4	3	
Puroo	2428	1					
Robin	991	2			T	T	
Saggia	1316	2			2+	3+	
Sangatsulka	78	3	1-2	3	4	4	
Santizo	1049	1					

TABLE 4.—Reaction of barley varieties to physiologic forms 1, 2, and 3 of the powdery mildew of barley (*Erysiphe graminis hordei*) in greenhouse studies in stated years—Continued

Variety	C. I. No.	Reaction to physiologic form—					
		1		3		2	
		1924	1926	1927	1929	1929	1930
<b>Hordeum vulgare coeleste—Continued.</b>							
Samet.....	1314	1			2+	3	
Swedish Hull-less.....	523	3			2+	4	
Taftan.....	605	4			3	4	
Thomas.....	1041	3				4	
Unnamed.....	571	1			1		3
Wetho.....	2458	1			0-1	3	1
Yanahadaka.....	580	3			3	3	
Zunpakel.....	692	1		2		3	
<b>Hordeum vulgare coeleste himalayense: Himaya.</b>							
.....	620	1	2-3	2	3-4	3	
<b>Hordeum vulgare coeleste nudipyramidatum:</b>							
Black Hull-less.....	596	3	2-3	2-3	3+	3	
Do.....	618	4	3	3	2+	4	
Do.....	666	1	2	0-2	3+	1-2	2
Do.....	1027	4					
Do.....	2320	3			2-3	3	
Do.....	2449	4				3	
Kamamngal.....	577	3				3+	
Mochi-Hadaka.....	2423	2			2	3+	
Do.....	2424	2					
Purple Hull-less.....	1415	4			4	4	
Spain.....	1370	2			3+	1+	2+
Taihu.....	668	1					
Taubash.....	573	4			4	3+	
<b>Hordeum vulgare trifurcatum:</b>							
Black Hull-less.....	1032	1	2	1-2	3+	3+	2-3
Lihor.....	666	0		0-2	2-3	2+	2-3
Nepal.....	247	1	2-3	4	4	4	
Do.....	250	1	2	3	4	4	
Do.....	262	1	2	4	2	4	
Do.....	475	1	2	2-3	4	4	3-4
Do.....	489	1	2	2-3	4	4	
Do.....	533	2	2-3	3-4	3	4	
Do.....	595	1	2	1	4	4	3-4
Do.....	598	1			3	4	
Do.....	1290	3	3	2	3	3	
Do.....	1292	1	3	2	3	3	
Do.....	1385	4	2	3-1	3	4	
Do.....	2322	1			3+	4	
Purple Nepal.....	1373	1		1-2	4	3+	3-4
Skinless.....	1414	1			4	3	
Subnepal.....	2321	1			4	2-3	
<b>Hordeum intermedium haxtoni: Famesh</b>							
Hordeum intermedium haxtoni tonsum:	616	1				T	0
Arlington Awnless.....	702	0	0	0	0	0	0
Bodu.....	753	1			1	3	3
Bozu.....	749	2					
Huwan.....	1080	0		0	0	1+	0-1
McFadden.....	1443	3			3	3	
Nakano Wase.....	754	1	1		4		
Saitama-Nishiki.....	752	1					
<b>Hordeum intermedium mortoni nigritionsum:</b>							
Chinerna.....	1079	0			1	T	0
Nigrata.....	2444	0		0	0-1	0	0
<b>Hordeum intermedium nudihaxtoni: Unnamed.</b>							
.....	2352	1			4	4	
<b>Hordeum intermedium cornutum:</b>							
Cornutum.....	1317	4			4	4	
Do.....	2366	1			4	4	
Nepal.....	724	2	2-3	2	3-4	2+	
<b>Abyssinia Intermediate:</b>							
Abyssinia.....	676	2			2+		
Abyssinian Intermediate.....	2326	4			4	1	
Do.....	2377	1				4	
Do.....	2379	1				1	
Do.....	2381	3			3+	3+	
Do.....	2392	3			3	3	
Do.....	2407	3					
Do.....	2409	1				1+	
Do.....	2415	3		3-4	4	3	
Do.....	2514	4			3-4	2+	
Black Abyssinian.....	2383	2			3	4	
Black Abyssinian Intermediate.....	2416	1		1	1+	1+	1-2
Mandarin.....	981	1					

TABLE 4.—Reaction of barley varieties to physiologic forms 1, 2, and 3 of the powdery mildew of barley (*Erysiphe graminis hordei*) in greenhouse studies in stated years—Continued

Variety	C. I. No.	Reaction to physiologic form—					
		1		3		2	
		1924	1926	1927	1929	1929	1930
<b>Hordeum distichon palmella:</b>							
Alpha	959	4			3	4	
Archer	2360	4			4	4	
Bolton	177	4			3	4	
Do.	922	3			4	2	
Cleroff	685	4					
Ernest	2443	2					
Excelsa	1262	0			0	0	1+
Fiddi	1445	4			4	3+	
Forsythe	2442	2				2	
Golden Grain	2883	4				4	
Goldthorpe	1424	4	3	3	4	4	
Hanchamont	1121	4			4	3+	
Khayyam	1117	4					
Klaver	2361	4			3	4	
Newby	2437	4			4	4	
Nortut	1077	4			4	0	2
Odesa	824	4	4	4	3	4	
Omar	896	4			4	4	4
Orel	351	3			4	4	
Palestine	930	2		0-2	1	1	0-1
Pandora	1077	1			1	4	
Pasvolski	1103	4			4	2	
Fryor	2359	4		2-3	4	3	
Rax	1388	4			4	4	
Roshal	1244	4			3+	4	
Semir	1255	4			4	4	
Shale	688	2			4	4	
Sibirak	1078	1					
Silesia	978	4					
Swanson	1342	4			2+	4	
Syria	1259	4	1			1+	
Thecla	1293	4			3	3+	
White Smyrna	658	2			4	4	
<b>Hordeum distichon palmella nutans:</b>							
Abed	1389	4		3-4	4	4	
Abed Binder	1061	4			4	4	
Do.	2446	4			4	4	
Do.	2447	4			4	3+	
Abyssinia	355	4			4	4	
Abyssinian	1229	4			2+	2	
Do.	1234	4			4	4	
Archer	1418	4		4	4	4	
Australian White	925	4			4	3	
Bander	2354	4			4	4	
Bema	1100	4			4	4	
Benito	1444	3			3+	3+	
Benny	1236	4			4	4	
Bohemian	32	4	3-1	2-3	3	4	4
Do.	204	4	2	4	4	4	4
Do.	933	4	3	2	4	4	4
Do.	1149	4	4	4	4	4	4
Broach	1101	4			4	4	4
Calotte	1102	4			4	4	4
Canadian Battledore No. 1	1033	4			4	4	4
Caucasian	714	3			4	4	4
Chalet	1110	4			4	4	4
Chevalier	156	4	4	4	2	4	4
Do.	278	4	3	4	2+	3	4
Do.	1419	4	3	3	3	4	4
Do.	2317	4	3-4	2-3	4	4	4
Do.	2375	4			4	4	4
Chevalier II	530	3	3-4	4	4	4	4
Creel	1298	2			2	3	1+
Danish Gold	1391	2		3	4	4	4
Eider	993	4		3	3-4	4	4
Franconian	679	4			3	4	4
Do.	680	4					
Frankish	933	3			4	3	4
Gisborne	1030	3			4	4	4
Gold	1145	4			4	4	4
Goldfoli	928	0	0	0	0	0	0
Goldthorpe	2357	3			4	4	4



TABLE 4.—Reaction of barley varieties to physiologic forms 1, 2, and 3 of the powdery mildew of barley (*Erysiphe graminis hordei*) in greenhouse studies in stated years—Continued

Variety	C. I. No.	Reaction to physiologic form—					
		1		3		2	
		1924	1926	1927	1929	1929	1930
<b>Hordeum distichon palmella nutans—Contd.</b>							
Gond Gerst	1393	3		2	4	3	
Hanna	24	4		4	4	4	
Do.	30	2		1	1	1+	
Do.	34	4	3	4	4	4	
Do.	203	4	3	4	3	3	
Do.	966	0	0	0	0	0	0
Do.	942	4	3		4	4	
Do.	966	2	1	1-2	3	1	1+
Do.	1122	4	3-4	3	4	4	
Hannchen	531	3	3	3	2+	3-4	
Do.	602	4	4	3	4	4	
Do.	1425	4	3	2	3	4	
Hell Hanna 1	681	4	3-4	3-4	3	4	
Hell Hanna 2	678	4	3-4	3-4	2	3+	
Hell Hanna 3	682	1	1-2	2-3	4	4	3-4
Horn	928	4	3-4	4	4	3	
Italian	914	4					
Klaver	1029	4			3+	4	
Do.	1434	3			4	4	
Klaver Chevalier	587	4	3-4	3	4	4	
Kirgiz	1253	4			4	4	
Kirgizian	1428	3			3+	4	
Kite	992	4			3	4	
Kitting	189	3			2-3	3+	
Kolter	987	4					
Kurall	2450	3			3-4	3+	
Kurof	1096	4			3	4	
Lonhals	1343	4			3	4	
Mahrtsche	912	3	4	1-2	2	1+	2+
Moravian	965	3	1	0	2+	2	
Nesbit	2451	4			3-4	3+	
Paulina	963	4			3	4	
Prentice	917	3			4	4	
Pride of Dakota	218	4			4	4	
Princess	529	4	4	4	4	4	
Do.	603	4	3-4	3-4	3-4	4	
Do.	1428	4	3-4	4	4	4	
Proskowetz	893	3	3	3	3-4	4	
Pryor	1429	4	3	4	3+	4	
Sealand Prentice	1392	4			4	4	
Selco	2452	4			3+	4	
Sbals	2431	4			4	4	
Steigum	907	4	4	3	4	4	
Do.	931	4	3-4	3	3	4	
Strigum	47	4	4		2	4	
Surprise X Primus	1124	3-4				4	
Tivannes	1109	4			4	4	
White Moravian	977	4			4	3+	
White Smyrna	195	4					
Wibley	2438	4		4	4	4	
Zero	1287	4			4	4	
<b>Hordeum distichon palmella erectum:</b>							
Anthony	1341	3			4	4	
Archer	1031	4		4	4	4	
Canadian Thorpe	740	4			4	4	
Duckbill	1420	4			4	4	
Garion 986	645	4			4	4	
Gar on Regenerated Malster	1421	4			4	4	
Gisborne	1422	4			4	3	
Golden Grafu	423	4			4	3+	
Golden Melon	968	4			4	3	
Goldthorpe	1340	4	3-4	3-4		4	
Imperial	017	4			3	4	
Invincible	590	4					
Nesbian	647	3	2-3	3	1+	4	
Pickett	1094	4			4	4	
Primus	532	4					
Do.	1427	4	3	3-4	4	4	
Svanhals	187	4	3-4	4	3	4	
Tanchang	1164	4			3	4	
Thorpe	921	4					
Unnamed	2355	4			3+	4	
Do.	2370	4			4	4	

TABLE 4.—Reaction of barley varieties to physiologic forms 1, 2, and 3 of the powdery mildew of barley (*Erysiphe graminis hordei*) in greenhouse studies in stated years—Continued

Variety	C. I. No.	Reaction to physiologic form—					
		1		3		2	
		1924	1926	1927	1929	1929	1930
<i>Hordeum distichon palmella</i> reeriton:							
Pan.....	1380	2			3+	4	
Do.....	1381	3				1+	2
<i>Hordeum distichon palmella hypsanthinum</i> :							
Abyssinian.....	1239	1			2	2	
<i>Hordeum distichon palmella subviolaceum</i> :							
Abyssinia.....	672	2			1	1	
<i>Hordeum distichon nigricans</i> :							
Black Arabian.....	202	4	3-4				
Black Egyptian.....	1246	1			1	0	0-2
Black Smyrna.....	191	4			3-4	4	
Callph.....	983	0					
Dentil.....	1260	2					
<i>Hordeum distichon nigricans paralcum</i> : Erak.....	1003	2			1+	1+	2+
<i>Hordeum distichon angustispicatum</i> :							
Childs.....	1326	4			4	4	
McFadden.....	1400	4		4			
Do.....	1403	4		2-3	4	3+	
Do.....	1407	4		4	4	4	
<i>Hordeum distichon nudum</i> :							
Baku.....	253	3		3-4	1+	1	2
Do.....	709	1					
Crimsaar Hull-less.....	320	2			1	1	2
Evans.....	621	2	1-2	1-2	2-3	2	
Gopal.....	1391	1			0	0	
Mess.....	2327	2			3	2+	
Milan.....	424	2			1	1+	3
Poppenheim.....	314	4			1	2+	3
Swedish Hull-less.....	2512	2			3	4	
<i>Hordeum distichon nudum</i> :anthinum: Irisaka.....	1063	0			0	0	
<i>Hordeum distichon nigrinum</i> : Jet.....	967	1			T	T	
<i>Hordeum deficiens deficiens</i> :							
Abyssinia.....	2376	1			2	1+	2+
Abyssinian.....	1224	2			2	2	
Do.....	1225	3		1-2	2+	1	2-3
Do.....	1236	2			2	1	2+
Do.....	1240	2			2	2	
Burley.....	1294	2			2	2	
Claudia.....	1297	3					
Deficiens.....	2325	2			2	1+	
Kitchin.....	1296	4			3	4	
Redfield.....	1295	3			2+	2+	
<i>Hordeum deficiens steudeli</i> :							
Abyssinia.....	362	2		1-2	1	1+	1
Blackhull.....	678	2	0-1	1	4	1	1
<i>Hordeum deficiens nudideficiens</i> : Buland.....	1684	4			4	4	

From Table 4 it is evident that resistance to powdery mildew physiologic form 1 is not limited to any particular group of barley varieties but is to be found throughout various types. It is evident also that different strains of the same variety may differ considerably in reaction. This is best shown in the variety Hanna; the strains C. I. Nos. 24, 203, 942, and 1122 were all found to be more or less susceptible, whereas the strains C. I. Nos. 30 and 966 were more or less resistant. The strain C. I. No. 906 was outstanding for very marked resistance, type 0.

Physiologic forms 2 and 3 were tested on a restricted series of varieties. As shown in Table 4, fewer varieties were resistant to these physiologic forms. As with physiologic form 1, there was considerable variation in type and stability of reaction. A number of varieties, however, showed considerable resistance to all three forms.

## DISCUSSION

It is evident that resistance to the various physiologic forms of the leaf rust and powdery mildews of barley is rather widely scattered throughout the barley groups. The varieties differ considerably, not only in the type of reaction but also in stability of reaction. Some show uniformly a marked resistance, whereas others fluctuate considerably in type of reaction.

On the other hand, such varieties as Chilean C, C. I. No. 1432, Chilean D, C. I. No. 1433, and Lynch, C. I. No. 919, varied considerably in reaction, being sometimes classified as highly resistant and at other times moderately susceptible. There is some evidence that these fluctuations are correlated with environmental changes, the varieties being more susceptible under high-light intensities and temperatures. Waterhouse<sup>1</sup> has noted marked differences of this nature in his studies in Australia.

Varieties also differed considerably in relative reaction in the greenhouse and in the field. Some varieties, such as strains of Horsford, when inoculated in the seedling stage in the greenhouse with physiologic form 1, were more resistant than when infected with the same form in the field in the head stage. (Table 1.) On the other hand, a number of varieties were more resistant in the field than in the greenhouse.

Not only are the barley varieties differentiated for distinguishing physiologic forms of the rust but physiologic forms of the rust may differentiate between very similar types of barley. Thus Featherston, C. I. No. 1120, is very resistant to physiologic form 1, while the Featherston strains, C. I. Nos. 911, 954, 1118, and 1119, are very susceptible. In Oderbrucker, strains C. I. Nos. 940 and 957 are very resistant, while strains C. I. Nos. 969, 1137, and 1396 are very susceptible.

Similar differences occurred in regard to reaction to powdery mildew. In the seedling stage a number of varieties are very susceptible to all the physiologic forms. Such varieties as Lynch, C. I. No. 919, and Peruvian, C. I. No. 935, are highly resistant to some of the physiologic forms and very susceptible to others. Some, such as Hansee Hull-less, C. I. No. 703, Nepal, C. I. Nos. 489 and 1385, and Pryor, C. I. No. 2359, varied considerably in reaction to a physiologic form. Such varieties as Arlington Awnless, C. I. No. 702, Bolivia, C. I. No. 1257, Chilean D, C. I. No. 1433, Duplex, C. I. No. 2433, Goldfoil, C. I. No. 928, Hanna, C. I. No. 906, and Kwan, C. I. No. 1016, showed remarkably uniform high resistance to all the physiologic forms used in these studies. As has been shown elsewhere,<sup>2</sup> Arlington Awnless, C. I. No. 702, Duplex, C. I. No. 2433, and Nigrate, C. I. No. 2444, are outstanding for their high resistance to all five of the physiologic forms thus far distinguished.

A number of varieties have shown resistance to both leaf rust and mildew. These include such varieties as Abacus, C. I. No. 1088, Abyssinia, C. I. No. 2192, Abyssinian, C. I. No. 1243, Arequipa, C. I. No. 2329, Chile, C. I. No. 663, Chile Brewing, C. I. No. 657, Chilean D, C. I. No. 1433, Coast, C. I. No. 276, Juliaca, C. I. No. 1114, and Kwan, C. I. No. 1016. The three varieties, Bolivia, C. I. No. 1257,

<sup>1</sup> WATERHOUSE, W. L. AUSTRALIAN RUST STUDIES I. *Linn. Soc. N. S. Wales, Proc.* 54: 615-680. 1920.

<sup>2</sup> MAINS, F. B., and DIETZ, S. M. *Op. cit.* See footnote 6.

Sulu, C. I. No. 1022, and Weider, C. I. No. 1021, are outstanding for resistance to the physiologic forms of both rust and mildew used in these studies.

#### SUMMARY

Barley varieties differ considerably in their reaction to leaf rust. Resistant varieties were found scattered throughout most of the barley groups. These differed in their type and stability of reaction.

Some varieties differed radically in their reaction to the two physiologic forms of leaf rust, being resistant to physiologic form 1 and susceptible to physiologic form 2. These include the varieties Featherston, C. I. No. 1120, Hooded Spring, C. I. No. 716, Horsford, C. I. Nos. 507 and 877, Malting, C. I. No. 1129, Manchuria, C. I. No. 2330, and Oderbrucker, C. I. Nos. 940 and 957.

The varieties Abacus, C. I. No. 1088, Abyssinia, C. I. No. 2192, Abyssinian, C. I. No. 1243, Arequipa, C. I. Nos. 1256 and 2329, Bolivia, C. I. No. 1257, Callas, C. I. No. 2440, Chile, C. I. No. 663, Chile Brewing, C. I. No. 657, Coast, C. I. Nos. 276 and 690, Danish Gold, C. I. No. 1391, Gond Gerst, C. I. No. 1393, Heil Hanna 3, C. I. No. 682, Juliaca, C. I. No. 1114, Luth, C. I. No. 972, Mecknos Moroc, C. I. No. 1379, Purple Nepal, C. I. No. 1373, Quinn, C. I. No. 1024, and Weider, C. I. No. 1021, showed marked resistance to both physiologic forms.

The varieties also differed considerably in their reaction to powdery mildew, showing differences in type and stability of reaction and marked differences in some cases to the three physiologic forms of mildew studied. Among others, the varieties Arequipa, C. I. No. 1256, Blackhull, C. I. No. 878, Lynch, C. I. No. 919, Oderbrucker, C. I. No. 940, and Peruvian, C. I. No. 935, showed marked differences in reaction to the physiologic forms included in these studies.

The following varieties were very resistant to physiologic forms 1, 2, and 3 of the mildew:

Abacus, C. I. No. 1088, Algerian, C. I. No. 1179, Arlington Awnless, C. I. No. 702, Barbican, C. I. Nos. 1265 and 2336, Black Egyptian, C. I. No. 1246, Bolivia, C. I. No. 1257, Chevron, C. I. No. 1111, Chilean D, C. I. No. 1433, Chinerme, C. I. No. 1079, Chorny, C. I. No. 875, Consul, C. I. No. 1061, Duplex, C. I. No. 2433, Ederle, C. I. No. 1015, Exedra, C. I. No. 1262, Fleche, C. I. No. 1263, Gehangir, C. I. No. 1089, Goldfoil, C. I. No. 928, Gopal, C. I. No. 1091, Hanna, C. I. No. 906, Huwan, C. I. No. 1080, Irisaka, C. I. No. 1083, Khar-sila, C. I. No. 733, Kwan, C. I. No. 1016, Malwet, C. I. No. 2459, Monte Cristo, C. I. No. 1017, Mulyan, C. I. No. 2453, Nani Tal, C. I. No. 1087, Necludowi, C. I. No. 1000, Nigrate, C. I. No. 2444, Pasha, C. I. No. 984, Pegan, C. I. No. 2454, Sulu, C. I. No. 1022, Watho, C. I. No. 2458, Welcome, C. I. No. 2439, Weider, C. I. No. 1021, and White Gatami, C. I. No. 920.

There apparently is no correlation between rust resistance and mildew resistance. Most of the rust-resistant varieties are susceptible to mildew and vice versa. In some cases the same variety may carry resistance to one or more of the physiologic forms of leaf rust and also to one or more of the physiologic forms of mildew. The varieties Bolivia, C. I. No. 1257, Sulu, C. I. No. 1022, and Weider, C. I. No. 1021, were outstanding for their marked resistance to all the physiologic forms of leaf rust and powdery mildew studied.

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