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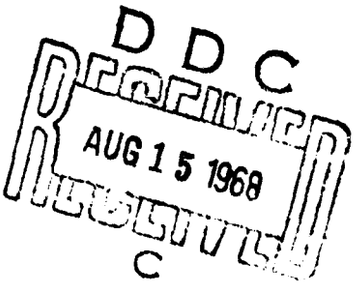

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533

INVESTIGATIONS ON THE OCCURRENCE OF BIOLOGICAL STRAINS OF THE STRIPE RUST OF WHEAT DURING THE YEAR 1932

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INVESTIGATIONS ON THE OCCURRENCE OF BIOLOGICAL STRAINS OF THE STRIPE RUST OF WHEAT DURING THE YEAR 1932

Arb. Biol. Reichsanst. fur Land-und Forstwirtschaft 21: 59-72. (Reports of the Federal Biological Institute for Agriculture and Silviculture).

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I. Introduction

In a publication issued last year (Gassner and Straib: 9), we devised a standard assortment for the determination of strains of stripe rust on the basis of examination of a great number of varieties of wheat (cf. Straib: 10) and described the diagnostic behavior of fourteen strains of stripe rust. In the following investigations which concern the examination of the origins of stripe rusts collected or furnished by third parties, in 1932, we are utilizing the same standard assortment. We shall report on the results of our examination in Section III of this communication, but it will first be necessary to furnish some supplementary information to our earlier reports on carrying out experiments for determination of strains of stripe rust. In earlier experiments for determination of strains of stripe rust. In earlier publications, we have repeatedly pointed out the particular difficulties inherent in working on stripe rust, due to the fact that experimental results are dependent on the particular experimental conditions to an extent not applicable to other types of rust (Gassner and Straib: 5,6,7,9). Although the determination of the strains of stripe rust found in 1932 was effected in principle in the same manner as in the experiments on which our communication of last year was based, there are some new factors in regard to methodology which are important in carrying out the experiments and evaluating the results of the latter, and shall therefore be discussed first.

II. Remarks on Methodology

By referring to our earlier publications (9), we need not here again repeat the experimental methodology used in the comparative determination of strains of stripe rust. We shall restrict ourselves here to the following remarks.

1. In producing the single-spore strains required for the exact determination of rust strains, it was shown that successful infection by single-spore inoculation in the actual winter months (December and January) leaves much to be desired. It has not been possible to determine whether the rate of infection which generally remains considerably below 1 percent, is due to inadequate maturing and a consequent poor infectivity of the spore material (cf. Becker: 1; Wilhelm: 11) or whether the poor light of this season affects the nutritional conditions of the fungus on the host plant to such an extent that only a fraction of the spores develops into pustules (Gassner and Appel: 2; Gassner and Straib: 5). It is recommended in any event to carry out single-spore infection in the season with better light in order to obtain pure strains of rust. Temperatures over 20° also affect infection adversely and should therefore be avoided. If no air-conditioned greenhouses are

available during the summer months, ice may be placed on the glass cylinders containing the inoculated plants.

2. In order to prevent interference with the infectious process by lack of nitrogen, we suggested earlier (9) to add five ccm of a 1.5% solution of ammonium nitrate to each of them at the time of inoculation if the soil is not very nutrient. We simultaneously pointed out that nitrogen fertilizer must be given especially during the season of good light because the lack of nitrogen indicated by premature yellowing of the first leaf has a much stronger effect in summer than in winter where such lack may be completely absent when the experimental plants are bred in the cold.

In different series of experiments during the winter of 1932-1933, the experiments were disturbed in some cases by the use of the recommended amounts of ammonium nitrate because fructification is then excessively prolonged and sometimes interferes with the outbreak of the pustules. This last manifestation is obviously the consequence of ammonia poisoning which is due to the fact that the amounts of carbohydrates available are insufficient, due to the lowered ability for assimilation of the plants in a season of poor light, to make possible the synthesis of the ammonia into organic nitrogen compounds (cf. Gassner and Hassedrauk: 3,4),

In order to eliminate the risk of ammonia poisoning, we now suggest replacing the ammonium nitrate by calcium nitrate. Because excessive fertilization with nitrogen salts produces an undesirable prolongation of the incubation and fructification period (cf. Gassner and Hassebrauk: 3), we further suggest reducing the nitrogen amount per pot. We now add to each pot 2 to 4 ccm of a 1.5% solution of calcium nitrate instead of the previously given 5 ccm of a 1.5% solution of ammonium nitrate. These doses are applicable to the nutrient-poor and sandy-clay soil utilized by us, and under standard growing conditions for the experimental plants where the lower doses are intended for seasons of poor and the higher doses for seasons of better light.

3. For the cultivation of the experimental plants to be utilized for the comparative determination of strains of stripe rust, we suggest a temperature of about 18° to 20 degrees. "Plants cultivated in a warm temperature possess longer leaves; these are not only more suitable for carrying out inoculation and for evaluation of the types of infection than the certainly stronger but shorter leaves of plants grown in the cold but also respond more uniformly to infection" (Gassner and Straib: 9, p 144).

We also attempted, in the experiments during 1932-1933, to maintain the cultivation temperatures as uniformly as possible; however, more recent observations have shown us that variations of the cultivation temperatures between 14° and 20° are permissible because they do not essentially change the type of infection of the standard types employed by us. It is important, however to avoid cultivation at low temperatures because the latter may increase receptivity in certain varieties. Such an effect of the cultivation temperatures is not surprising when we consider the influence of the temperature reported in our earlier observations on the reaction of plant varieites to stripe rust (Gassner and Straib: 6) because such an influence of the cultivation temperature would act in the same sense as the effect of temperature during the actual experiment for infection in which an increase of temperature may result in increase of resistance and a decrease of temperatures in an increase of receptivity.

4. The strain tests themselves were again carried out at a temperature of 15°, kept as uniform as possible. Minor variations of the average temperatures of plus/minus 0.5° could not be avoided and the temperature in the actual winter months was somewhat lower than in the season of good light.

These variations, unimportant in themselves, are obviously not adequate to explain certain differences in the experimental results during the winter months where Carstens Dickkopf, by comparison with the strains 1,2,3,4,6,8, 12, 17, no longer showed type 0 with sharply defined large and small necroses but often a marked formation of pustules and the infectious type II and III, whereas type 0 survived on Carstens Dickkopf also in the winter months as compared with the strains 9, 15, 16. A slight decrease of resistance, during the months of December and January, was also observed in the types "Rouge prolifique barbu," "Spaldings prolific" and "Holzapfels Fruhweizen", in comparison with the strains 5, 6, 7, 8.

It is very difficult, however, to obtain a definite insight into the final uses of the shifts in resistance just mentioned because the inevitable variations of lighting in the different seasons obviously also change the conditions of both cultivation and experimentation. We must consider in this mainly the reaction of the lighting conditions on the other nutrient processes of the plant which find their definite expressions, among others, in the varying nitrogen requirements corresponding to the variations in season.

In any event, we recommend, on the basis of the indications just given, not to utilize the light poor months of December and January without a corresponding critical evaluation of the experimental results for the determination of strains of stripe rust. We ourselves carry these experiments out, as far as possible, during the months September to November and February to May.

5. The dependence of the results of infection on the experimental conditions, as stressed above in regard to stripe rust, appears to make it necessary, in the examination of the origin of stripe rust in regard to strain classification as well as in the determination of new strains of stripe rust for purposes of comparison, to always retest the most important and known strains from time to time. Only this seems to make possible adequate control of the constancy of the experimental conditions because any variation in the latter must affect, and produce a variation in, the behavior of the control varieties.

6. The evaluation of the infectious types has already been carried out in the manner described earlier by employing the designations i, 00,0, I, II, III, IV (Gassner and Straib: 9, p 146). The designation 0-plus is new. As will be seen from the listing of the infectious pictures of the 14 biological strains of the stripe rust of wheat in the standard classification given last year (Gassner and Straib: 9, p 154), there occurs in some cases an isolated formation of spores (type I to II), in addition to infection type 0. The infection picture was then given as 0-I and/or 0-II. In place of this, we are now utilizing the designation 0-plus. The plus sign is meant to indicate that in addition to the generally uniform type 0 (necroses and discoloration without spore deposit), there also exists an occasional slight formation of spores or tendency toward the latter.

In the grouping given subsequently of all of the strains of stripe rust found by us, the biotypes already described are identified by the new designation 0-plus instead of the earlier findings 0-I and/or 0-II.

7. The standard assortment utilized for the diagnosis of strains of stripe rust has been utilized in the arrangement established earlier. Deviations and/or supplementary indications exist in the sense shown below:

a) The variety "Rouge prolifique barbu" which had been suggested last year not as an actual test but only as a "complementary variety" (Gassner and Straib: 9), has been included in the main standard assortment which now consists of 10 instead of 9 varieties of wheat. This inclusion facilitates and confirms the specific determination of the rather frequently occurring strains 2 and 3, and is also valuable for the diagnosis of the strains 15 and 17 of stripe rust which are being newly described in the following.

b) In our report of last year, the varieties "Rouge prolifique barbu" and "Chinese 166" had been utilized as complementary varieites. The former has been included in the main varieities of the assortment and Chinese 166 was retained as complementary variety. For the sake of completeness, the behavior of this variety in response to all the strains of stripe rust has been communicated, but it should be stressed that infection type i applies under the prescribed test temperature of 15°C. At lower temperatures (10 to 12°), i would be replaced by type 0 and/or 00. The standard assortment, for strains of stripe rust now consists of 10 main and one complementary variety.

III. Compilation of the Origin of the Stripe Rusts Investigated and the Results of Examination

The study of strains of stripe rust during 1932 again received the support of various organizations within and outside of Germany who sent us samples of stripe rust. In so far as we were able to obtain infections with these samples, the donors are named in Table 1 and we take this occasion to thank them and all others for collecting and sending us this material.

As shown in the following compilation, a total of 77 stripe rusts could be cultivated successfully; of these, 71 came from Germany and 6 from other countries. Since several samples of rust were collected in the same localities, the number of points of origin is less than that of the samples investigated (77 samples from 59 localities). The samples of rust were first multiplied on a highly receptive variety (Michigan Amber) and initially tested as "populations" against the standard of classification. For the final and exact examination, we again used only single-spore strains and attempted to produce and test 3 single-spore strains from each population. We were not entirely successful in this because the number of single-spore strains is less in some and more in other cases.

On two of the stripe rusts, tests with single-spore strains could not be made, and the results obtained with these populations are therefore given later in parentheses (Table 3, page 66).

The tests of a total of 192 single-spore strains isolated from the various samples were made primarily during the months of February to May 1933. As far as possible, the tests were repeated several times and the standard of assortment was inoculated 567 times with the different strains and populations.

A total of 12 different strains of stripe rust were demonstrated by this, of which the strains 2, 3, 4, 5, 7, 8, 9, 12 had already been classified during the years 1927 to 1931 (Gassner and Straib: 9); the strains 1, 6, 10, 11, 13 were not contained in the samples of the year 1932 inasfar as it is possible to come to definite conclusions from negative findings. Three strains are new and have been designated as 15, 16, 17. (Note: In regard to the locality of origin of the strains 11 and 12 in our report of last year, the correct point of origin of these strains is not Himberg near Vienna but Unter-Himberg near Kufstein in the Tyrol, according to later information by the sender).

Table 2 contains the diagnosis of all strains of stripe rust classified so far and includes those which we did not again encounter in 1932. The new strains 15 to 17 are arranged for better review by being placed alongside and/or between closely related strains.

The strains 1 to 14 described last year have been re-tested, and the results concord well with the findings of last year. In some cases, especially for Carsens V, we again observed occasionally the formation of pustules in addition to type 0 so that the mean type of infection now must be designated as 0 plus. We stress again (cf. page 61) that the reaction of Carsens V is more dependent on the season than that of other varieties. The findings reported do not refer to the light-poor season in which Carstens V shows a surprising increase of the otherwise existing type 0 plus to II-III. The following remarks apply to the characterisation of the new strains 15 to 17:

Strain 15 was isolated for the first time from a sample from Austria (Wieselberg-Erlauf) and was later found again in the Finnish stripe rust (Jokioinen). It is generally not very aggressive for most of the varieties of the standard assortment, and is differentiated from the closely related strain 12 perhaps only by the strong infection which it causes in Spaldings Prolific which is not attacked by strain 12. The examination of the two origins of strain 15 was carried out only on the standard assortment (including the complementary varieties) but not on a larger wheat assortment. There is a slight possibility consequently that wheat varieties not included in the standard assortment would still show differences between the Austrian strain 15 and the Finnish stripe rust identified with the latter.

Strain 16 was found first in Pabstorf (Braunschweig) and simultaneously in Hamersleben (Sachsen) as well as later in Finland (Jokioinen). The identity of the Finnish strain with the German strain 16 was definitely confirmed both by the findings on the standard of assortment as well as by tests of a larger wheat assortment. Physiologically, strain 16 is closely related to strain 9 and the main difference lies in the resistance to strain 16 of Heines Kolben-Weizen and the receptivity of this wheat to strain 9. We should not neglect to state that the different reaction to strains 9 and 16 is restricted to Heines Kolben-Weizen but does not extend to Rumkers Sommerdickkopf which shows the same reaction to all other known strains of stripe rust as Heines Kolbensommerweizen (cf. Straib: 10).

Strain 17 was found only once in West Germany (Bonn) and is differentiated from strain 7 by the resistance of Carstens V and the receptivity of Spaldings Prolific as well as by higher rate of infection in Webster C.J. 3780.

The geographic distribution of the stripe rusts found in 1932 will be seen on the preceding Table 3 in which the corresponding findings of the years 1927 to 1931 are listed for comparison in the last column.

As already mentioned, the strains 1, 6, 10, 11, 13, 14 were not determined; the existing strains of rust were found as follows:

Strain	2	in 12 (12)	localities
"	3	16 (16)	"
"	1	5 (4)	"
"	5	15 (15)	"
"	7	7 (7)	"
"	8	8 (6)	"
"	9	3 (3)	"
"	12	1 (0)	"
"	15	2 (0)	"
"	16	3 (2)	"
"	17	1 (1)	"

The numbers shown between parentheses refer to the points of origin within Germany and the numbers preceding them refer to the total number of localities in which they were found.

In order to facilitate a review of the geographic distribution, we show a special compilation by provinces and countries in Table 4. Small dots represent the localities from which samples of stripe rust were cultivated and tested successfully, and large black circles represent the number of localities in which the corresponding strains of rust were confirmed within the respective province or country.

Appreciable differences exist in the frequency of occurrence of the individual rust strains during 1932. In the main German wheat cultivation areas, the strains 2, 3, 5 were noted most frequently, and in second place come strains 7 and 8. In detail, the distribution picture is rather multifold because the same forms of rust are often found in widely separated regions. Strain 8 was encountered in the provinces of Saxony, Hessen-Nassau, Rhineland, in the state of Hessen and also in Sweden and Canada; strain 16 was found in the province of Saxony, in the state of Braunschweig, and in Finland. Strain 15 could be demonstrated for Austria and for Finland.

Whereever a larger number of rust samples from different localities in a given land was examined, several strains could be observed as follows:

Land	Locality	Strain
Saxony	22	2,3,5,7,8,9,16
Hanover	14	2,5,7
Hessen-Nassau	4	3,5,8
Rhineland	6	5,8,17
Braunschweig	18	2,3,4,5,16
Hessen	5	2,3,8

It follows from this that we are inadequately informed on the distribution of rust strains in those counties and countries in which material from only one locality was investigated, and that there is no point in discussing geographic distribution of rust forms in detail, considering the present status of our knowledge. For this speaks also the comparison of the findings of the year 1932 with those of the years 1927-1931 (Table 3). These findings concord only to a very minor extent. The part of Germany (Saxony) which was tested most thoroughly, presented the strains 1, 4, 5, 9, 10 during 1927-1931, and the strains 2, 3, 5, 7, 8, 9, 16 during 1932.

We can say with certainty today that stripe rust is largely specialised and that we will encounter an increasing number of strains with an increasing number of investigations. (Note: During 1927-1933, a total of 6 strains was found in Schlanstedt which was examined especially thoroughly, and, in the region of Magedburg, a total of 10 different strains of stripe rust. The relatively extensive material for observation received during 1932 from Saxony and Braunschweig also lets us recognize that the percentual share of the different strains of stripe rust observed here is uneven and that certain strains, especially strains 2, 3, 5 as well as 7 and 8, occur particularly frequently in Central Germany. There is no doubt that the distribution (as already stressed by Gassner and Straib: 8,9) is closely related to the varieties of wheat primarily cultivated in a given wheat-raising area. The strains of rust mentioned are without exception those which attack the widely used "Dickkopf" wheat of the type Strubes Dickkopf. The strains 5 and 7 are further characterised by the fact that they also attack Carstens V which has been widely cultivated in recent times, and we must expect therefore that their propagation will keep step with the increased cultivation of this variety. In the opposite sense, we may anticipate that strain 8 which heavily attacks "Panzer wheat" will diminish in frequency with the decreasing cultivation of this variety. Nor can it be more chance that the rust strains 16, 9-11, 15, 12-14, listed behind strain 8 in the arrangement given (Table 2), show a less wide distribution on the standard of classification than the forms first mentioned and are encountered much more seldom in Germany (cf. right half of Table 4). It is a peculiar fact initially not explainable that strain 1, normally extraordinarily aggressive (which was demonstrated by us earlier to be a mutation of strain 9 and also found in 1931 on location) was not found in any rust locality of 1932 although it was again found in 1933.

At the time that this article went into print, the investigations on the occurrence of stripe rust in 1933 had been terminated in general but could not be included in the foregoing. We restrict ourselves therefore here to the short statement that we found, among the samples collected during 1933, at least 5 more new and as yet unknown strains which received the numbers 18 to 22.

Postscript

While proofreading this article, a report was published by Hanna Becker on the rust investigations carried out in the Agricultural Institute of the University at Halle (Kuhn-Archiv 1933, p 293-305). The author described five new strains of stripe rust by utilising our standard of assortment, and gave them the numbers 15 to 19.

For important reasons, it is unfortunately not possible for us to adopt these strains in our compilation of forms of stripe rust. The author did not effect the investigations with the absolutely required single-spore lines but with populations. We do know however, that in such populations several strains may be present simultaneously in which the infectious type of one strain may become superimposed on those of the other strains in a great variety of ways and may combine with these in such a manner that new and different strains seem to have been observed. It is for this reason that the determination of new strains of rust makes it absolutely necessary to first obtain a specific starting material in the form of pure lines as conditio sine qua non.

Main Content

1. The above investigations contain the results of the analysis of 77 samples of stripe rust from 59 different localities which are generally located in the main wheat-growing areas of Germany. All samples investigated were from the year 1932.

2. In the samples of stripe rust investigated, a total of 11 different strains of stripe rust was classified, of which strains 2, 3, 4, 5, 7, 8, 9, 12 are already known from our earlier investigations, whereas the strains 15, 16, 17 are new.

3. The frequency of the rust strains is very irregular in the different localities and is apparently determined by the reaction of the individual strains to the varieties of wheat primarily cultivated in a given area.

4. The analysis of the rust strains was carried out in the manner described earlier but the standard assortment was enlarged by including one of the complementary varieties among the number of main varieties so that the test assortment now consists of 10 instead of 9 varieties. In regard to further details, we refer to the preceding text.

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Table 1. Compilation of Origins of Stripe Rust Tested for 1932

c Der Einsendung a Nr.	b Datum	d Ort	e Gesammelt von	f Zahl der geprüften Einsporstämme
		Deutschland:		
		Provinz Brandenburg		
6	10. 6.	Müncheberg (Mark)	Dr. v. Rosenstiel	3
61	3. 7.	Müncheberg (Mark)	Dr. Oehler	1
		Provinz Schleswig-Holstein		
48	30. 6.	Kiel-Kitzeberg	Dr. Pape	3
20 a	23. 6.	Schwartau bei Lübeck	Carsten	—
20 b	23. 6.	dgl.	"	—
20 c	23. 6.	dgl.	"	5
20 d	23. 6.	dgl.	"	—
20 e	23. 6.	dgl.	"	—
		Provinz Sachsen		
3	8. 6.	Hadmersleben, Kr. Oschersleben	Vettel	2
19 a	20. 6.	" "	selbst	2
19 b	20. 6.	" "	selbst	2
26	26. 6.	" "	Vettel	1
4	8. 6.	Klein-Wanzleben, Kr. Oschersleben	Dr. Feistritzer	4
86 a	8. 7.	Hamersleben, Kr. Oschersleben	Hansen	4
86 b	8. 7.	" "	"	3
5	8. 6.	Schlanstedt, Kr. Oschersleben	Dr. Bonne	3
73	5. 7.	" "	"	3
98 b	8. 7.	" "	selbst	
128 a	11. 7.	" "	Dr. Bonne	1
52	2. 7.	Hötensleben, "	selbst	1
53	2. 7.	Hornhausen, "	selbst	7
54	2. 7.	" "	selbst	3
44	29. 6.	Emersleben, Kr. Halberstadt	v. Rümker	4
47	30. 6.	Langenstein a. Harz	Dr. Thoenes	1
55	2. 7.	Andersleben, Kr. Halberstadt	selbst	4
56	2. 7.	" "	selbst	3
94	8. 7.	Dingelstedt, Kr. Oschersleben	selbst	1
96	8. 7.	Anderbeck, Kr. Halberstadt	selbst	1
97	8. 7.	Dardesheim, "	selbst	—
124	12. 7.	Halberstadt	selbst	3
121	12. 7.	Quedlinburg a. Harz	selbst	1
63	4. 7.	Olvenstedt bei Magdeburg	selbst	3
64	4. 7.	Eichenbarleben, Kr. Neuhaldensleben	selbst	3
65	4. 7.	Tundersleben, "	selbst	2
27	27. 6.	Salzmünde bei Halle a. d. Saale	Riebesel	4
58	2. 7.	Hecklingen bei Staßfurt	selbst	3
57	2. 7.	Schneidlingen, Kr. Querfurt	selbst	3
116	12. 7.	Görsbach, Kr. Sangerhausen	selbst	3
114	12. 7.	Hesserode bei Nordhausen	selbst	3
		Provinz Hannover		
29	25. 6.	Himmelstür, Kr. Hildesheim	selbst	3
31	25. 6.	Hohnsen, Kr. Hameln	selbst	3
32	25. 6.	Aerzen, Kr. Hameln	selbst	3
143	16. 7.	Ebstorf bei Ülzen	Dr. Senf	—

(continued on following page)

Der Einsendung Nr.	Datum	Ort	Gesammelt von	Zahl der geprüften Einspor-stämme
		Provinz Hessen Nassau		
36	25. 6.	Lorch a. Rhein	selbst	3
37	26. 6.	Sossenheim bei Frankfurt Main	selbst	3
42	26. 6.	Kerstenhausen, Kr. Fritzlar	selbst	3
182	27. 6.	Grambach bei Kassel	Dr. G. O. Appel	2
		Provinz Rheinland		
11	14. 6.	Bonn a. Rhein	Prof. Schaffnit	1
[illegible]	[illegible]	Ruschenhoven bei Bonn	"	3
13	[illegible]	[illegible]kirchen	"	3
14	12. 6.	[illegible]ndorf bei Euskirchen	"	1
15	25. 6.	Klein-Maischeid, Bezirk Coblenz	selbst	1
		Freistaat Braunschweig		
83	8. 7.	Glasmarode bei Braunschweig	selbst	1
84	8. 7.	" "	selbst	4
176	8. 7.	" "	selbst	3
190	8. 7.	" "	selbst	3
70	8. 7.	Harxdorf bei Braunschweig	Dr. Rabien	3
10	13. 6.	Sonnenhof bei Braunschweig	Dr. Hassebrauk	3
17	17. 6.	" "	"	3
80	8. 7.	Scheppau "	Dr. Rabien	3
51	2. 7.	Esbeck, Kr. Helmstedt	selbst	3
70	4. 7.	Helmstedt	selbst	3
93	8. 7.	Pabstorf, Kr. Wolfenbüttel	selbst	5
92	8. 7.	Mattierzoll, Kr. Wolfenbüttel	selbst	2
		Freistaat Hessen		
16	18. 6.	Lich, Kr. Gießen	Dr. G. O. Appel	3
21	26. 6.	Großenlinden, Kr. Gießen	"	4
22	26. 6.	Langgöns, Kr. Gießen	"	3
40	2. 7.	Gießen a. d. Lahn	"	3
40	26. 6.	Friedberg (Oberhessen)	selbst	3
98	26. 6.	Steinbach, Kr. Offenbach	selbst	2
		Bayerische Rheinpfalz		
8	13. 6.	Limburgerhof bei Mutterstadt	Landw. Versuchsstation	5
		Oesterreich		
7	10. 6.	Wieselburg a. d. Erlauf	Dr. Steiner	1
		Ungarn:		
46	30. 6.	Magyarovar	Prof. Husz	4
		England:		
1	13. 6.	Cambridge	Prof. Brooks	3
		Schweden:		
45	29. 6.	Svalöf	Prof. Åkerman	1
		Finnland:		
181 c	22. 7.	Jokioinen	Prof. Pesola	4
		Canada:		
17	(1. 6.)?	Duncan	Dr. Newton	3
Zusammen:		77 Proben als Populationen vorgeprüft von 51 verschiedenen Orten		102 Einsporstämme in der Hauptprüfung

/key to Table 1 on following page/

? /Key to Table 1/

a. Number
b. Date
c. Sample
d. Origin
e. Collected by
f. Number of Single-Spore Strains Tested
g. Total
h. 77 samples from 51 localities pre-tested as population
i. single-spore strains for main tests

Table 2. Compilation of Infection Type of Biological Strains of Stripe Rust Nos 1-17

d Versuchsbedingungen: Anzucht bei ca. 18° C Prüfungstemperatur: 15° C.
Rel. Luftfeuchtigkeit: 80–90%.
Diffuses Tageslicht, ausreichende Stickstoffernährung.

e Gelbrostrasse Nr.	b Hauptsorten: Michigan Amber	Vilmorin Blé rouge d'Ecosse	Strubes Dickkopf	Webster C. I. 3780	Holzapfels Früh	Vilmorin 23	Heines Kolben	Carstens V	Spaldings prolific	Rouge prolifique barbu	Ergänzungssorte c Chinese 166
1	IV	IV	IV	II–IV	IV	IV	IV	0+	i	i	i
2	IV	IV	IV	IV III	IV	IV	0	0+	III IV	IV III	i
3	IV	IV	IV	IV III	IV	IV	0	0+	0+	0+	i
4	IV	IV	IV	III	IV	IV–III	0	0+	i	i	i
5	IV	IV	IV	IV III	0+	00	0	IV	0+	0+	i
6	IV	IV	IV	IV–III	0	00	0	0+	0+	0+	i
17	IV	IV	IV	II III	0	00	0	0+	IV III	0	i
7	IV	IV	IV	0+	0+	00	0	IV	0+	0+	i
8	IV	IV	IV	0+	0	00	0	0+	0+	0+	i
16	IV	IV	0	III–IV	IV	1	0+	0	i	i	i
9	IV	IV	0	III–IV	IV	0+	IV	0	i	i	i
10	IV	IV	0	0+	0	0	IV	0	i	i	i
11	IV	IV	0	III	0	0	0	0	i	i	i
15	IV	IV	0	0	0	00	0	0	IV	0+	i
12	IV	IV	0	0	0	0	0	0+	i	i	i
13	IV	00	00	III–II	00	00	0	00	i	i	IV
14	IV	0+	0	0	0	0	0	0	i	i	0

[1]) Bezüglich des Fundortes der in unserer vorjährigen Mitteilung (Gassner und Straib 9) aufgestellten Rassen 11 und 12 müssen wir ergänzend mitteilen, daß es sich nicht um den Ort Himberg bei Wien, sondern nach freundlicher nachträglicher Mitteilung des Einsenders, Herrn Dr. Steiner, um den Ort Unter-Himberg bei Kufstein in Tirol gehandelt hat.

a. Stripe Rust Strain No
b. Main varieties
c. Complementary variety
d. Experimental conditions: initial growth at appr. 18°C. Test temperature 15°C. Relative humidity 80-90%. Diffuse daylight, adequate nitrogen supply.

Table 3. **Geographic Distribution of Stripe Rust Strains in 1932 (Compared With the Distribution of the Strains in Preceding Years)**

(im Vergleich zur Verbreitung der Rassen in früheren Jahren). d

a Land	b Ort	c 1932 gefundene Gelbrostrassen	1927–1931 festgestellte Gelbrostrassen
Deutschland			
Prov. Ostpreußen	Hasenberg bei Tapiau	vacat	8
Prov. Brandenburg	Muncheberg	7	
Prov. Schleswig Holstein	Kiel	7	
bzw. Oldenburg	Schwartau	7	
Prov. Sachsen	Hadmersleben	5, 7, 9	9, 10
	Klein-Wanzleben	5	1, 5, 9
	Hamersleben	16	
	Schlanstedt	2, 3, 8, 9	4, 5
	Hötensleben	5	
	Hornhausen	2, 3	
	Emersleben	2	9
	Langenstein a. Harz	3	
	[illegible]leben	3, 9	
	Dingelstedt	5	
	Anderbeck	5	
	Dardesheim	(3) *)	
	Halberstadt	7	
	Quedlinburg	2	
	Olvenstedt	3	
	Eichenbarleben	5	
	Tundersleben	5	
	Salzmünde	2, 3	
	Hecklingen	3	
	Schneidlingen	3	
	Gorsbach	3	
	Hesserode	7	
Prov. Hannover	Hemmelstär	5	
	Hohnsen	5	
	Aerzen	7	
	Ebstorf	(2) *)	
Prov. Hessen Nassau	Oestrich a. Rhein	3	
	Sossenheim	3	
	Kerstenhausen	8	
	Grumbach	5	
Prov. Rheinland	Bonn a. Rhein	17	
	Buschenhoven	5	
	Euskirchen	5, 8	
	Ludendorf	8	
	Klein-Maischeid	5	
Freistaat Braunschweig	Gliesmarode	2, 4, 5	
	Hordorf	4	
	Nortenhof	2, 3	5
	Scheppau	2	
	Esbeck	4	
	Helmstedt	5	

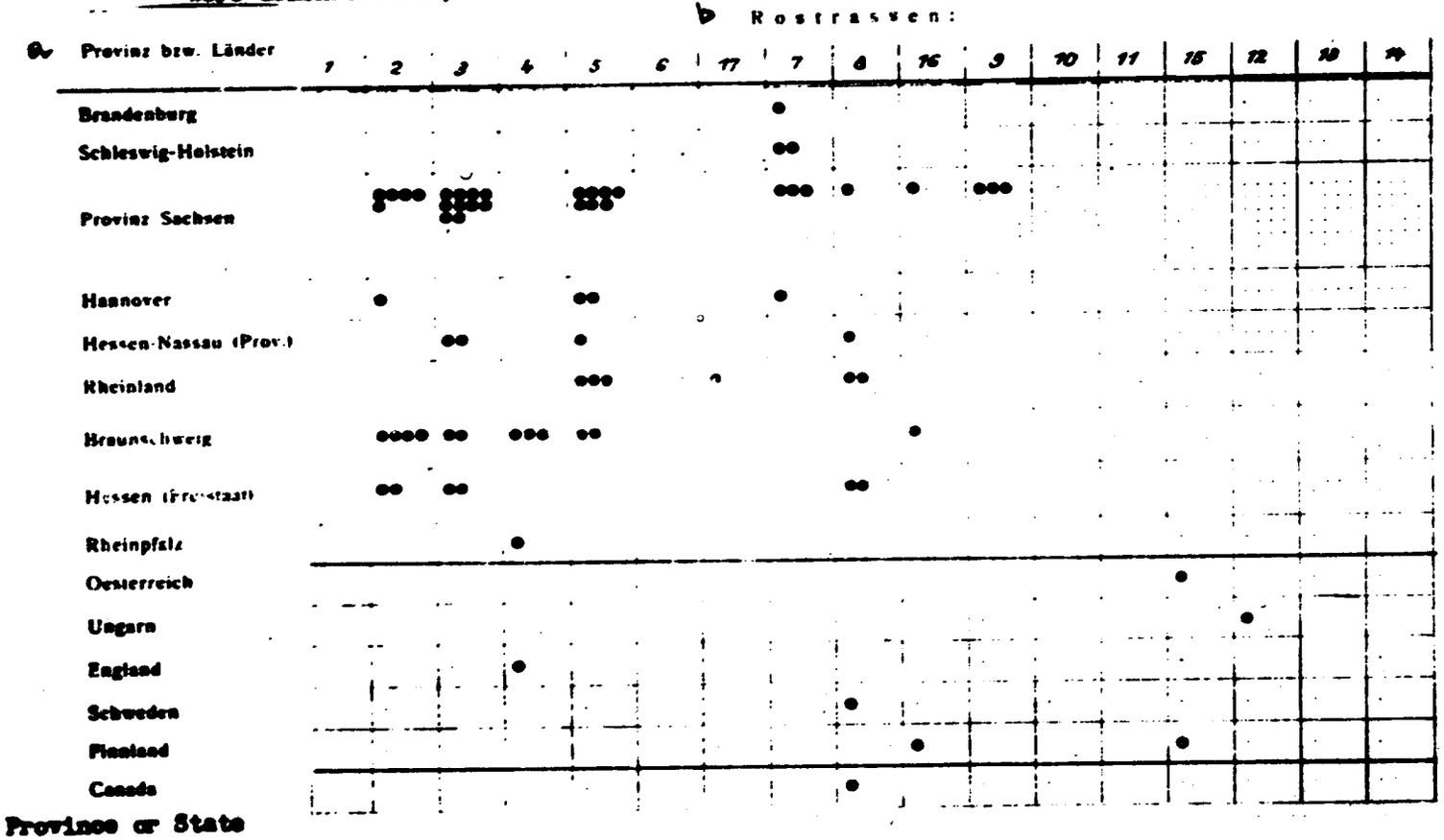
e *) war als Population, n i c h t als Einsporlinie geprüft. Vergl. S. 62.

[continued on following page]

a Land	b Ort	c 1932 gefundene Gelbrost-rassen	d 1927—1931 festgestellte Gelbrost-rassen
Freistaat Braunschweig	Pabstorf	16	
	Mattierzoll	2, 3	
Freistaat Hessen	Lich	2, 3	
	Großenlinden	2	
	Langgöns	3	
	Gießen	8	3, 6, 8
	Steinbach	8	
Bayerische Rheinpfalz	Limburgerhof	4	
Mecklenburg	Bandelstorf bei Rostock	vacat	5
Oesterreich	Wieselburg	15	
	Himberg	vacat	11, 12
Ungarn	Magyarovar	12	
Frankreich			
Dept. Seine et Oise	Noissy le Roi	vacat	2
	Verrières	vacat	2, 3
	Versailles	vacat	2
England	Cambridge	4	
Schweden	Svalöf	8	7, 8
Finnland	Jokioinen	15, 16	14
Nordamerika, Alberta	Olds	vacat	13
Canada	Duncan	8	

a. Country (province)
b. Locality
c. Strains Found in 1932
d. Strains classified in 1927-1931
e. *) Was tested as population but not as single-spore line, cf. p 62.

Table 4. Occurrence of Rust Strains Nos 1-17 in Different Provinces and States During 1932. (Small dots represent localities where the respective rust strains could not be determined; black circles represent the localities in which the respective rust strains were demonstrated.)



a. Province or State
b. Rust Strains