Behavior of Vine Varieties Resistant to Fungal Diseases in the Somontano Region

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SUPPORTING INFORMATION

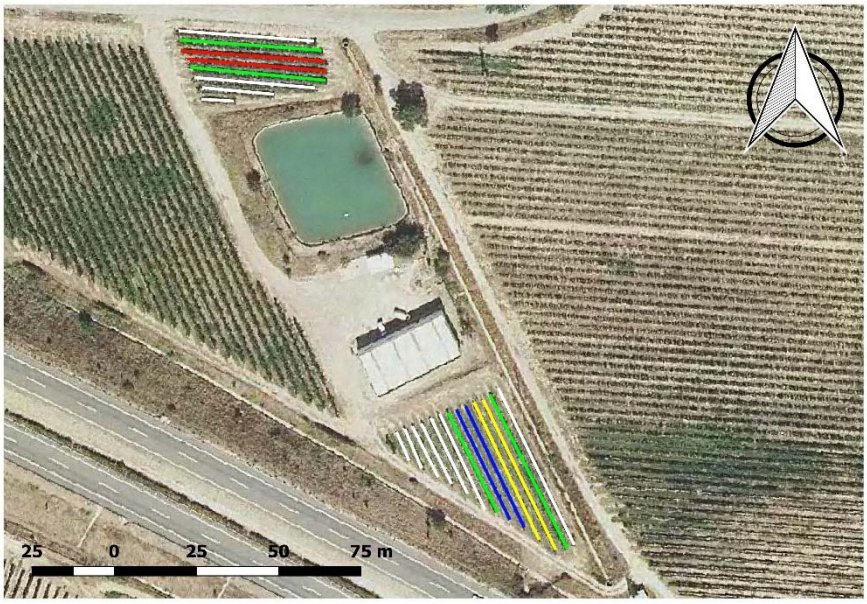

Figure S1. Distribution of the different grapevine varieties under study in the two adjacent plots (*top*: plot #1; *bottom*, plot #2). Sauvignon Kretos rows are colored in red, those of Souvignier gris in yellow, those of Muscaris in blue, those of the Sauvignon blanc control in green, and those of the treated Sauvignon blanc in white.

Table S1. Fertilization data.

Growing season	Date	Fertilizer	Dose (kg/ha)
2016	25/05/2016	N 32 (32% w/w)	37
	30/06/2016	4-2.5-9 N-P-K	77
	23/09/2016	16-8-0 N-P-K	95
2017	20/05/2017	7-3-12 N-P-K	144
	04/07/2017	9-4-12 N-P-K	155
	19/09/2017	15-1-5 N-P-K	53
2018	17/05/2018	5-3-12 N-P-K	72
	11/07/2018	2-0-12-1 N-P-K-Mg	143
	09/10/2018	15-1-5 N-P-K	192

Table S2. Treatments against fungal diseases

Growing season	Date	Active principle and dose
2016	11/05/2016	Myclobutanil 12.5%, 300 cm^3/ha
	31/05/2016	Bupirimate 25%, 400 cm^3/ha $Cu(OH)_2$ 25%, 1.8 kg/ha
	17/06/2016	Tebuconazole 25%, 600 cm^3/ha Metalaxyl 8%+mancozeb 64%, 2 kg/ha
	30/06/2016	Proquinazid 20%, 250 cm^3/ha
	13/07/2016	Proquinazid 20%, 250 cm^3/ha
2017	09/05/2017	Myclobutanil 12.5%, 300 cm^3/ha
	24/05/2017	Bupirimate 25%, 400 cm^3/ha $Cu(OH)_2$ 25%, 1.8 kg/ha
	28/06/2017	Tebuconazole 25%, 600 cm^3/ha Metalaxyl 8%+mancozeb 64%, 2 kg/ha
	07/07/2017	Proquinazid 20%, 250 cm^3/ha
2018	03/05/2018	Myclobutanil 12.5%, 300 cm^3/ha Mancozeb 80%, 2 kg/ha
	17/05/2018	Tebuconazole 25%, 600 cm^3/ha
	24/05/2018	Folpet 40%+metalaxyl 10%, 2 kg/ha Micronized sulfur 80%, 30 kg/ha
	08/06/2018	Metalaxyl 8%+mancozeb 64%, 2 kg/ha $NaHCO_3$ 99%, 6 kg/ha Bupirimate 25%, 400 cm^3/ha Proquinazid 20%, 250 cm^3/ha
	22/06/2018	Cymoxanil 45%, 16.2 kg/ha Micronized sulfur 80%, 30 kg/ha
	25/06/2018	Micronized sulfur 80%, 30 kg/ha
	09/07/2018	Metrafenone 50%, 0.2 L/ha $Cu(OH)_2$ 25%, 1.8 kg/ha Cymoxanil 45%, 16.2 kg/ha

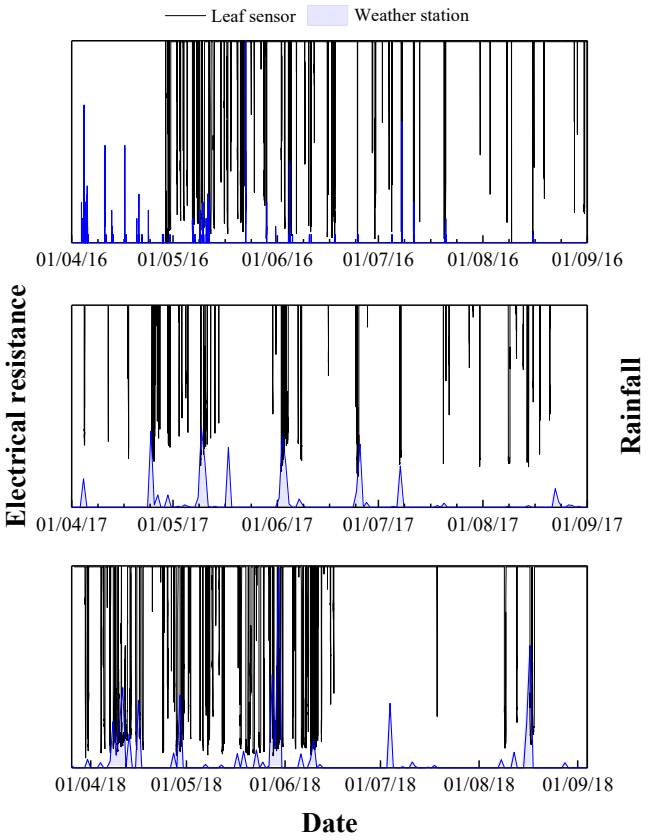

Figure S2. Electrical resistance measured by the leaf wetness sensors (left y-axis) and rainfall data from the weather station (right y-axis).

Table S3. Phenological data for the three growing seasons (2016-2018).

	Phenological growth state	Sauvignon Kretos	Souvigier gris	Muscaris	Sauvignon blanc
	5. “Wool stage”: brown wool clearly visible	23/03/2016	23/03/2016	23/03/2016	30/03/2016
	3. “Wool stage”: brown wool clearly visible	26/03/2017	31/03/2017	31/03/2017	31/03/2017
	B. Bourgeon dans le coton	16/03/2018	16/03/2018	16/03/2018	16/03/2018
	7. Beginning of bud burst: green shoot tips just visible	30/03/2016	30/03/2016	30/03/2016	08/04/2016
	5. Beginning of bud burst: green shoot tips just visible	31/03/2017	07/04/2017	07/04/2017	07/04/2017
	C. Pointe verte	06/04/2018	06/04/2018	29/03/2018	06/04/2018
	13. 3rd leaves unfolded	08/04/2016	14/04/2016	08/04/2016	14/04/2016
	09. 3rd leaves unfolded	07/04/2017	07/04/2017	07/04/2017	02/04/2017
	E. Développment des feuilles	13/04/2018	13/04/2018	13/04/2018	13/04/2018
	53. Inflorescences clearly visible	20/04/2016	20/04/2016	20/04/2016	27/04/2016
	12. Inflorescences clearly visible	12/04/2017	12/04/2017	07/04/2017	20/04/2017
	F. Grappes nettement visibles	20/04/2018	20/04/2018	20/04/2018	27/04/2018
	57. Inflorescences fully developed; flowers separating	27/04/2016	27/04/2016	27/04/2016	11/05/2016
	17. Inflorescences fully developed; flowers separating	04/05/2017	27/04/2017	27/04/2017	18/05/2017
	H. Boutons floraux séparés	27/04/2018	27/04/2018	27/04/2018	04/05/2018
	61. Beginning of flowering: 10% of flowerhoods fallen	25/05/2016	18/05/2016	18/05/2016	03/06/2016
	19. Beginning of flowering: 10% of flowerhoods fallen	25/05/2017	18/05/2017	18/05/2017	25/05/2017
	I1. Début floraison	01/06/2018	25/05/2018	25/05/2018	01/06/2018
	65. Full flowering: 50% of flowerhoods fallen	03/06/2016	25/05/2016	25/05/2016	08/06/2016
	23. Full flowering: 50% of flowerhoods fallen	02/06/2017	25/05/2017	25/05/2017	02/06/2017
	I2. Pleine fleur	04/06/2018	28/05/2018	28/05/2018	08/06/2018
	71. Fruit set: young fruits begin to swell, remains of flowers lost	14/06/2016	03/06/2016	03/06/2016	14/06/2016
	27. Fruit set: young fruits begin to swell, remains of flowers lost	09/06/2017	25/05/2017	25/05/2017	02/06/2017
	J. Nouaison	08/06/2018	01/06/2018	01/06/2018	15/06/2018
	75. Berries pea-sized, bunches hang	28/06/2016	14/06/2016	14/06/2016	23/06/2016
	31. Berries pea-sized, bunches hang	22/06/2017	02/06/2017	02/06/2017	09/06/2017
	K. Petit pois	23/06/2018	08/06/2018	08/06/2018	23/06/2018
	81. Beginning of ripening	03/08/2016	28/07/2016	28/07/2016	28/07/2016
	35. Beginning of ripening	27/07/2017	28/07/2017	20/07/2017	27/07/2017
	M1. Véraison	03/08/2018	26/07/2018	26/06/2018	10/08/2018
	85. Softening of berries	09/08/2016	03/08/2016	09/08/2016	09/08/2016
	36. Softening of berries	10/08/2017	04/08/2017	04/08/2017	27/07/2017
	M2. Véraison	16/08/2018	10/08/2018	10/08/2018	16/08/2018
	89. Berries ripe for harvest	29/08/2016	29/08/2016	29/08/2016	29/08/2016
	38. Berries ripe for harvest	17/08/2017	17/08/2017	10/08/2017	10/08/2017
	N. Récolte	23/08/2018	23/08/2018	16/08/2018	29/08/2018

Table S4. Ampelographical data for the three growing seasons (2016-2018).

OIV descriptor	2016				2017				2018			
	Sauvignon Kretos	Souvignier gris	Muscaris	Sauvignon blanc	Sauvignon Kretos	Souvignier gris	Muscaris	Sauvignon blanc	Sauvignon Kretos	Souvignier gris	Muscaris	Sauvignon blanc
1	5	5	5	5	7	7	7	5	5	5	5	5
4	1	1	1	3	1	3	3	3	1	1	1	3
16	1	1	1	1	1	1	1	1	1	1	1	1
51	1	1	3	2	3	1	3	2	3	1	3	2
53	3	3	3	5	1	3	1	5	1	3	1	5
65	5	4	3	3	5	4	5	3	5	4	5	3
67	4	4	4	3	4	3	5	3	4	3	5	3
72	1	1	1	2	1	2	2	2	1	2	2	2
75	5	5	5	5	5	5	3	5	5	5	3	5
81-2	1	1	1	1	1	1	1	1	1	1	1	1
84	1	3	1	5	1	3	1	5	1	3	1	5
87	1	3	1	5	1	3	1	5	1	3	1	5
151	3	3	3	3	3	3	3	3	3	3	3	3
202	5	3	5	5	5	3	5	5	5	3	5	5
203	3	3	3	3	3	3	3	3	3	3	3	3
204	5	5	5	7	5	5	5	7	5	5	5	7
208	2	1	1	1	2	1	1	1	2	1	1	1
209	2	2	2	1	2	2	2	1	2	2	2	1
220	3	3	3	3	3	3	3	3	3	3	3	3
221	3	3	3	3	3	3	3	3	3	3	3	3
223	2	2	2	2	2	2	2	2	2	2	2	2
225	1	2	1	1	1	2	1	1	1	2	1	1
241	3	3	3	3	3	3	3	3	3	3	3	3
301	5	5	5	7	5	5	5	7	5	5	5	7
302	5	5	5	5-7	5	5	5	3	5	5	5	5 – 7
304	5	5	5	5	5	5	5	5	5	5	5	5
452	9	9	9	9	9	9	9	9	9	9	9	9
453	9	9	9	9	9	9	9	9	9	9	9	9
453	9	9	9	7	9	9	9	7	9	9	9	9
455	9	9	9	9	9	9	9	9	9	9	9	9
456	9	9	9	5	9	9	9	5	9	9	9	5
456	9	9	9	5	9	9	9	5	9	9	9	9

458	9	9	9	9	9	9	9	9	9	9	9	5
459	9	9	9	9	9	9	9	9	1	1	1	*
459	9	9	9	5	9	9	9	5	1	3	3	3
502	1	1	1	*	1	1	1	*	7	9	9	5
503	1	3	3	3	1	3	3	3	5	5	3	3
505	7	9	9	5	7	9	9	5	5	5	5	5
506	5	5	3	3	5	5	3	3	9	9	9	9
508	5	5	5	5	5	5	5	5	9	9	9	5

Table S5. Kruskal-Wallis test and multiple pairwise comparisons using the Conover-Iman procedure for the different powdery mildew degrees of attack in leaves in growing season 2016.

K (Observed value)	8.724
K (Critical value)	12.592
DF	6
p-value (Two-tailed)	0.190
alpha	0.05

Sample	Frequency	Sum of ranks	Mean of ranks	Groups
S. Kretos	11	390.500	35.500	A
S. gris	11	390.500	35.500	A
Muscaris	11	390.500	35.500	A
Treatment 1	11	427.000	38.818	A
Treatment 2	11	430.000	39.091	A
Control 2	11	468.500	42.591	A
Control 1	11	506.000	46.000	A

Table S6. Kruskal-Wallis test and multiple pairwise comparisons using the Conover-Iman procedure for the different powdery mildew degrees of attack in clusters in growing season 2016.

K (Observed value)	36.120
K (Critical value)	12.592
DF	6
p-value (Two-tailed)	< 0.0001
alpha	0.05

Sample	Frequency	Sum of ranks	Mean of ranks	Groups		
S. Kretos	11	302.500	27.500	A		
S. gris	11	302.500	27.500	A		
Muscaris	11	302.500	27.500	A		
Control 2	11	367.500	33.409	A	B	
Treatment 1	11	522.000	47.455		B	C
Treatment 2	11	535.500	48.682		B	C
Control 1	11	670.500	60.955			C

Table S7. Kruskal-Wallis test and multiple pairwise comparisons using the Conover-Iman procedure for the different powdery mildew degrees of attack in leaves in growing season 2017.

K (Observed value)	33.609
K (Critical value)	12.592
DF	6
p-value (Two-tailed)	< 0.0001
alpha	0.05

Sample	Frequency	Sum of ranks	Mean of ranks	Groups		
S. Kretos	15	645.000	43.000	A		
S. gris	15	645.000	43.000	A		
Muscaris	15	645.000	43.000	A		
Treatment 2	15	700.500	46.700	A	B	
Treatment 1	15	817.000	54.467	A	B	C
Control 1	15	1001.000	66.733		B	C
Control 2	15	1111.500	74.100			C

Table S8. Kruskal-Wallis test and multiple pairwise comparisons using the Conover-Iman procedure for the different powdery mildew degrees of attack in clusters in growing season 2017.

K (Observed value)	18.591
K (Critical value)	12.592
DF	6
p-value (Two-tailed)	0.005
alpha	0.05

Sample	Frequency	Sum of ranks	Mean of ranks	Groups	
S. Kretos	15	690.000	46.000	A	
S. gris	15	690.000	46.000	A	
Muscaris	15	690.000	46.000	A	
Treatment 2	15	746.500	49.767	A	B
Treatment 1	15	846.500	56.433	A	B
Control 2	15	909.000	60.600		B
Control 1	15	993.000	66.200		B

Table S9. Kruskal-Wallis test and multiple pairwise comparisons using the Conover-Iman procedure for the different powdery mildew degrees of attack in clusters in growing season 2018.

K (Observed value)	11.619
K (Critical value)	12.592
DF	6
p-value (Two-tailed)	0.071
alpha	0.05

Sample	Frequency	Sum of ranks	Mean of ranks	Groups
S. gris	10	254.500	25.450	A
S. Kretos	10	292.500	29.250	A
Muscaris	10	296.000	29.600	A
Treatment 2	10	349.500	34.950	A
Treatment 1	10	366.500	36.650	A
Control 1	10	460.500	46.050	A
Control 2	10	465.500	46.550	A

Table S10. Kruskal-Wallis test and multiple pairwise comparisons using the Conover-Iman procedure for the different downy mildew degrees of attack in leaves in growing season 2016.

K (Observed value)	6.607
K (Critical value)	12.592
DF	6
p-value (Two-tailed)	0.359
alpha	0.05

Sample	Frequency	Sum of ranks	Mean of ranks	Groups
S. gris	11	359.000	32.636	A
S. Kretos	11	361.500	32.864	A
Muscaris	11	363.000	33.000	A
Control 1	11	460.000	41.818	A
Treatment 1	11	473.000	43.000	A
Control 2	11	483.500	43.955	A
Treatment 2	11	503.000	45.727	A

Table S11. Kruskal-Wallis test and multiple pairwise comparisons using the Conover-Iman procedure for the different downy mildew degrees of attack in clusters in growing season 2016.

K (Observed value)	29.569
K (Critical value)	12.592
DF	6
p-value (Two-tailed)	< 0,0001
alpha	0.05

Sample	Frequency	Sum of ranks	Mean of ranks	Groups	
S. Kretos	11	291.500	26.500	A	
S. gris	11	291.500	26.500	A	
Muscaris	11	291.500	26.500	A	
Treatment 2	11	441.500	40.136	A	B
Control 1	11	522.500	47.500		B
Treatment 1	11	582.000	52.909		B
Control 2	11	582.500	52.955		B

Table S12. Kruskal-Wallis test and multiple pairwise comparisons using the Conover-Iman procedure for the different downy mildew degrees of attack in leaves in growing season 2018.

K (Observed value)	4.980
K (Critical value)	12.592
DF	6
p-value (Two-tailed)	0.546
alpha	0.05

Sample	Frequency	Sum of ranks	Mean of ranks	Groups
Muscaris	10	284.000	28.400	A
S. gris	10	311.000	31.100	A
S. Kretos	10	312.000	31.200	A
Treatment 2	10	373.000	37.300	A
Treatment 1	10	386.000	38.600	A
Control 2	10	390.500	39.050	A
Control 1	10	428.500	42.850	A

Table S13. Kruskal-Wallis test and multiple pairwise comparisons using the Conover-Iman procedure for the different downy mildew degrees of attack in clusters in growing season 2018.

K (Observed value)	6.352
K (Critical value)	12.592
DF	6
p-value (Two-tailed)	0.385
alpha	0.05

Sample	Frequency	Sum of ranks	Mean of ranks	Groups
S. Kretos	10	271.500	27.150	A
Muscaris	10	298.000	29.800	A
Treatment 1	10	348.500	34.850	A
S. gris	10	358.000	35.800	A
Treatment 2	10	383.000	38.300	A
Control 1	10	409.000	40.900	A
Control 2	10	417.000	41.700	A

Table S14. Kruskal-Wallis test and multiple pairwise comparisons using the Conover-Iman procedure for the different Botrytis bunch rot degrees of attack in clusters in growing season 2016.

K (Observed value)	6.592
K (Critical value)	12.592
DF	6
p-value (Two-tailed)	0.360
alpha	0.05

Sample	Frequency	Sum of ranks	Mean of ranks	Groups
S. Kretos	11	385.000	35.000	A
S. gris	11	385.000	35.000	A
Muscaris	11	385.000	35.000	A
Treatment 1	11	460.000	41.818	A
Treatment 2	11	460.500	41.864	A
Control 2	11	463.000	42.091	A
Control 1	11	464.500	42.227	A

Table S15. Kruskal-Wallis test and multiple pairwise comparisons using the Conover-Iman procedure for the different Botrytis bunch rot degrees of attack in clusters in growing season 2017.

K (Observed value)	5.834
K (Critical value)	12.592
DF	6
p-value (Two-tailed)	0.442
alpha	0.05

Sample	Frequency	Sum of ranks	Mean of ranks	Groups
S. Kretos	15	750.000	50.000	A
S. gris	15	750.000	50.000	A
Muscaris	15	750.000	50.000	A
Treatment 1	15	802.500	53.500	A
Control 1	15	805.000	53.667	A
Control 2	15	853.500	56.900	A
Treatment 2	15	854.000	56.933	A

Table S16. PCA results. Eigenvalues (top) and correlations between variables and factors after Varimax rotation (bottom).

	F1	F2	F3
Eigenvalue	4.679	1.339	0.798
Variability (%)	58.487	16.742	9.978
Cumulative %	58.487	75.229	85.207

	D1	D2
Date	0.407	0.313
S. Kretos	0.216	**0.916**
S. gris	0.554	**0.712**
Muscaris	0.121	**0.912**
Control 1	**0.857**	0.372
Control 2	**0.889**	0.270
Treatment 1	**0.771**	0.105
Treatment 2	**0.921**	0.136