

Investigations about the genetic resources of grapes with regard to resistance characteristics to powdery mildew (*Oidium tuckeri*)

by

R. EIBACH

Bundesanstalt für Züchtungsforschung an Kulturpflanzen, Institut für Rebenzüchtung Geilweilerhof, Siebeldingen, Deutschland

S u m m a r y : During 1991 through 1993 a total of 475 cvs were rated for oidium infection of leaves and berries. It was established that there was no infection of the berries of 41 cvs and on the leaves of one cultivar. A comparison with the *V. vinifera* cvs Müller-Thurgau and Silvaner clearly shows that an impressive number of genotypes have a substantially lower degree of infection. The wide genetic variation offers a good basis upon which new cvs with improved oidium resistance can be bred. Despite the significant correlation between oidium infection on leaves and berries, there was, in many cases, considerable variation in leaf infection within one level of berry infection, or in berry infection within one level of leaf infection. Therefore, a precise conclusion as to the resistance of berries can not be made on the basis of screening procedures in the greenhouse or *in vitro* to determine the degree of resistance on leaves.

K e y w o r d s : gene resources, powdery mildew, resistance, variety of vine.

Introduction

One of the most important fungus diseases world-wide is *Oidium tuckeri*, the pathogen of powdery mildew. In a number of countries around the world there are breeding programmes which seek to develop new mildew-resistant cvs, which are also resistant to powdery mildew. In this type of breeding programme it is vital to determine suitable resistance sources. For this purpose the genetic resources of grapes must be evaluated with regard to suitable carrier of resistance genes. Many authors have dealt with the oidium resistance of different cvs (for literature see ROY and RAMMING 1990). However, it is often difficult to compare the results because they have been attained under different conditions or with different methods. In addition to field observations (BOUBALS 1961; DOSTER and SCHNATHORST 1985; PATIL *et al.* 1990), *in vitro* procedures have also been described as means of evaluating resistance genes (KLEMPKA *et al.* 1984; HEINTZ *et al.* 1985; DIEHL and HEINTZ 1987). Moreover, the results are often limited to only a few genotypes. Therefore, it was the goal of the investigations presented here to evaluate a wide spectrum

of genotypes for their degree of resistance to oidium under the same conditions.

Materials and methods

Over a period of 3 years from 1991 to 1993 the degree of oidium infection on the leaves and berries of plants in the field was determined. Each year the infection observations took place during the period from the end of July to mid-August. Set on of berry ripening occurred within this period for most of the cvs. After the beginning of ripening the berries are rarely infected (DELP 1954; SEEM *et al.* 1990), meaning that the data gathered reflects maximum infection in the course of the vegetation period. This is not true of the leaves. Here the degree of infection may increase in August/September depending on the genotype and the weather conditions. The ratings were done in accordance with the scheme of the OIV (ANONYMOUS 1983). However, the degree of infection was noted instead of the degree of resistance (Tab. 1). This takes into account that infection is subject to fluctuations depending on varying environ-

Table 1
Rating levels for oidium infection of leaves and berries

Level	leaves	berries
1	no infection	no infection
3	small punctuated necrosis; attacked patches clearly limited	small punctuated necrosis; only a few berries on individual clusters attacked
5	spread necrosis with 2 - 5 cm diameter; attacked patches mostly limited	up to about 30% of the berries attacked; no or only very few cracked berries
7	large, extensive attacked patches; some of them still limited	about 50% of the berries attacked; few cracked berries
9	not limited and very extensive attacked patches; most of the entire leaf attacked	more than 70% of the berries attacked; repeated cracked berries

Table 2

The maximum degree of oidium infection of leaves and berries of interspecific crossings; field observations 1991-1993; B/L = berry/leaf. *V. viniferacvs* for comparison: Müller-Thurgau B/L = 9/7, Silvaner B/L = 9/9

No.	VARIETY	B/L	No.	VARIETY	B/L	No.	VARIETY	B/L	No.	VARIETY	B/L	No.	VARIETY	B/L
1	BARRY (N)	1/2	49	SEIBEL 8116 (B)	2/2	97	POUGETTE MUSQUEE (B)	2/3	145	REFREN	2/5	193	FREIBURG 6147 (N)	3/3
2	BON NOIR (N)	1/2	50	SEIBEL 8343 (B)	2/2	98	RELANCE (N)	2/3	146	CASCADE (N)	2/6	194	FREIBURG 993-60 (B)	3/3
3	BURDIN 5406 (N)	1/2	51	SEYVAL (B)	2/2	99	SCHUYLER (N)	2/3	147	DNESTROVSKII ROZOVYI (RG)	2/6	195	GALIBERT COULONDRE 21-2 (N)	3/3
4	CASTEL 3917 (N)	1/2	52	SEYVE VILLARD 12-481 (B)	2/2	100	SEIBEL 13666 (N)	2/3	148	NEW YORK 36661 (B)	2/6	196	GEILWEILERHOF 64-170-1 (B)	3/3
5	CAYUGA WHITE (B)	1/2	53	SEYVE VILLARD 18-515 (N)	2/2	101	SEIBEL 19881 (N)	2/3	149	VALIANT (N)	2/6	197	GEILWEILERHOF 67-198-2 (B)	3/3
6	ELVIRA (B)	1/2	54	SEYVE VILLARD 3-54 (B)	2/2	102	SEIBEL 5178 (B)	2/3	150	MANDL 501 (RG)	2/8	198	GEILWEILERHOF C-43-39 (B)	3/3
7	GEILWEILERHOF GA-47-42 (B)	1/2	55	UNIVERS (B)	2/2	103	SEIBEL 867 (B)	2/3	151	VENTURA (B)	3/1	199	GEILWEILERHOF GA-48-12 (B)	3/3
8	JOANNES SEYVE 13733 (B)	1/2	56	ALWOOD (N)	2/3	104	SEIBEL 880 (B)	2/3	152	BERTILLE SEYVE 2846 (N)	3/2	200	GEILWEILERHOF GA-50-34 (B)	3/3
9	LUCIE KUHLMANN (N)	1/2	57	AMBER (B)	2/3	105	SENIOR (B)	2/3	153	CHELOIS (N)	3/2	201	GEILWEILERHOF GA-52-42 (B)	3/3
10	NAUMBURG 5028-670 (N)	1/2	58	ASPIGNAN 2 (N)	2/3	106	SEYVE VILLARD 12-327 (N)	2/3	154	FESTIVALNYI (RS)	3/2	202	GEILWEILERHOF KOE.48-43 (B)	3/3
11	SEYVE VILLARD 10-271 (N)	1/2	59	BERTILLE SEYVE 1372 (B)	2/3	107	SEYVE VILLARD 18-402 (N)	2/3	155	IONA (RG)	3/2	203	GEISENHEIM 322-58 (B)	3/3
12	SOVEREIGN NOIR (N)	1/2	60	BERTILLE SEYVE 3408 (N)	2/3	108	SEYVE VILLARD 5-247 (N)	2/3	156	JACQUEZ (N)	3/2	204	HANOVER (N)	3/3
13	VINELAND 68021 (RG)	1/2	61	BERTILLE SEYVE 3411 (N)	2/3	109	SEYVE VILLARD 6-276 (B)	2/3	157	LANDOT EXCELSIOR (B)	3/2	205	HECTOR (RS)	3/3
14	BERTILLE SEYVE 1808 (N)	1/3	62	BETA (N)	2/3	110	SKORENSKI ROZOVYJ (RG)	2/3	158	PHOENIX (B)	3/2	206	JOANNES SEYVE 16150 (B)	3/3
15	BON LAURENT (N)	1/3	63	BLANC DU BOIS (B)	2/3	111	SOVEREIGN CHARTER (N)	2/3	159	PIFOS (B)	3/2	207	JOANNES SEYVE 26790 (B)	3/3
16	DIANA (RG)	1/3	64	BLUESTAR (N)	2/3	112	SOVEREIGN CONCORDIA (N)	2/3	160	REGENT (N)	3/2	208	JOANNES SEYVE 31392 (N)	3/3
17	FREIBURG 54-64 (N)	1/3	65	BURDIN 4655 (N)	2/3	113	SOVEREIGN JADE (B)	2/3	161	ROSELA (RG)	3/2	209	KOZMA CSFT 159 (B)	3/3
18	MILLARDET (N)	1/3	66	CADAMON 1 (N)	2/3	114	SOVEREIGN JUBILEE (B)	2/3	162	ROUCANEUF (RS)	3/2	210	KOZMA CSFT 195 (B)	3/3
19	NAUMBURG 5004-51 (N)	1/3	67	CAMPBELL EARLY (N)	2/3	115	SOVEREIGN ROUGE (RG)	2/3	163	SIEGFRIEDREBE (B)	3/2	211	KRISZTALY (B)	3/3
20	NEW YORK 43096 (B)	1/3	68	CANADA MUSCAT (B)	2/3	116	VERGENNES (RG)	2/3	164	SKORENSKI TCHERNYJ (N)	3/2	212	LADY PATRICIA (B)	3/3
21	NORWOOD (N)	1/3	69	CATAWBA (RG)	2/3	117	VINELAND 50201 (B)	2/3	165	STEPNYAK (B)	3/2	213	LAKHEGYI MEZES (B)	3/3
22	OBERLIN 705 (N)	1/3	70	CHAMPANEL (N)	2/3	118	VINELAND 64032 (B)	2/3	166	TIRAS (B)	3/2	214	LANDAL (N)	3/3
23	OTHELLO (N)	1/3	71	COLOBEL (N)	2/3	119	VINELAND 68041 (N)	2/3	167	VILLARD BLANC (B)	3/2	215	LANDOT 5400 (B)	3/3
24	ROSE QUEEN (RS)	1/3	72	COOK (N)	2/3	120	VINELAND 71141 (B)	2/3	168	ZVEZDNYJ (N)	3/2	216	LANKA (B)	3/3
25	SEIBEL 11342 (G)	1/3	73	COUDERC 198-21 (N)	2/3	121	VIORIKA (B)	2/3	169	AMBROR (B)	3/3	217	LUMINICA (N)	3/3
26	SEINOIR (N)	1/3	74	COUDERC 241-123 (N)	2/3	122	WATKINS (N)	2/3	170	ARIS (B)	3/3	218	MISSOURI RIESLING (B)	3/3
27	SEYVE VILLARD 39-639 (B)	1/3	75	COUDERC 71-60 (N)	2/3	123	BURDIN 4570 (N)	2/4	171	ARON (B)	3/3	219	MOLDOVA (N)	3/3
28	SOVEREIGN EMERALD (B)	1/3	76	COUDERC NOIR (N)	2/3	124	CANADICE (RG)	2/4	172	AUGUSTOVSKIJ (B)	3/3	220	MUSKAT DE YALOVEN (B)	3/3
29	SOVEREIGN PRINCESS (N)	1/3	77	FESTIVEE (N)	2/3	125	DOINA (N)	2/4	173	BATH (N)	3/3	221	NAPLES (RG)	3/3
30	SREMSKI KARLOVCI 77-10-69 (B)	1/3	78	FREDONIA (N)	2/3	126	GEILWEILERHOF A-60-3 (N)	2/4	174	BERTILLE SEYVE 2049 (N)	3/3	222	NERO (N)	3/3
31	VIDAL BLANC (B)	1/3	79	FREIBURG 8-62 (B)	2/3	127	GEILWEILERHOF VI.5861 (N)	2/4	175	BIANCA (B)	3/3	223	NEW YORK 33998 (N)	3/3
32	VINELAND 64035 (B)	1/3	80	GENERAL (N)	2/3	128	GOLDEN MUSCAT (B)	2/4	176	BURDIN 4077 (N)	3/3	224	NEZHNYI (B)	3/3
33	YUBILEI MOLDAVII (RG)	1/3	81	GLOIRE DE SEIBEL (B)	2/3	129	NAUMBURG 2-76-24 (N)	2/4	177	BURDIN 4716 (N)	3/3	225	OBERLIN 702 (N)	3/3
34	AURORE (B)	1/4	82	HIMROD (B)	2/3	130	NIAGARA (N)	2/4	178	CHANCELLOR (N)	3/3	226	ONITSKANSKI BELYI (B)	3/3
35	NEW YORK 34762 (N)	1/4	83	LJANA (B)	2/3	131	SEYVE VILLARD 26-166 (N)	2/4	179	COLMAR PRECOCE NOIR (N)	3/3	227	PAMYATI VERDEREVSKOGO (B)	3/3
36	VEEPORT (N)	1/4	84	MARECHAL FOCH (N)	2/3	132	SORISIL (N)	2/4	180	COMMANDANT (N)	3/3	228	PERBOS 159 (B)	3/3
37	PONTIAC (N)	1/5	85	MARECHAL JOFFRE (N)	2/3	133	SOVEREIGN CORONATION (N)	2/4	181	CONTASSOT (N)	3/3	229	PERLE NOIRE (N)	3/3
38	SOVEREIGN ROYALE (N)	1/5	86	MARS (N)	2/3	134	SOVEREIGN JEWEL (B)	2/4	182	COUDERC 109-4 (N)	3/3	230	PLANTET (N)	3/3
39	ZARYA SEVERA (N)	1/5	87	MCDONALD BLUE (RG)	2/3	135	SOVEREIGN OPAL (B)	2/4	183	CROTON (B)	3/3	231	PRICE (N)	3/3
40	AGAWAM (RG)	1/6	88	MEYNIEU 6 (B)	2/3	136	VANESSA (RS)	2/4	184	DEMETERA (N)	3/3	232	RAKISCH (RG)	3/3
41	ISABELLA (N)	1/6	89	MUSCADOULE (N)	2/3	137	VINELAND 64111 (B)	2/4	185	DR.JULIO (B)	3/3	233	RAVAT NOIR (N)	3/3
42	DATTIER PRECOCE DE SEIBEL (B)	2/1	90	MUSCAT DE ST. CHRISTOL (B)	2/3	138	BACO NOIR (N)	2/5	186	DR.SEABRA (B)	3/3	234	RAYON D'OR (B)	3/3
43	ASPIGNAN 1 (N)	2/2	91	NEW YORK 12128 (RG)	2/3	139	BERTILLE SEYVE 1353 (B)	2/5	187	DUC PETIT (N)	3/3	235	RITON (B)	3/3
44	BEYER 2 (B)	2/2	92	OBERLIN 716 (N)	2/3	140	DELAWARE (RG)	2/5	188	DUTCHESS (B)	3/3	236	ROUGEON (N)	3/3
45	CADAMON 2 (RG)	2/2	93	OBERLIN NOIR (N)	2/3	141	FREIBURG 423-51 (N)	2/5	189	ETOILE I (N)	3/3	237	RUBILANDE (RS)	3/3
46	FREIBURG 52-64 (B)	2/2	94	PERBOS 82 (N)	2/3	142	ILLINOIS 172-3 (B)	2/5	190	EXCELSIOR (B)	3/3	238	RUBIN TAIROVSKII (N)	3/3
47	JOANNES SEYVE 23416 (N)	2/2	95	PICADOUL NOIR (N)	2/3	143	KOZMA CSFT 194 (B)	2/5	191	FLAKERA (N)	3/3	239	RULIK (B)	3/3
48	MERBEIN 46-32 (B)	2/2	96	PINARD (N)	2/3	144	NEW YORK 34824 (N)	2/5	192	FLOT D'OR (B)	3/3	240	RUSSKII KONKORD (N)	3/3

Table 2 (continued)

No.	VARIETY	B/L	No.	VARIETY	B/L	No.	VARIETY	B/L	No.	VARIETY	B/L	No.	VARIETY	B/L
241	SEIBEL 10790 (RS)	3/3	288	VINELAND 65163 (RG)	3/4	335	FREIBURG 868-59 (RG)	4/2	382	ALDEN (N)	5/3	429	OVIDIOPOLSKII (B)	5/8
242	SEYVE VILLARD 12-303 (B)	3/3	289	YUBILEI 70 (B)	3/4	336	TERRAS 20 (N)	4/2	383	BURDIN 7696 (B)	5/3	430	VINERED (RG)	5/8
243	SEYVE VILLARD 12-347 (N)	3/3	290	ALBANIA (B)	3/5	337	KOZMA CSFT 92 (B)	4/3	384	GALJA (B)	5/3	431	VINEHEVYI RANNII (N)	5/9
244	SEYVE VILLARD 12-401 (N)	3/3	291	BLACK EAGLE (N)	3/5	338	FLORENTAL (N)	4/3	385	GEILWEILERHOF B-2-11 (B)	5/3	432	GEILWEILERHOF 67-457-1 (N)	6/4
245	SEYVE VILLARD 15-151 (B)	3/3	292	BURDIN 1585 (B)	3/5	339	GEILWEILERHOF GA-58-14 (B)	4/3	386	GEILWEILERHOF C-96-37 (B)	5/3	433	BURDIN 1580 (B)	6/5
246	SEYVE VILLARD 19-410 (N)	3/3	293	BURDIN 4555 (B)	3/5	340	KUTUZOVSKII (N)	4/3	387	GEILWEILERHOF C-97-38 (B)	5/3	434	BURDIN 4672 (B)	6/5
247	SEYVE VILLARD 28-86 (N)	3/3	294	BURMUNK (B)	3/5	341	MUSCAT DE ST. VALLIER BLANC (B)	4/3	388	GEILWEILERHOF F.S.4-208-13 (N)	5/3	435	GAILLARD 194 (N)	6/5
248	SEYVE VILLARD 39-522 (N)	3/3	295	EMERALD (N)	3/5	342	ORIGINAL (RG)	4/3	389	GEILWEILERHOF SBL.5-24-20 (B)	5/3	436	FRUMOASA ALBE (B)	6/6
249	SIRIUS (B)	3/3	296	GEILWEILERHOF A-100-3 (B)	3/5	343	ORION (B)	4/3	390	LANDOT 1678 (N)	5/3	437	GEILWEILERHOF B-8-20 (B)	6/6
250	SOVEREIGN SUNGLO (B)	3/3	297	GEILWEILERHOF B-14-7 (N)	3/5	344	REFORM (B)	4/3	391	PLAJ (N)	5/3	438	RUSSKII RANNII (RG)	6/6
251	STRUGURASH (N)	3/3	298	GEILWEILERHOF B-8-8 (B)	3/5	345	SEIBEL 10076 (B)	4/3	392	SAINTON (B)	5/3	439	SEIBEL 78 (N)	6/6
252	SUFFOLK RED (RG)	3/3	299	GEILWEILERHOF F.S.4-206-36 (RS)	3/5	346	SEYVE VILLARD 12-390 (N)	4/3	393	SREMSKI KARLOVCI 77-5-3 (B)	5/3	440	VYDVIZHENETS (B)	6/6
253	SURPRIZ (B)	3/3	300	GLENORA (N)	3/5	347	SMUGLYANKA MOLDAVSKAYA (N)	4/3	394	ALB DE YALOVEN (B)	5/4	441	BREIDECKER (B)	6/7
254	TOTIMUR (B)	3/3	301	LAKEMONT SEEDLESS (B)	3/5	348	SOVEREIGN ROSE (RS)	4/3	395	ALICANTE GANZIN (N)	5/4	442	GEILWEILERHOF B-4-6 (N)	6/7
255	UROZHAINYI (B)	3/3	302	LANDOT 3474 (N)	3/5	349	VAROUSSET (N)	4/3	396	BELLANDAIS (N)	5/4	443	NASLADA (B)	6/7
256	VERTES CSILLAGA (B)	3/3	303	MANDL 28 (N)	3/5	350	ZALA GYOENGYE (B)	4/3	397	BRIGHTON (RG)	5/4	444	CVETOTSCHNYI (B)	6/8
257	VIERUL 59 (N)	3/3	304	NOAH (B)	3/5	351	BURDIN 6205 (N)	4/4	398	GEILWEILERHOF C-41-44 (B)	5/4	445	DATSCHNYJ (N)	6/8
258	VIGNOLES (B)	3/3	305	OBERLIN 605 (N)	3/5	352	CADILLON DORE (B)	4/4	399	RAVAT BLANC (B)	5/4	446	GEILWEILERHOF C-97-45 (B)	6/8
259	VIKTORIA 40 (RS)	3/3	306	PATE NOIR (N)	3/5	353	CHAMBOURCIN (N)	4/4	400	BESSARABSKIJ MUSKATNYI (B)	5/5	447	MANDL 30 (N)	7/3
260	VILLARD NOIR (N)	3/3	307	ROSETTE (N)	3/5	354	FLOT ROUGE (N)	4/4	401	BRUNI 18 (B)	5/5	448	ATOKA (N)	7/5
261	VINELAND 67154 (B)	3/3	308	SEYVE VILLARD 46-147 (B)	3/5	355	NAUMBURG 5007-9 (N)	4/4	402	CADILLON TARDIF (B)	5/5	449	LEDNICE D 73 (B)	7/5
262	VINELAND 71121 (B)	3/3	309	SOVEREIGN GOLD (B)	3/5	356	NEGRU DE YALOVEN (N)	4/4	403	DUNKIRK (RG)	5/5	450	SEYVE VILLARD 12-364 (B)	7/5
263	BACO 1-24 (N)	3/4	310	TAYLOR (B)	3/5	357	NEW YORK 36806 (B)	4/4	404	FREIBURG 50-64 (B)	5/5	451	STARTOVYI (N)	7/5
264	BACO BLANC (B)	3/4	311	VALERIEN (B)	3/5	358	OBERLIN 812 (B)	4/4	405	GALIBERT COULONDRE 23-1 (N)	5/5	452	SUPER HAMBURG (N)	7/5
265	BERTILLE SEYVE 4825 (N)	3/4	312	VINELAND 64237 (N)	3/5	359	RAMI (B)	4/4	406	GEILWEILERHOF C-116-53 (B)	5/5	453	KISCHINEVSKJE ZORY (B)	7/6
266	BOKAY (B)	3/4	313	WAYNE (N)	3/5	360	SEIBEL 15051 (B)	4/4	407	KLOSTERNEUBURG 1358-1-42 (N)	5/5	454	SREMSKI KARLOVCI 78-3-52 (B)	7/6
267	BURDIN 5440 (N)	3/4	314	WESTFIELD (N)	3/5	361	STEUBEN (N)	4/4	408	ROMULUS (B)	5/5	455	STRASHENSKII (N)	7/6
268	CASTEL 19637 (N)	3/4	315	YATES (RG)	3/5	362	YORK MADEIRA (N)	4/4	409	SEYVE VILLARD 34-211 (B)	5/5	456	SUPUTINSKII BELYI (B)	7/6
269	CONCORD (N)	3/4	316	BEN HUR (N)	3/6	363	BANNER (RS)	4/5	410	BAILEY ALICANTE A (N)	5/6	457	TISSIER RAVAT (B)	7/6
270	DAITIER DE ST. VALLIER (B)	3/4	317	BURDIN 4503 (B)	3/6	364	BURDIN 5540 (N)	4/5	411	COLOREDO JARDIN (N)	5/6	458	ILLINOIS 316-3 (N)	7/7
271	DE CHAUNAC (N)	3/4	318	CASTOR (B)	3/6	365	EMON 9 (N)	4/5	412	FLORA (RG)	5/6	459	KUNBARAT (B)	7/7
272	DONA EMILIA (N)	3/4	319	CENTURY 1 (N)	3/6	366	GALIBERT COULONDRE 15-2 (B)	4/5	413	KANTEMIROVSKIJ (B)	5/6	460	POMPON D'OR (B)	7/7
273	DOURIUO (B)	3/4	320	FREIBURG 946-60 (B)	3/6	367	GEILWEILERHOF KOE-48-44 (B)	4/5	414	KOZMA CSVT 55 (N)	5/6	461	DUNAVSKI LAZUR (B)	7/8
274	FERDINAND DE LESSEPS (B)	3/4	321	INTERLAKEN SEEDLESS (B)	3/6	368	SEYVE VILLARD 61-393 (B)	4/5	415	MUSCAT BAILEY A (N)	5/6	462	SAPERAVI SEVERNYI (N)	7/8
275	GALIBERT TREBLANC (B)	3/4	322	LEON MILLOT (N)	3/6	369	VIVANT (B)	4/5	416	REMAILY SEEDLESS (B)	5/6	463	AUGUST GIANT (N)	7/9
276	GEILWEILERHOF A-89-10 (N)	3/4	323	OBERLIN 701 (N)	3/6	370	YUBIELEI ZHURAVLJA (RG)	4/5	417	VINELAND 63261 (B)	5/6	464	BURDIN 7419 (B)	7/9
277	STAUFER (B)	3/4	324	POLLUX (B)	3/6	371	KODRYANKA (N)	4/6	418	AMUR (N)	5/7	465	ZOLOTISTYI USTOICHIVYI (B)	7/9
278	LANDOT 2282 (N)	3/4	325	SENECA (B)	3/6	372	SEIBEL 1 (N)	4/6	419	BESSARABSKIJ TSCHORNYJ (N)	5/7	466	AMBER QUEEN (N)	8/5
279	MANDL 24 (N)	3/4	326	STOUT SEEDLESS (B)	3/6	373	SEYVE VILLARD 23-512 (B)	4/6	420	FREIBURG 459-51 (N)	5/7	467	ARMALAGA (B)	8/5
280	MERBEIN 26-10 (B)	3/4	327	VEEBLANC (B)	3/6	374	SHERIDAN (N)	4/6	421	KUNLEANY (B)	5/7	468	BURDIN 6664 (B)	8/8
281	NEW YORK 36095 (B)	3/4	328	GOFF (N)	3/7	375	SUZI (B)	4/6	422	PAMYATI NEGRULYA (N)	5/7	469	CHAMBERTIN 1391 (N)	8/8
282	OBERLIN 604 (N)	3/4	329	NEW YORK 17452 (RG)	3/7	376	COURNON (N)	4/7	423	VINCENT (N)	5/7	470	GOLUBOK (N)	8/9
283	FLAMENNYI (N)	3/4	330	SATURN (N)	3/7	377	DEKABRSKII (N)	4/7	424	VINELAND 64201 (B)	5/7	471	SREMSKI KARLOVCI 76-3-3 (B)	9/5
284	SEYVE VILLARD 1-72 (B)	3/4	331	SOVEREIGN TIARA (B)	3/7	378	FREIBURG 3925-1 (N)	4/8	425	ANTEI MAGARACHSKII (N)	5/8	472	AMBERONTE (N)	9/9
285	TELEGRAPH (N)	3/4	332	ESTELLAT (N)	3/8	379	HERBERT (N)	4/7	426	BRONX SEEDLESS (RS)	5/8	473	FIOLETOVYI RANNII (B)	9/9
286	VENUS (N)	3/4	333	VYNOSLIVYI (N)	3/8	380	KABERAM (N)	4/8	427	KARMRAYUT (N)	5/8	474	FREIBURG 63-64 (N)	9/9
287	VINELAND 64023 (B)	3/4	334	BLACK QUEEN (N)	4/2	381	MENDELEUM (N)	4/8	428	KLOSTERNEUBURG 1435-3-11 (N)	5/8	475	KLOSTERNEUBURG 1358-1-47 (N)	9/9

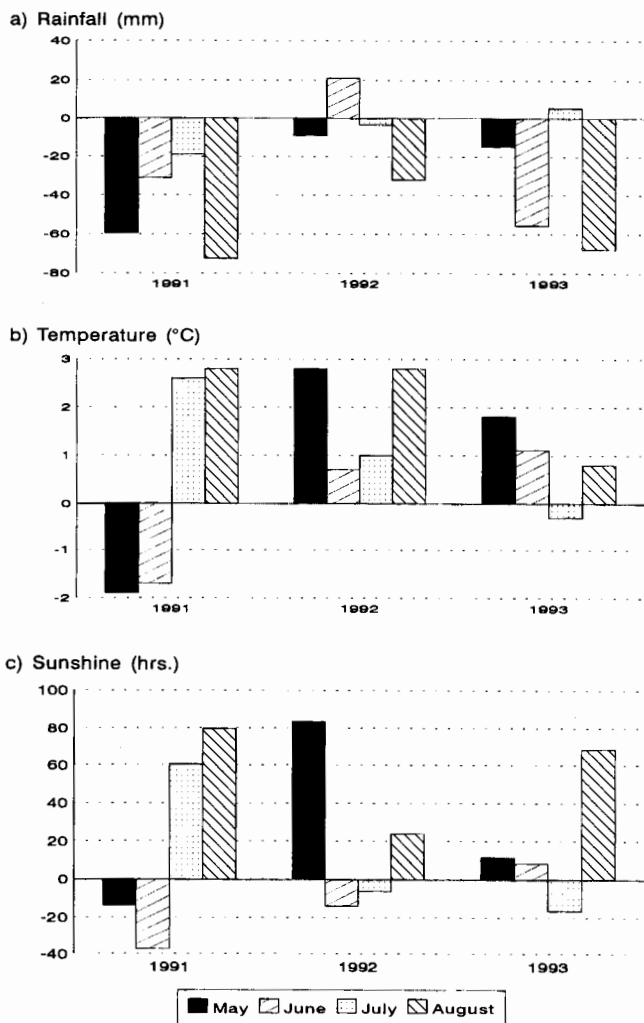


Figure: Climatic data 1991-1993 - deviations from long-term values (1951-80)

mental factors. Thus it may not correspond to the genetic degree of resistance of a genotype. Therefore, the results make it feasible to compare the degree of infection or resistance of the different cvs rather than simply determining the resistance characteristics of one cultivar.

The genotypes have been planted in a testing field at the Institute for Grapevine Breeding Geilweilerhof. This field has been stocked with so-called interspecific crossings exclusively. The field has never been treated with fungicides. The cv. names used here correspond to those by ALLEWELDT and DETTWEILER-MÜNCH (1992), who also provide further details on each cultivar. For comparison purposes the *V. vinifera* cvs Silvaner and Müller-Thurgau were also cultivated on a neighbouring field without any plant protection treatment and their degrees of infection were ascertained.

In comparison to the long-term mean, temperatures were higher, the amount of sunshine was up, and rainfall was down from May to August during the 3 years of study (Figure). The result was an above-average degree of oidium infection, providing a good situation for collecting data on resistance characteristics under natural infection conditions.

Results and discussion

Tab. 2 shows the mean values of degree of infection on leaves and berries for the 3-year period. The cvs are listed in sequence according to the degree of berry infection, the first showing the least amount of infection (listing of the cvs in alphabetical order: see Appendix). Within each level of berry infection the cvs are listed in order of leaf infection, again the first being the lowest. 41 (= 9 %) out of the 475 cvs tested showed no infection on the berries (Tab. 3) but cv. Dattier precoce de Seibel alone was free of oidium infection on the leaves. No cultivar did show any oidium infection on leaves and on berries during the whole period.

333 cvs (70 %) had a maximum rating of 3 on berry infection. Only 29 cvs showed a rating of ≥ 7 as a maximum for the 3 years, making them comparable to the *V. vinifera* cvs Silvaner and Müller-Thurgau. It was determined that the mean leaf infection was higher. For 256 cvs the maximum infection level was ≤ 3 , whereas 58 cvs had a maximum infection rating of ≥ 7 , which corresponds to the infection ratings of Silvaner and Müller-Thurgau. Similar research

Table 3

Total survey of grouping into oidium infection levels (n = 475 varieties) based on the maximum infection ratings during the years 1991 to 1993

Oidium - leaves	Oidium - berries									Total
	1	2	3	4	5	6	7	8	9	
1	-	1	1	-	-	-	-	-	-	2
2	13	13	17	3	-	-	-	-	-	46
3	20	67	94	14	12	-	1	-	-	208
4	3	15	27	12	6	1	-	-	-	64
5	3	8	26	8	10	3	5	2	1	66
6	2	4	12	5	8	5	5	-	-	41
7	-	-	4	4	7	3	3	-	-	21
8	-	1	2	2	6	3	2	2	-	18
9	-	-	-	-	1	-	3	1	4	9
Total	41	109	183	48	50	15	19	5	5	475

done in the field by BOUBALS (1961) includes 76 of the genotypes observed here. Although the ratings can not be compared directly due to different grouping methods, the relation between the genotypes is identical to a great degree. The degree of infection ascertained in this study is generally higher, which may be due to high oidium infection pressure.

The results for the cultivar spectrum tested show a large deviation for oidium infection reflecting the very wide genetic variation of the genotypes tested. Only a very small minority showed a degree of susceptibility similar to the *V. vinifera* cvs. The great majority was considerably less infected by oidium not only on the leaves but also on the berries.

For wine-grape cvs an infection level of 2 for berries or 3 for leaves ought to be tolerable. A total of 114 (24 %) of the genotypes tested show these or lower infection ratings. For breeding purposes there is thus a remarkably wide genetic basis for developing new cvs with sufficient oidium resistance. However no genotypes were found being completely free of infection. This should make it quite difficult to breed new cvs with absolute oidium resistance on the basis of this cultivar group.

A significant correlation ($r=0.54$ (1992) and $r=0.59$ (1993)) can be documented between infection of the leaves

and berries (Tab. 4). However, the coefficients of determination indicate that only between 29 % (1992) and 35 % (1993) of the variation in the berry infection can be explained by the variation in the leaf infection and vice versa. Even if only the maximum ratings are considered, the coefficient of determination is only slightly higher (0.37). The total summary (Tab. 3) points out that the variation in the leaf infection within one level of berry infection is, in some cases, considerable and may deviate as much as 8 rating levels. The situation is similar with regard to the variation in berry infection within one leaf infection level. BLAICH (1987) describes various resistance mechanisms against oidium. The fact that infection of berries and leaves may vary considerably for many genotypes might be due to the differing importance of certain defense mechanisms in the two organs. In view of early diagnosis procedures it is important from a breeding point of view that the degree of infection of the berries can't be inferred from the degree of infection of the leaves with a sufficient degree of certainty. *In vitro* resistance tests of leaf disks (DIEHL 1987) or intact plants can be a valuable screening method for determining the degree of leaf resistance. However, additional tests are required to determine berry resistance exactly.

Table 4

Correlation coefficients and coefficients of determination for oidium infection on leaves and berries

Year	Correlation coefficient r	Coefficient of determination r^2
1991	0,57	0,32
1992	0,54	0,29
1993	0,59	0,35
Maximum from 1991 - 1993	0,61	0,37

Literature

- ALLEWELDT, G.; DETTWEILER-MÜNCH, E.; 1992: The genetic resources of *Vitis*. Genetic and geographic origin of grape cultivars, their prime names and synonyms, 3rd edition. Institute for Grapevine Breeding Geilweilerhof, Siebeldingen, Germany.
- ANONYMOUS; 1983: Descriptor list for grapevine varieties and *Vitis* species. OIV, Paris.
- BLAICH, R.; 1987: Mechanismen der Pilzresistenz bei Reben. Vortr. Pflanzenzüchtung **13**, 109-118.
- BOUBALS, D.; 1961: Etude des causes de la résistance des Vitacées à l'Oidium de la vigne - *Uncinula necator* (SCHW.) BURR.- et de leur mode de transmission héréditaire. Ann. Amélior. Plant. **11**, 401-500.
- DELP, C. J.; 1954: Effect of temperature and humidity on the grape powdery mildew fungus. Phytopathology **44**, 615-626.
- DIEHL, H. J.; 1987: Untersuchungen zur Erbllichkeit von Resistenzeigenschaften bei Reben gegen *Oidium tuckeri*, *Plasmopara viticola* und *Botrytis cinerea*. Diss. Univ. Hohenheim.
- ; HEINTZ, C.; 1987: Studies on the generative reproduction of grapevine powdery mildew (*Uncinula necator*). Vitis **26**, 114-122.
- DOSTER, M.; SCHNATHORST, W.; 1985: Comparative susceptibility of various grapevine cultivars to the powdery mildew fungus on grapes. Amer. J. Enol. Viticult. **36**, 101-104.
- HEINTZ, C.; STEIN, U.; BLAICH, R.; 1985: Recherches sur la résistance de nouvelles variétés de vigne à l'Oidium. Progr. Agric. Vitic. **102**, 585-590.
- KLEMPKA, K. C.; MEREDITH, C. P.; SALL, M. A.; 1984: Dual culture of grape powdery mildew (*Uncinula necator* BURR) on its host (*Vitis vinifera* L.). Amer. J. Enol. Viticult. **35**, 170-174.
- PATIL, S. G.; HONRAO, B. K.; RAO, V. G.; PATIL, V. P.; 1990: Screening of grape (*Vitis* species) germplasm for resistance to three major fungal diseases. Indian J. Agricult. Sci. **60**, 836 - 838.
- ROY, R. R.; RAMMING, D. W.; 1990: Varietal resistance of grape to the powdery mildew fungus, *Uncinula necator*. Fruit Var. J. **44**, 149-155.
- SEEM, R. C.; GADOURS, D. M.; PEARSON, R. C.; 1990: Disease incidence-severity relationships in grape powdery mildew. Phytopathology **80**, 970.

Received March 21, 1994

Appendix

(see following pages)

Appendix

Listing of the cultivars studied. Berry colour: B= blanc (white); G = gris (grey); N = noir (black) ; RG = rouge (red);
RS = rosé (rose)

Current number as to Tab. 2 is indicated

AGAWAM (RG) = 40; ALB DE YALOVEN (B) = 394; ALBANIA (B) = 290; ALDEN (N) = 382; ALICANTE GANZIN (N) = 395; ALWOOD (N) = 56; AMBER (B) = 57; AMBER QUEEN (N) = 466; AMBERBONTE (N) = 472; AMBROR (B) = 169; AMUR (N) = 418; ANTEI MAGARACHSKII (N) = 425; ARIS (B) = 170; ARMALAGA (B) = 467; ARON (B) = 171; ASPIGNAN 1 (N) = 43; ASPIGNAN 2 (N) = 58; ATOKA (N) = 448; AUGUST GIANT (N) = 463; AUGUSTOVSKIJ (B) = 172; AURORE (B) = 34

BACO 1-24 (N) = 263; BACO BLANC (B) = 264; BACO NOIR (N) = 138; BAILEY ALICANTE A (N) = 410; BANNER (RS) = 363; BARRY (N) = 1; BATH (N) = 173; BELLANDAIS (N) = 396; BEN HUR (N) = 316; BERTILLE SEYVE 1353 (B) = 139; BERTILLE SEYVE 1372 (B) = 59; BERTILLE SEYVE 1808 (N) = 14; BERTILLE SEYVE 2049 (N) = 174; BERTILLE SEYVE 2846 (N) = 152; BERTILLE SEYVE 3408 (N) = 60; BERTILLE SEYVE 3411 (N) = 61; BERTILLE SEYVE 4825 (N) = 265; BESSARABSKIJ MUSKATNYI (B) = 400; BESSARABSKIJ TSCHORNYJ (N) = 419; BETA (N) = 62; BEYER 2 (B) = 44; BIANCA (B) = 175; BLACK EAGLE (N) = 291; BLACK QUEEN (N) = 334; BLANC DU BOIS (B) = 63; BLUESTAR (N) = 64; BOKAY (B) = 266; BON LAURENT (N) = 15; BON NOIR (N) = 2; BREIDECKER (B) = 441; BRIGHTON (RG) = 397; BRONX SEEDLESS (RS) = 426; BRUNI 18 (B) = 401; BURDIN 1580 (B) = 433; BURDIN 1585 (B) = 292; BURDIN 4077 (N) = 176; BURDIN 4503 (B) = 317; BURDIN 4555 (B) = 293; BURDIN 4570 (N) = 123; BURDIN 4655 (N) = 65; BURDIN 4672 (B) = 434; BURDIN 4716 (N) = 177; BURDIN 5406 (N) = 3; BURDIN 5440 (N) = 267; BURDIN 5540 (N) = 364; BURDIN 6205 (N) = 351; BURDIN 6664 (B) = 468; BURDIN 7419 (B) = 464; BURDIN 7696 (B) = 383; BURMUNK (B) = 294

CADAMON 1 (N) = 66; CADAMON 2 (RG) = 45; CADILLON DORE (B) = 352; CADILLON TARDIF (B) = 402; CAMPBELL EARLY (N) = 67; CANADA MUSCAT (B) = 68; CANADICE (RG) = 124; CASCADE (N) = 146; CASTEL 19637 (N) = 268; CASTEL 3917 (N) = 4; CASTOR (B) = 318; CATAWBA (RG) = 69; CAYUGA WHITE (B) = 5; CENTURY 1 (N) = 319; CHAMBERTIN 1391 (N) = 469; CHAMBOURCIN (N) = 353; CHAMPANEL (N) = 70; CHANCELLOR (N) = 178; CHELOIS (N) = 153; COLMAR PRECOCE NOIR (N) = 179; COLOBEL (N) = 71; COLOREDO JARDIN (N) = 411; COMMANDANT (N) = 180; CONCORD (N) = 269; CONTASSOT (N) = 181; COOK (N) = 72; COUDERC 109-4 (N) = 182; COUDERC 198-21 (N) = 73; COUDERC 241-123 (N) = 74; COUDERC 71-60 (N) = 75; COUDERC NOIR (N) = 76; COURNON (N) = 376; CROTON (B) = 183; CVETOTSCHNYI (B) = 444

DATSCHNYI (N) = 445; DATTIER DE ST. VALLIER (B) = 270; DATTIER PRECOCE DE SEIBEL (B) = 42; DE CHAUNAC (N) = 271; DEKABRSKII (N) = 377; DELAWARE (RG) = 140; DEMETERA (N) = 184; DIANA (RG) = 16; DNESTROVSKII ROZOVYI (RG) = 147; DOINA (N) = 125; DONA EMILIA (N) = 272; DOURIOU (B) = 273; DR.JULIO (B) = 185; DR.SEABRA (B) = 186; DUC PETIT (N) = 187; DUNAVSKI LAZUR (B) = 461; DUNKIRK (RG) = 403; DUTCHESS (B) = 188

ELVIRA (B) = 6; EMERALD (N) = 295; EMON 9 (N) = 365; ESTELLAT (N) = 332; ETOILE I (N) = 189; EXCELSIOR (B) = 190

FERDINAND DE LESSEPS (B) = 274; FESTIVALNYI (RS) = 154; FESTIVEE (N) = 77; FIOLETOVYI RANNII (B) = 473; FLAKERA (N) = 191; FLORA (RG) = 412; FLORENTAL (N) = 338; FLOT D'OR (B) = 192; FLOT ROUGE (N) = 354; FREDONIA (N) = 78; FREIBURG 3925-1 (N) = 378; FREIBURG 423-51 (N) = 141; FREIBURG 459-51 (N) = 420; FREIBURG 50-64 (B) = 404; FREIBURG 52-64 (B) = 46; FREIBURG 54-64 (N) = 17; FREIBURG 6147 (N) = 193; FREIBURG 63-64 (N) = 474; FREIBURG 8-62 (B) = 79; FREIBURG 868-59 (RG) = 335; FREIBURG 946-60 (B) = 320; FREIBURG 993-60 (B) = 194; FRUMOASA ALBE (B) = 436

GAILLARD 194 (N) = 435; GALIBERT COULONDRE 15-2 (B) = 366; GALIBERT COULONDRE 21-2 (N) = 195; GALIBERT COULONDRE 23-1 (N) = 405; GALIBERT TREBLANC (B) = 275; GALJA (B) = 384; GEILWEILERHOF 64-170-1 (B) = 196; GEILWEILERHOF 67-198-2 (B) = 197; GEILWEILERHOF 67-457-1 (N) = 432; GEILWEILERHOF A-100-3 (B) = 296; GEILWEILERHOF A-60-3 (N) = 126; GEILWEILERHOF A-89-10 (N) = 276; GEILWEILERHOF B-14-7 (N) = 297; GEILWEILERHOF B-2-11 (B) = 385; GEILWEILERHOF B-4-6 (N) = 442; GEILWEILERHOF B-8-20 (B) = 437; GEILWEILERHOF B-8-8 (B) = 298; GEILWEILERHOF C-116-53 (B) = 406;

GEILWEILERHOF C-41-44 (B) = 398; GEILWEILERHOF C-43-39 (B) = 198; GEILWEILERHOF C-96-37 (B) = 386; GEILWEILERHOF C-97-38 (B) = 387; GEILWEILERHOF C-97-45 (B) = 446; GEILWEILERHOF F.S.4-206-36 (RS) = 299; GEILWEILERHOF F.S.4-208-13 (N) = 388; GEILWEILERHOF GA-47-42 (B) = 7; GEILWEILERHOF GA-48-12 (B) = 199; GEILWEILERHOF GA-50-34 (B) = 200; GEILWEILERHOF GA-52-42 (B) = 201; GEILWEILERHOF GA-58-14 (B) = 339; GEILWEILERHOF KOE.48-43 (B) = 202; GEILWEILERHOF KOE.48-44 (B) = 367; GEILWEILERHOF SBL.5-24-20 (B) = 389; GEILWEILERHOF VI.5861 (N) = 127; GEISENHEIM 322-58 (B) = 203; GENERAL (N) = 80; GLENORA (N) = 300; GLOIRE DE SEIBEL (B) = 81; GOFF (N) = 328; GOLDEN MUSCAT (B) = 128; GOLUBOK (N) = 470

HANOVER (N) = 204; HECTOR (RS) = 205; HERBERT (N) = 379; HIMROD (B) = 82

ILLINOIS 172-3 (B) = 142; ILLINOIS 316-3 (N) = 458; INTERLAKEN SEEDLESS (B) = 321; IONA (RG) = 155; ISABELLA (N) = 41

JACQUEZ (N) = 156; JOANNES SEYVE 13733 (B) = 8; JOANNES SEYVE 16150 (B) = 206; JOANNES SEYVE 23416 (N) = 47; JOANNES SEYVE 26790 (B) = 207; JOANNES SEYVE 31392 (N) = 208

KABERAM (N) = 380; KANTEMIROVSKIJ (B) = 413; KARMRAYUT (N) = 427; KISCHINEVSKIJE ZORY (B) = 453; KLOSTERNEUBURG 1358-1-42 (N) = 407; KLOSTERNEUBURG 1358-1-47 (N) = 475; KLOSTERNEUBURG 1435-3-11 (N) = 428; KODRYANKA (N) = 371; KOZMA CSFT 159 (B) = 209; KOZMA CSFT 194 (B) = 143; KOZMA CSFT 195 (B) = 210; KOZMA CSFT 92 (B) = 337; KOZMA CSVT 55 (N) = 414; KRISZTALY (B) = 211; KUNBARAT (B) = 459; KUNLEANY (B) = 421; KUTUZOVSKII (N) = 340

LADY PATRICIA (B) = 212; LAKEMONT SEEDLESS (B) = 301; LAKHEGYI MEZES (B) = 213; LANDAL (N) = 214; LANDOT 1678 (N) = 390; LANDOT 2282 (N) = 278; LANDOT 3474 (N) = 302; LANDOT 5400 (B) = 215; LANDOT EXCELSIOR (B) = 157; LANKA (B) = 216; LEDNICE D 73 (B) = 449; LEON MILLOT (N) = 322; LJANA (B) = 83; LUCIE KUHLMANN (N) = 9; LUMINICA (N) = 217

MANDL 24 (N) = 279; MANDL 28 (N) = 303; MANDL 30 (N) = 447; MANDL 501 (RG) = 150; MARECHAL FOCH (N) = 84; MARECHAL JOFFRE (N) = 85; MARS (N) = 86; MCDONALD BLUE (RG) = 87; MENDELEUM (N) = 381; MERBEIN 26-10 (B) = 280; MERBEIN 46-32 (B) = 48; MEYNIEU 6 (B) = 88; MILLARDET (N) = 18; MISSOURI RIESLING (B) = 218; MOLDOVA (N) = 219; MUSCADOULE (N) = 89; MUSCAT BAILEY A (N) = 415; MUSCAT DE ST. CHRISTOL (B) = 90; MUSCAT DE ST. VALLIER BLANC (B) = 341; MUSKAT DE YALOVEN (B) = 220

NAPLES (RG) = 221; NASLADA (B) = 443; NAUMBURG 2-76-24 (N) = 129; NAUMBURG 5004-51 (N) = 19; NAUMBURG 5007-9 (N) = 355; NAUMBURG 5028-670 (N) = 10; NEGRU DE YALOVEN (N) = 356; NERO (N) = 222; NEW YORK 12128 (RG) = 91; NEW YORK 17452 (RG) = 329; NEW YORK 33998 (N) = 223; NEW YORK 34762 (N) = 35; NEW YORK 34824 (N) = 144; NEW YORK 36095 (B) = 281; NEW YORK 36661 (B) = 148; NEW YORK 36806 (B) = 357; NEW YORK 43096 (B) = 20; NEZHNYI (B) = 224; NIAGARA (N) = 130; NOAH (B) = 304; NORWOOD (N) = 21

OBERLIN 604 (N) = 282; OBERLIN 605 (N) = 305; OBERLIN 701 (N) = 323; OBERLIN 702 (N) = 225; OBERLIN 705 (N) = 22; OBERLIN 716 (N) = 92; OBERLIN 812 (B) = 358; OBERLIN NOIR (N) = 93; ONITSKANSKII BELYI (B) = 226; ORIGINAL (RG) = 342; ORION (B) = 343; OTHELLO (N) = 23; OVIDIOPOLSKII (B) = 429

PAMYATI NEGRULYA (N) = 422; PAMYATI VERDEREVSKOGO (B) = 227; PATE NOIR (N) = 306; PERBOS 159 (B) = 228; PERBOS 82 (N) = 94; PERLE NOIRE (N) = 229; PHOENIX (B) = 158; PICADOUL NOIR (N) = 95; PIFOS (B) = 159; PINARD (N) = 96; PLAJ (N) = 391; PLAMENNYI (N) = 283; PLANTET (N) = 230; POLLUX (B) = 324; POMPON D'OR (B) = 460; PONTIAC (N) = 37; POUGETTE MUSQUEE (B) = 97; PRICE (N) = 231

RAKISCH (RG) = 232; RAMI (B) = 359; RAVAT BLANC (B) = 399; RAVAT NOIR (N) = 233; RAYON D'OR (B) = 234; REFORM (B) = 344; REFREN; 145; REGENT (N) = 160; RELIANCE (N) = 98; REMAILY SEEDLESS (B) = 416; RITON (B) = 235; ROMULUS (B) = 408; ROSE QUEEN (RS) = 24; ROSELA (RG) = 161; ROSETTE (N) = 307; ROUCANEUF (RS) = 162; ROUGEON (N) = 236; RUBILANDE (RS) = 237; RUBIN TAIROVSKII (N) = 238; RULIK (B) = 239; RUSSKII KONKORD (N) = 240; RUSSKII RANNII (RG) = 438

SAINTON (B) = 392; SAPERAVI SEVERNYI (N) = 462; SATURN (N) = 330; SCHUYLER (N) = 99; SEIBEL 1

(N) = 372; SEIBEL 10076 (B) = 345; SEIBEL 10790 (RS) = 241; SEIBEL 11342 (G) = 25; SEIBEL 13666 (N) = 100; SEIBEL 15051 (B) = 360; SEIBEL 19881 (N) = 101; SEIBEL 5178 (B) = 102; SEIBEL 78 (N) = 439; SEIBEL 8116 (B) = 49; SEIBEL 8343 (B) = 50; SEIBEL 867 (B) = 103; SEIBEL 880 (B) = 104; SEINOIR (N) = 26; SENECA (B) = 325; SENIOR (B) = 105; SEYVAL (B) = 51; SEYVE VILLARD 1-72 (B) = 284; SEYVE VILLARD 10-271 (N) = 11; SEYVE VILLARD 12-303 (B) = 242; SEYVE VILLARD 12-327 (N) = 106; SEYVE VILLARD 12-347 (N) = 243; SEYVE VILLARD 12-364 (B) = 450; SEYVE VILLARD 12-390 (N) = 346; SEYVE VILLARD 12-401 (N) = 244; SEYVE VILLARD 12-481 (B) = 52; SEYVE VILLARD 15-151 (B) = 245; SEYVE VILLARD 18-402 (N) = 107; SEYVE VILLARD 18-515 (N) = 53; SEYVE VILLARD 19-410 (N) = 246; SEYVE VILLARD 23-512 (B) = 373; SEYVE VILLARD 26-166 (N) = 131; SEYVE VILLARD 28-86 (N) = 247; SEYVE VILLARD 3-54 (B) = 54; SEYVE VILLARD 34-211 (B) = 409; SEYVE VILLARD 39-522 (N) = 248; SEYVE VILLARD 39-639 (B) = 27; SEYVE VILLARD 46-147 (B) = 308; SEYVE VILLARD 5-247 (N) = 108; SEYVE VILLARD 6-276 (B) = 109; SEYVE VILLARD 61-393 (B) = 368; SHERIDAN (N) = 374; SIEGFRIEDREBE (B) = 163; SIRIUS (B) = 249; SKORENSKIJ ROZOVYJ (RG) = 110; SKORENSKIJ TCHERNYJ (N) = 164; SMUGLYANKA MOLDAVSKAYA (N) = 347; SORISIL (N) = 132; SOVEREIGN CHARTER (N) = 111; SOVEREIGN CONCORDIA (N) = 112; SOVEREIGN CORONATION (N) = 133; SOVEREIGN EMERALD (B) = 28; SOVEREIGN GOLD (B) = 309; SOVEREIGN JADE (B) = 113; SOVEREIGN JEWEL (B) = 134; SOVEREIGN JUBILEE (B) = 114; SOVEREIGN NOIR (N) = 12; SOVEREIGN OPAL (B) = 135; SOVEREIGN PRINCESS (N) = 29; SOVEREIGN ROSE (RS) = 348; SOVEREIGN ROUGE (RG) = 115; SOVEREIGN ROYALE (N) = 38; SOVEREIGN SUNGLO (B) = 250; SOVEREIGN TIARA (B) = 331; SREMSKI KARLOVCI 76-3-3 (B) = 471; SREMSKI KARLOVCI 77-10-69 (B) = 30; SREMSKI KARLOVCI 77-5-3 (B) = 393; SREMSKI KARLOVCI 78-3-52 (B) = 454; STARTOVYI (N) = 451; STAUFER (B) = 277; STEPNYAK (B) = 165; STEUBEN (N) = 361; STOUT SEEDLESS (B) = 326; STRASHENSKII (N) = 455; STRUGURASH (N) = 251; SUFFOLK RED (RG) = 252; SUPER HAMBURG (N) = 452; SUPUTINSKII BELYI (B) = 456; SURPRIZ (B) = 253; SUZI (B) = 375

TAYLOR (B) = 310; TELEGRAPH (N) = 285; TERRAS 20 (N) = 336; TIRAS (B) = 166; TISSIER RAVAT (B) = 457; TOTMUR (B) = 254

UNIVERS (B) = 55; UROZHAINYI (B) = 255

VALERIEN (B) = 311; VALIANT (N) = 149; VANESSA (RS) = 136; VAROUSSET (N) = 349; VEEBLANC (B) = 327; VEPORT (N) = 36; VENTURA (B) = 151; VENUS (N) = 286; VERGENNES (RG) = 116; VERTES CSILLAGA (B) = 256; VIDAL BLANC (B) = 31; VIERUL 59 (N) = 257; VIGNOLES (B) = 258; VIKTORIA 40 (RS) = 259; VILLARD BLANC (B) = 167; VILLARD NOIR (N) = 260; VINCENT (N) = 423; VINELAND 50201 (B) = 117; VINELAND 63261 (B) = 417; VINELAND 64023 (B) = 287; VINELAND 64032 (B) = 118; VINELAND 64035 (B) = 32; VINELAND 64111 (B) = 137; VINELAND 64201 (B) = 424; VINELAND 64237 (N) = 312; VINELAND 65163 (RG) = 288; VINELAND 67154 (B) = 261; VINELAND 68021 (RG) = 13; VINELAND 68041 (N) = 119; VINELAND 71121 (B) = 262; VINELAND 71141 (B) = 120; VINERED (RG) = 430; VIORIKA (B) = 121; VISHNEVYI RANNII (N) = 431; VIVANT (B) = 369; VYDVIZHENETS (B) = 440; VYNOSLIVYI (N) = 333

WATKINS (N) = 122; WAYNE (N) = 313; WESTFIELD (N) = 314

YATES (RG) = 315; YORK MADEIRA (N) = 362; YUBIELEI ZHURAVLJA (RG) = 370; YUBILEI 70 (B) = 289; YUBILEI MOLDAVII (RG) = 33

ZALA GYOENGYE (B) = 350; ZARYA SEVERA (N) = 39; ZOLOTISTYI USTOICHIVYI (B) = 465; ZVEZDNYI (N) = 168