

Dynamics of bacterial blight disease in resistant and susceptible rice varieties [supplementary material]

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Online Resource 2: Variogram analysis to investigate spatial structure.

First, we test to see if there is a trend in the data. This may be because there is a large-scale fixed effect that is making one part of the field more susceptible to disease than another or because the scale of the secondary infection spread is large compared with the plot size. We assume that there is significant spatial trend if the p-value is less than 0.05.

Next we look at the magnitude of the spatial dependence quantified by the partial sill (C1) over the total sill value (Nugget + C1). The range tells us the distance over which there is spatial structure and so may help to quantify the range of the secondary spread.

The final two columns compare the AIC of the spatial model with the non-spatial model (AIC Nugget). If the AIC of the non-spatial model is smaller than the spatial there is no evidence that the data are more than randomly varying.

In the below we colour data with significant spatial trend in grey and those where there is no evidence of spatial dependence blue. The model fits were done using maximum likelihood to the whole data set not to the empirical variogram which uses a subset of the paired points.

Pila – Wet Season 2016

Table S1 Variogram analysis for the susceptible variety at Pila during Wet Season 2016

variable	p-value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.005	0.21	1.08	2692.89	2737.5
Observation 2	0.068	0.18	3.77	2913.97	3007.56
Observation 3	0.275	0.21	2.73	2851.26	2915.07
Observation 4	0.279	0.27	2.64	2779.23	2926.28
Observation 5	0.011	0.58	4.21	3999.56	4588.78
Observation 6	0.01	0.51	1.01	3123.48	3316.39

Table S2 Variogram analysis for the resistant variety at Pila during Wet Season 2016

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1**	1	1	0.21	-2039.01	-2033.77
Observation 2	0.007	0.12	0.92	746.24	757.67
Observation 3	0.078	0	0	1589.41	1585.41
Observation 4	0.087	0.05	3.34	842.54	854.4
Observation 5	0.826	0	0	1386.11	1382.11
Observation 6	0.314	0.07	7.24	1692.87	1731.74

** Note the range parameter is the length of the smallest observation suggesting that there is little evidence of spatial dependence.

Table S3 Model parameters with no spatial trend assumed for incidence data from Pila during Wet Season 2016

	Susceptible variety			Resistant variety		
	C1	Spatial dependence	Range	C1	Spatial dependence	Range
Observation 1	0.110	0.19	2.37	0.011	1.00	0.21
Observation 2	0.134	0.18	3.77	0.012	0.11	3.69
Observation 3	0.148	0.21	2.73	0.000	0.00	0.00
Observation 4	0.185	0.27	2.64	0.006	0.05	3.34
Observation 5	3.845	0.76	11.49	0.000	0.00	0.00
Observation 6	0.512	0.49	1.43	0.017	0.07	7.24

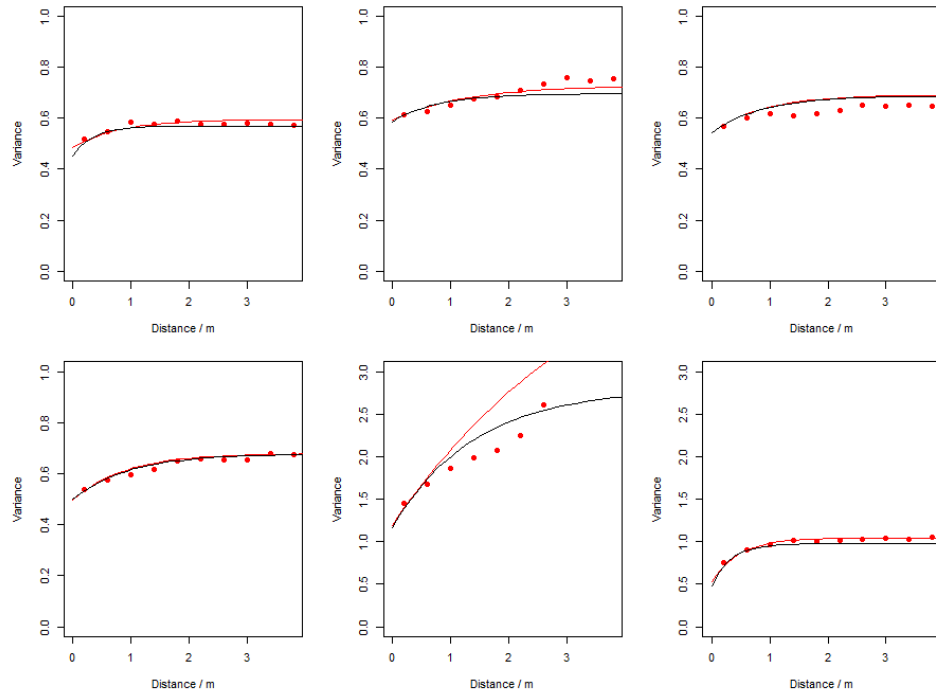


Fig. S19 Susceptible variety Pila Wet season 2016. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

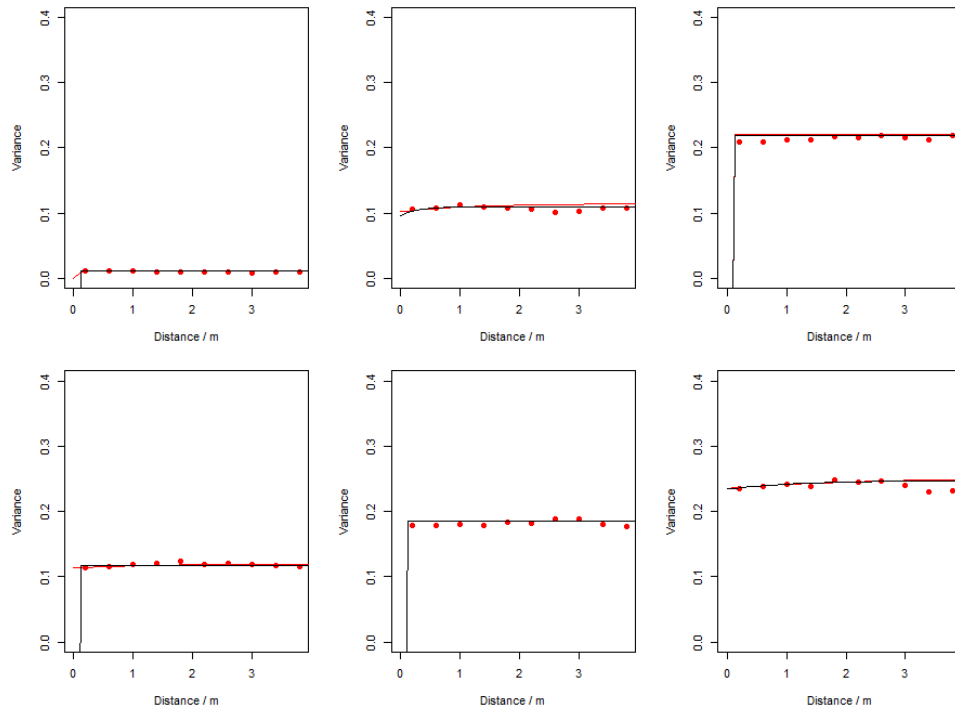


Fig. S20 Resistant variety Pila Wet season 2016. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

Victoria – Wet Season 2016

Table S4 Variogram analysis for the susceptible variety at Victoria during Wet Season 2016

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.08	0.02	2.37	442.76	441.39
Observation 2	0.053	0.5	5.71	2019.12	2366.16
Observation 3	0.001	0.42	0.83	1667.06	1770.46
Observation 4	0.001	0.54	0.67	2415.75	2532.84
Observation 5	0.064	0.28	2.22	2847.34	3013.69
Observation 6	0.119	0.32	1.28	2465.02	2586.43

Table S5 Variogram analysis for the resistant variety at Victoria during Wet Season 2016

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1**	0.103	0	0	-486.52	-490.52
Observation 2	0.18	0	0	279.52	275.52
Observation 3	1	0.08	0.95	1485.07	1489.92
Observation 4	0.195	0.05	2.39	1540.23	1547.28
Observation 5	0.296	0.11	3.77	2124.48	2171.58
Observation 6	0.15	0.05	13.29	555.51	566.98

** Note the range parameter is the length of the smallest observation suggesting that there is little evidence ... see picture too

Table S6 Model parameters with no spatial trend assumed

	Susceptible variety			Resistant variety		
	C1	Spatial dependence	Range	C1	Spatial dependence	Range
Observation 1	0.002	0.02	2.37	0.002	0.02	2.37
Observation 2	0.248	0.50	5.71	0.248	0.50	5.71
Observation 3	0.096	0.34	2.88	0.096	0.34	2.88
Observation 4	0.183	0.36	1.66	0.183	0.36	1.66
Observation 5	0.203	0.28	2.22	0.203	0.28	2.22
Observation 6	0.162	0.32	1.28	0.162	0.32	1.28

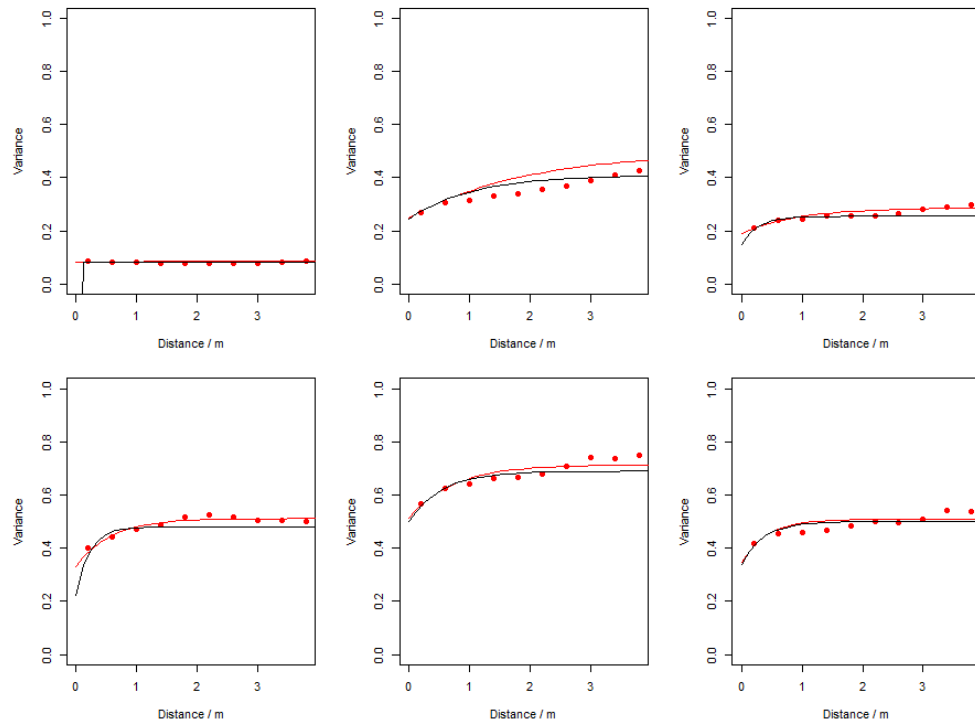


Fig. S21 Susceptible variety Victoria Wet season 2016. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

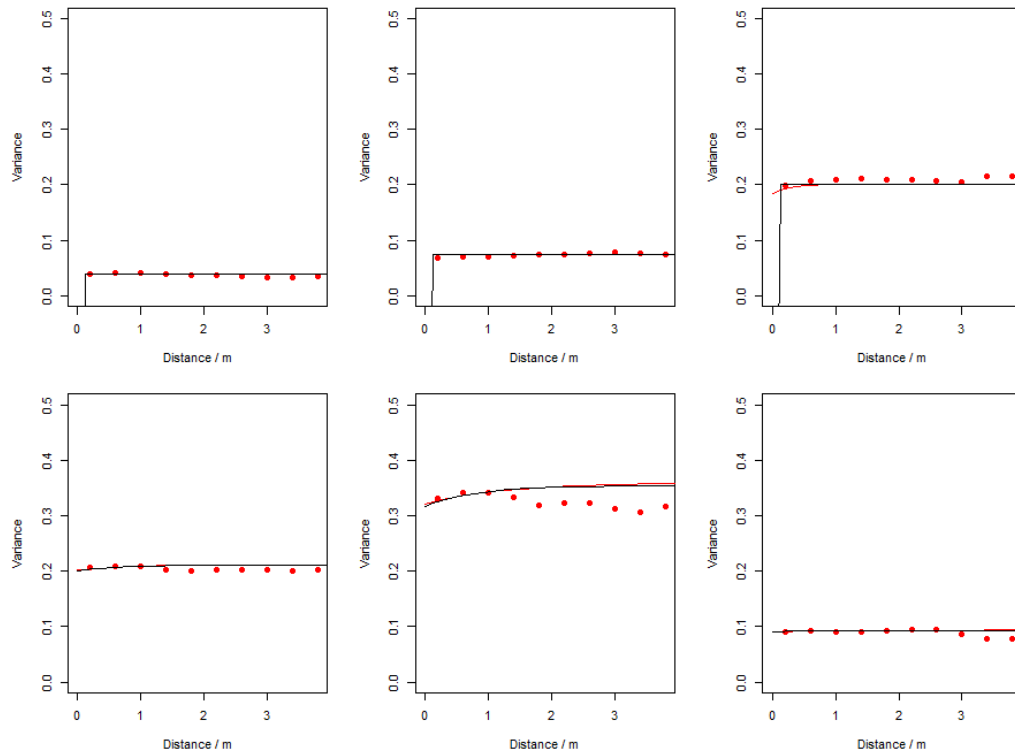


Fig. S22 Resistant variety Victoria Wet season 2016. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

Malayantoc – Wet Season 2016

Table S7 Variogram analysis for the susceptible variety at Malayantoc during Wet Season 2016

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.006	0.16	5.83	2587.96	2687.48
Observation 2	0.006	0.26	2.56	3393.15	3523.42
Observation 3	0.049	0.23	7	3647.14	3836.02
Observation 4	0.056	0.47	6.99	3990.13	4584.45
Observation 5	0.054	0.29	5.55	6389.05	6726.8
Observation 6	0.002	0.49	2.2	6574.01	6854.71
Observation 7	0.06	0.39	4.77	7025.6	7239.45
Observation 8	0.253	0.54	12.18	6421.87	6825.14

Table S8 Variogram analysis for the resistant variety at Malayantoc during Wet Season 2016

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.331	0.08	2.96	2504.62	2531.77
Observation 2	0.233	0.15	8.13	3065.87	3184.86
Observation 3	0.889	0.19	3.89	3216.45	3309.59
Observation 4	0.058	0.2	3.3	3016.07	3098.39
Observation 5	0.005	0.42	1.34	4164.65	4327.47
Observation 6	0	0.24	1.74	4043	4144.41
Observation 7	0.696	0.43	8.25	4650.11	5102.46
Observation 8	0.493	0.61	10.18	5275.2	5828.98

Table S9 Model parameters with no spatial trend assumed

	Susceptible variety			Resistant variety		
	C1	Spatial dependence	Range	C1	Spatial dependence	Range
Observation 1	0.388	0.45	29.86	0.331	0.08	2.96
Observation 2	0.506	0.37	7.09	0.233	0.15	8.13
Observation 3	0.762	0.41	16.42	0.889	0.19	3.89
Observation 4	1.207	0.47	6.99	0.058	0.2	3.3
Observation 5	4.295	0.29	5.55	0.005	0.42	1.34
Observation 6	15.089	0.59	4.69	0	0.24	1.74
Observation 7	11.941	0.39	4.77	0.696	0.43	8.25
Observation 8	18.482	0.54	12.18	0.493	0.61	10.18

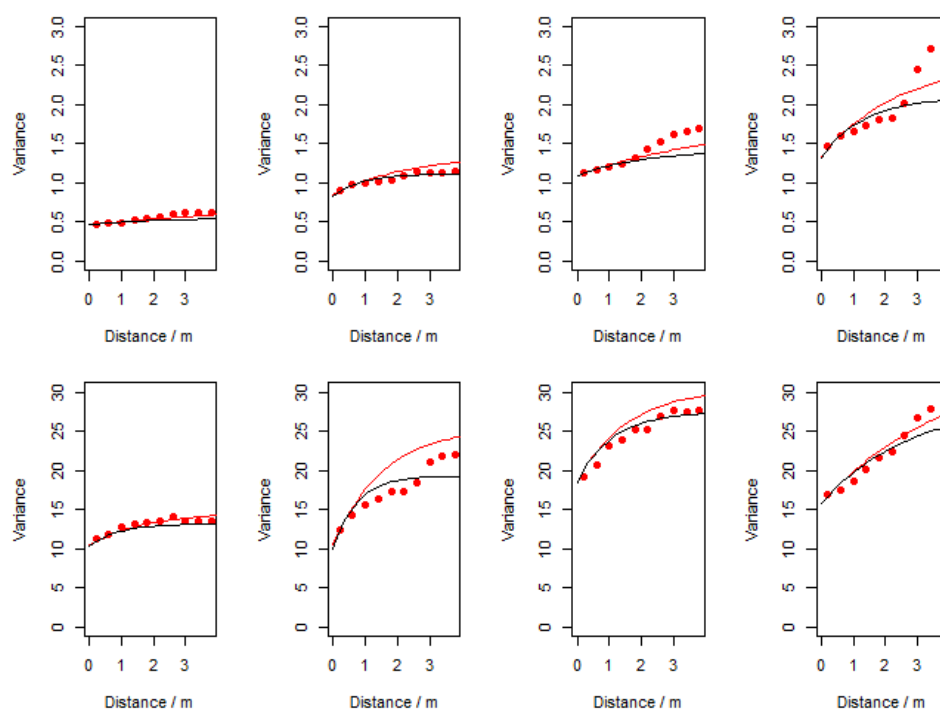


Fig. S23 Susceptible variety Malayantoc Wet season 2016. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

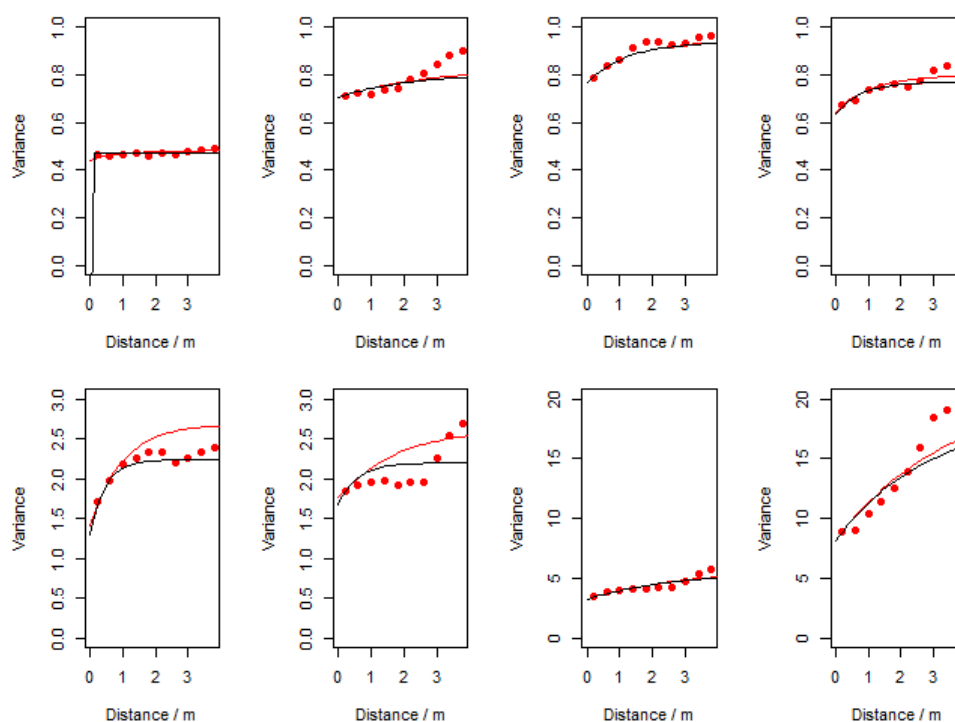


Fig. S24 Resistant variety Malayantoc Wet season 2016. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

Maligaya– Wet Season 2016

Table S10 Variogram analysis for the susceptible variety at Maligaya during Wet Season 2016

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.462	0.23	3.02	3123.46	3244.2
Observation 2	0.001	0.93	0.32	3174.5	3218.85
Observation 3	0.003	0.15	1.63	3112.04	3154.55
Observation 4	0.028	0.19	3.21	3803.23	3890.16
Observation 5	0.313	0.16	2.85	4572.08	4645.85
Observation 6	0.001	0.34	1.33	4748.6	4849.42
Observation 7	0.526	0.46	4.3	5218.76	5692.28
Observation 8	0.701	0.44	2.63	5837.75	6071.57

Table S11 Variogram analysis for the resistance variety at Maligaya during Wet Season 2016

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.904	0.08	5.84	2126.6	2169.55
Observation 2	1	1	0.25	2577.01	2594.25
Observation 3	0.205	0.07	7.99	2473.8	2522.21
Observation 4	0.003	0.05	4.25	3107.41	3117.84
Observation 5	0.051	0.23	7.68	4187.03	4360.37
Observation 6	0.27	0.24	5.79	4842.41	5020.09
Observation 7	0	0.3	0.58	3709.71	3734.77
Observation 8	0.384	0.25	1.45	3871.9	3940.8

Table S12 Model parameters with no spatial trend assumed

	Susceptible variety			Resistant variety		
	C1	Spatial dependence	Range	C1	Spatial dependence	Range
Observation 1	0.199	0.23	3.02	0.030	0.08	5.84
Observation 2	0.330	0.38	0.66	0.507	1	0.25
Observation 3	0.179	0.2	5.08	0.033	0.07	7.99
Observation 4	0.631	0.33	10.79	0.231	0.24	25.45
Observation 5	0.450	0.16	2.85	0.514	0.23	7.68
Observation 6	1.611	0.38	4.06	0.941	0.24	5.79
Observation 7	3.059	0.46	4.3	0.328	0.21	1.62
Observation 8	6.175	0.44	2.63	0.490	0.25	1.45

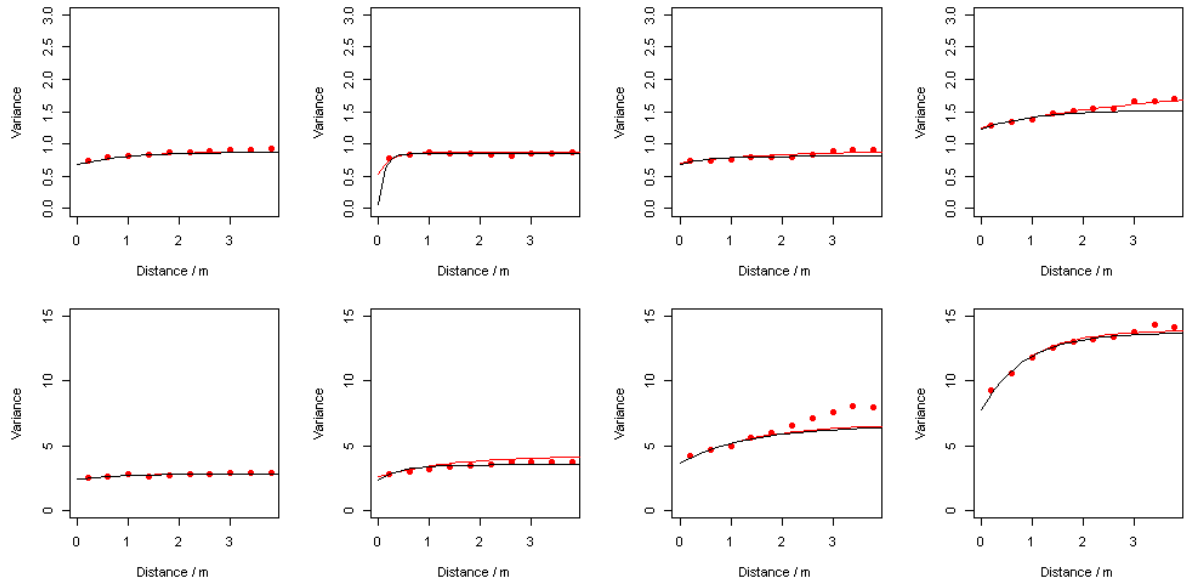


Fig. S25 Susceptible variety Maligaya Wet season 2016. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

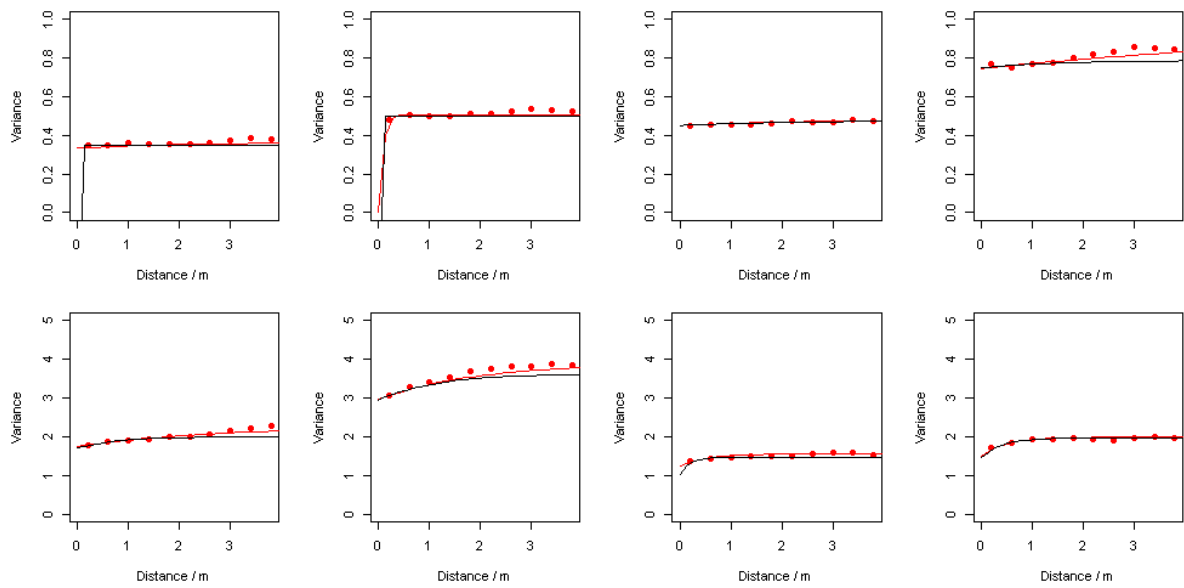


Fig. S26 Resistant variety Maligaya Wet season 2016. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

Malayantoc – Dry Season 2017

Table S13 Variogram analysis for the susceptible variety at Malayantoc during Dry Season 2017

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.437	0.27	4.2	4378.59	4537.69
Observation 2	0.016	0.23	5.1	4432.9	4520.59
Observation 3	0.061	0.2	8.09	4888.27	5063.53
Observation 4	0.036	0.12	4.31	4418.81	4475.89
Observation 5	0.693	0.12	2.47	4716.58	4753.78
Observation 6	0.281	0.19	3.25	5125.22	5208.99

Table S14 Variogram analysis for the resistant variety at Malayantoc during Dry Season 2017

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.026	0.09	6.34	4082.92	4131.75
Observation 2	0	0.11	0.89	4191.27	4199.59
Observation 3	0.522	0.28	9.65	4741.49	5003.51
Observation 4	0.587	0.31	2.61	4338.3	4549.7
Observation 5	0.071	0.78	28.83	4355.87	4901.21
Observation 6	0.356	0.2	7.29	4305.95	4465.14

Table S15 Model parameters with no spatial trend assumed

	Susceptible variety			Resistant variety		
	C1	Spatial dependence	Range	C1	Spatial dependence	Range
Observation 1	0.714	0.27	4.20	0.545	0.25	23.39
Observation 2	1.425	0.40	12.84	0.577	0.24	19.34
Observation 3	0.776	0.20	8.09	1.084	0.28	9.65
Observation 4	0.486	0.18	7.95	0.800	0.31	2.61
Observation 5	0.370	0.12	2.47	6.357	0.78	28.83
Observation 6	0.878	0.19	3.25	0.497	0.20	7.29

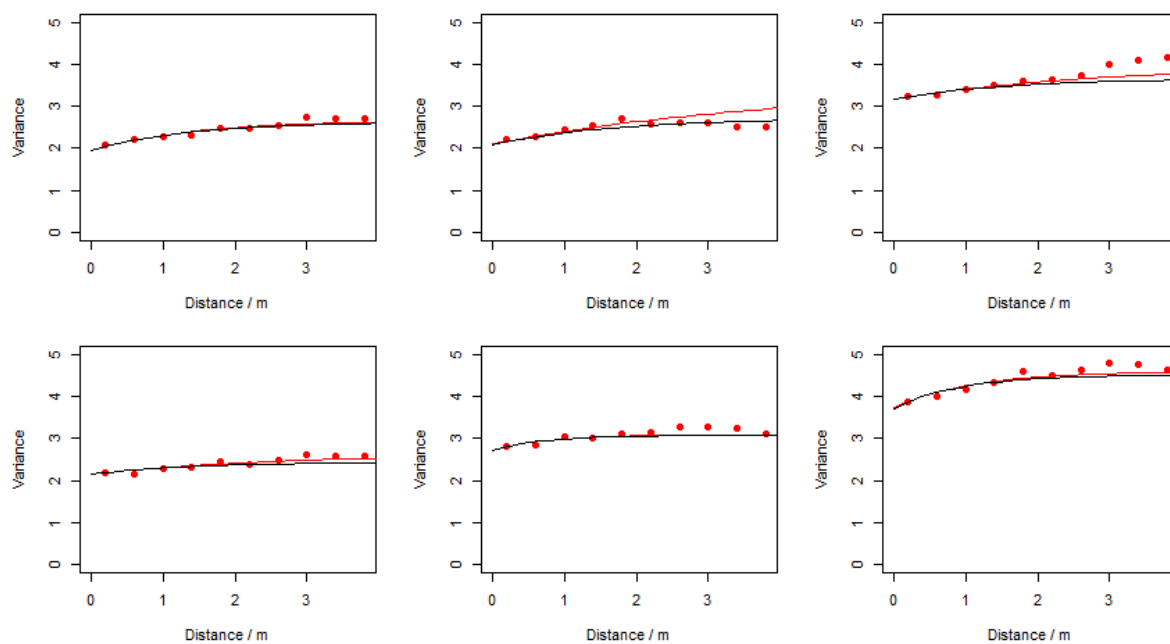


Fig. S27 Susceptible variety Malayantoc Dry season 2017. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

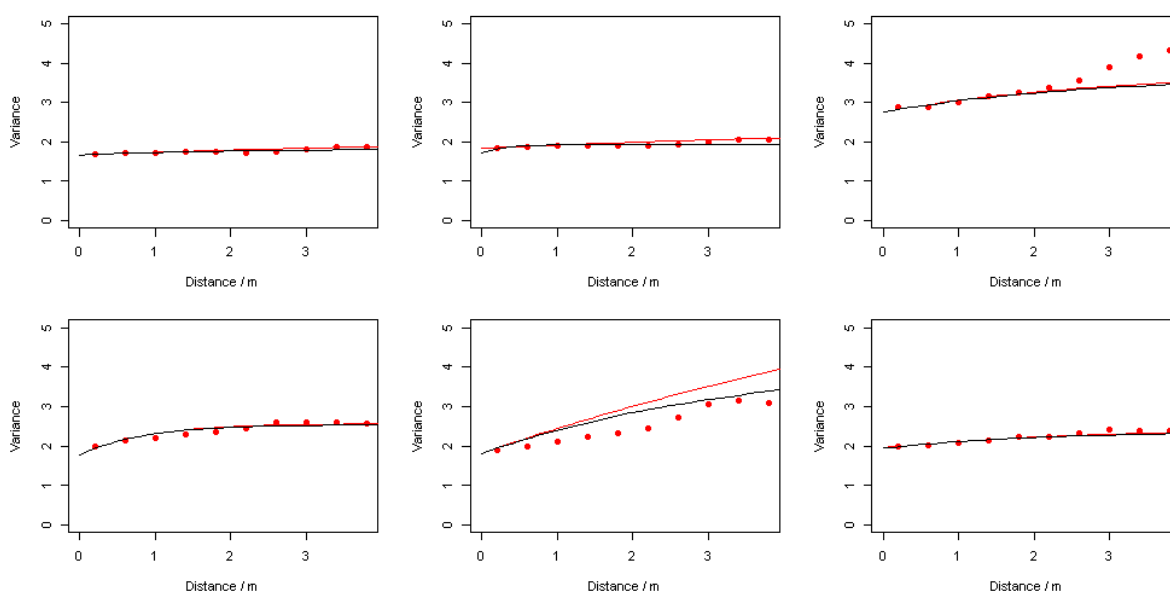


Fig. S28 Resistant variety Malayantoc Dry season 2017. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

Maligaya – Dry Season 2017

Table S16 Variogram analysis for the susceptible variety at Maligaya during Dry Season 2017

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.623	0.37	7.55	3551.99	4006.25
Observation 2	0.195	0.25	3.3	4065.99	4232.47
Observation 3	0.031	0.15	1.05	4192.58	4213.9
Observation 4	0.36	0.26	4.25	3447.6	3623.09
Observation 5	0.908	0.42	5.65	4611.8	4938.81
Observation 6	0.734	0.29	4.27	4715.22	4871.45

Table S17 Variogram analysis for the resistant variety at Maligaya during Dry Season 2017

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.185	0.18	5.64	2847.54	2986.84
Observation 2	0.118	0.26	4.17	3604.05	3787.52
Observation 3	0.063	0.24	6.21	3862.4	4027.77
Observation 4	0.214	0.16	3.59	3541.58	3630.21
Observation 5	0.865	0.36	9.32	4214.34	4519.5
Observation 6	0.884	0.26	6.27	3980.64	4132.66

Table S18 Model parameters with no spatial trend assumed

	Susceptible variety			Resistant variety		
	C1	Spatial dependence	Range	C1	Spatial dependence	Range
Observation 1	0.563	0.37	7.55	0.126	0.18	5.64
Observation 2	0.497	0.25	3.3	0.365	0.26	4.17
Observation 3	0.269	0.13	2.68	0.417	0.24	6.21
Observation 4	0.323	0.26	4.25	0.189	0.16	3.59
Observation 5	1.605	0.42	5.65	0.981	0.36	9.32
Observation 6	1.054	0.29	4.27	0.510	0.26	6.27

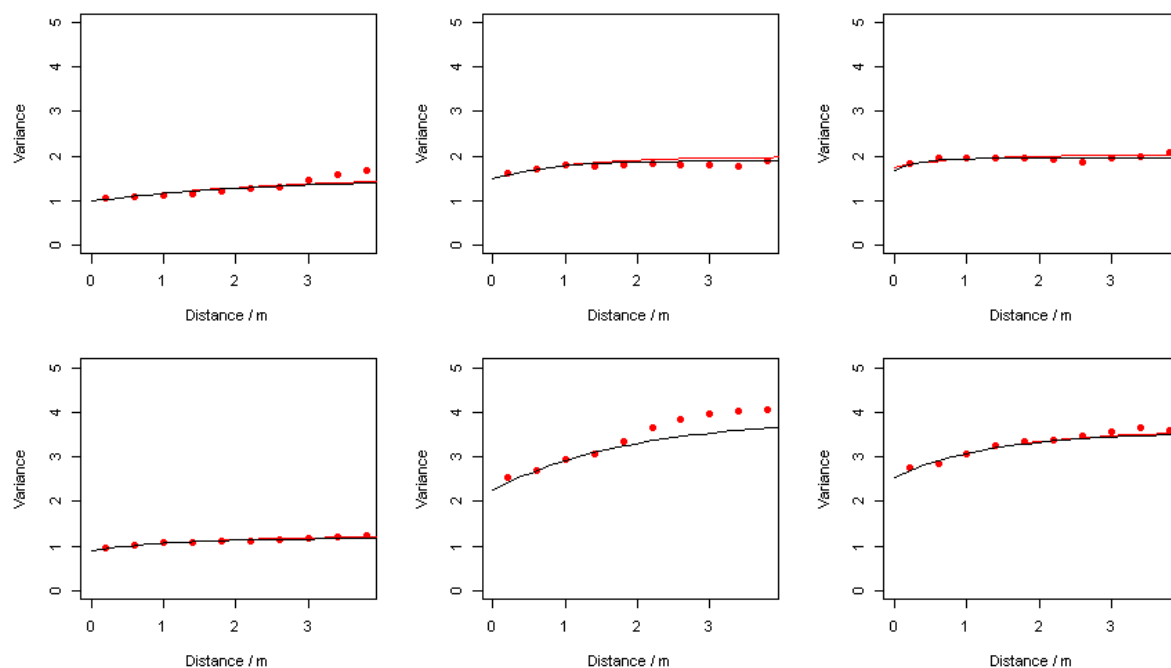


Fig. S29 Susceptible variety Maligaya Dry season 2017. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

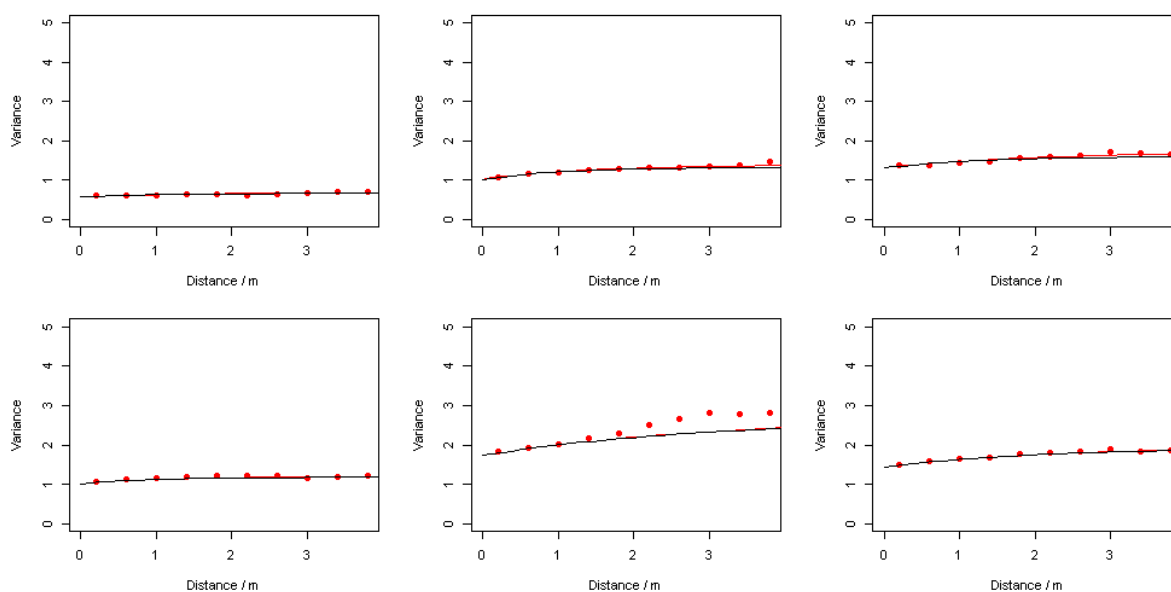


Fig. S30 Resistant variety Maligaya Dry season 2017. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

Pila – Wet Season 2017

Table S19 Variogram analysis for the susceptible variety at Pila during Wet Season 2017

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.157	0	0	409.27	405.27
Observation 2	0.033	0.09	2.91	1919.62	1936.77
Observation 3	0	0.15	1.15	3035.15	3061.12
Observation 4	0.202	0.4	3.84	2217.97	2527.65
Observation 5	0.089	0.39	1.44	2778	2918.61
Observation 6	0.166	0.23	4	2111.35	2263.1

Table S20 Variogram analysis for the resistant variety at Pila during Wet Season 2017

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.967	0.01	4.71	-935.73	-936.29
Observation 2	0.144	0	0	-152.2	-156.2
Observation 3	0.752	0.16	3.43	1632.95	1707.89
Observation 4	0.19	0.47	3.74	1936.74	2289.73
Observation 5	0.134	0.4	4.42	2233.94	2465.08
Observation 6	0.57	0.11	1.55	1704.43	1726.9

Table S21 Model parameters with no spatial trend assumed

	Susceptible variety			Resistant variety		
	C1	Spatial dependence	Range	C1	Spatial dependence	Range
Observation 1	0	0	0	0.0003	0.01	4.71
Observation 2	0.042	0.13	7.5	0	0	0
Observation 3	1.108	0.62	48.71	0.040	0.16	3.43
Observation 4	0.199	0.4	3.84	0.198	0.47	3.74
Observation 5	0.265	0.39	1.44	0.205	0.4	4.42
Observation 6	0.093	0.23	4	0.026	0.11	1.55

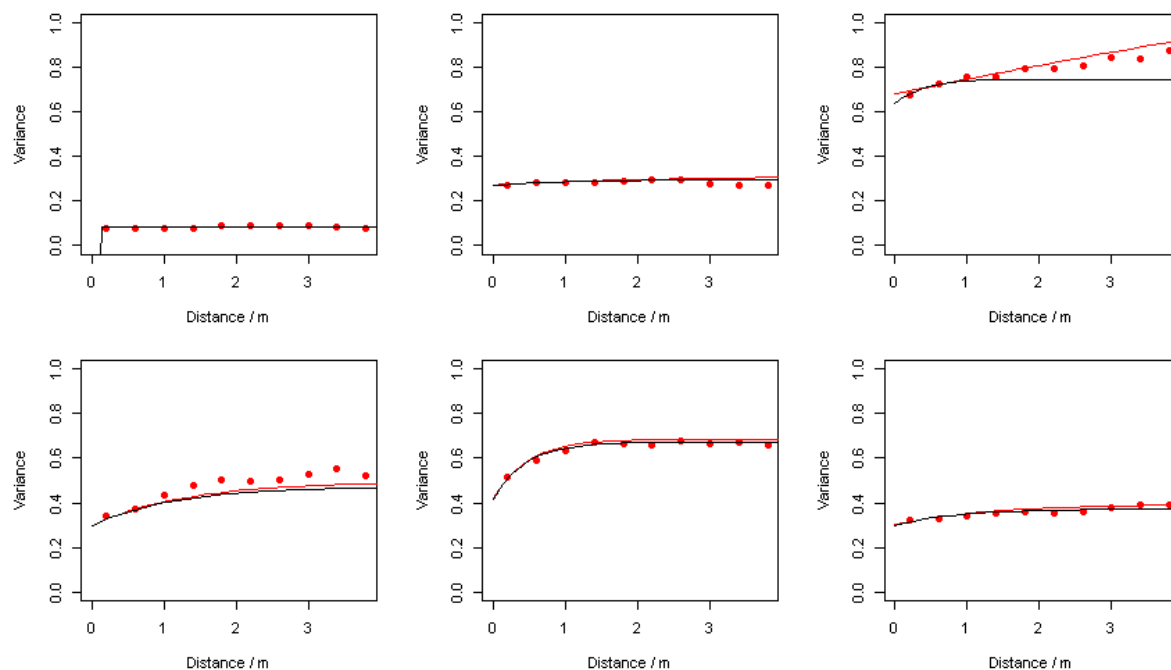


Fig. S31 Susceptible variety Pila wet season 2017. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

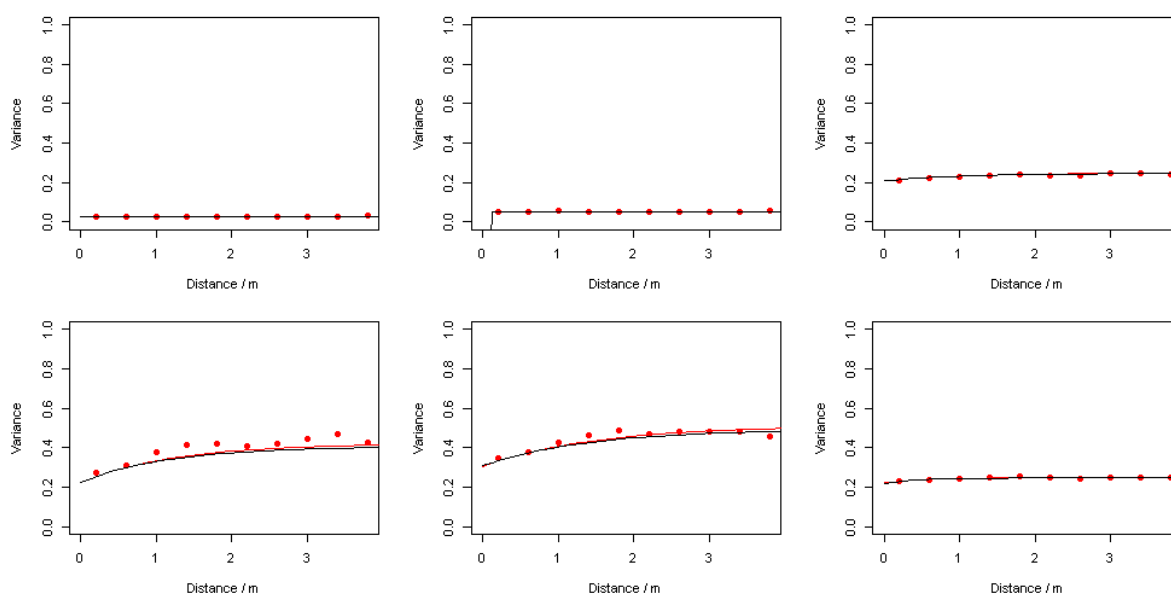


Fig. S32 Resistant variety Pila wet season 2017. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

Victoria – Wet Season 2017

Table S22 Variogram analysis for the susceptible variety at Victoria during Wet Season 2017

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.383	0	0	2576.71	2572.71
Observation 2	0.01	0.25	1.8	1550.72	1661.44
Observation 3	0.054	0.27	0.76	1851.63	1894.26
Observation 4	0.131	0.12	2.64	2354.58	2398.3
Observation 5	0.508	0.15	1.16	4575.9	4594.34
Observation 6	0.224	0.33	2.53	1917.05	2150.08

Table S23 Variogram analysis for the resistant variety at Victoria during Wet Season 2017

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.942	0	0	-238.84	-242.84
Observation 2	1	0.08	1.18	676.18	685.7
Observation 3	0.581	0.2	0.86	1379.46	1408.05
Observation 4**	1	1	0.23	2081.33	2091.4
Observation 5	0.195	0.32	0.53	1859.8	1884.74
Observation 6**	1	1	0.25	630.85	645.52

** Note the range parameter is the length of the smallest observation suggesting that there is little evidence ... see picture too

Table S24 Model parameters with no spatial trend assumed

	Susceptible variety			Resistant variety		
	C1	Spatial dependence	Range	C1	Spatial dependence	Range
Observation 1	0	0	0	0	0	0
Observation 2	0.072	0.29	3.14	0.009	0.08	1.18
Observation 3	0.077	0.27	0.76	0.037	0.2	0.86
Observation 4	0.051	0.12	2.64	0.333	1	0.23
Observation 5	0.393	0.15	1.16	0.091	0.32	0.53
Observation 6	0.112	0.33	2.53	0.100	1	0.25

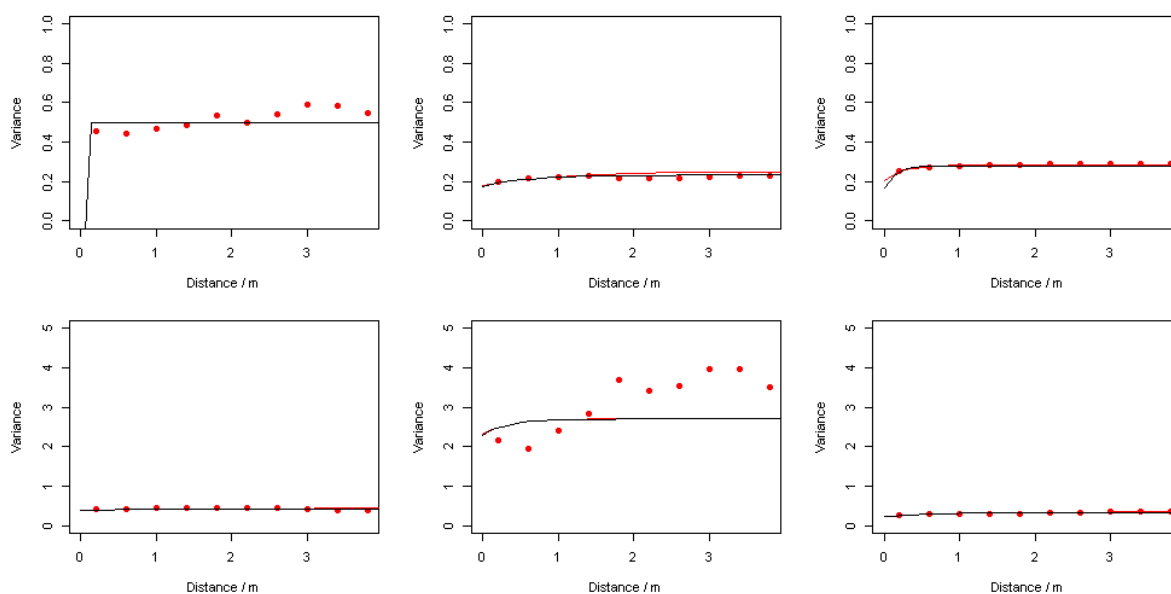


Fig. S33 Susceptible variety Victoria wet season 2017. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

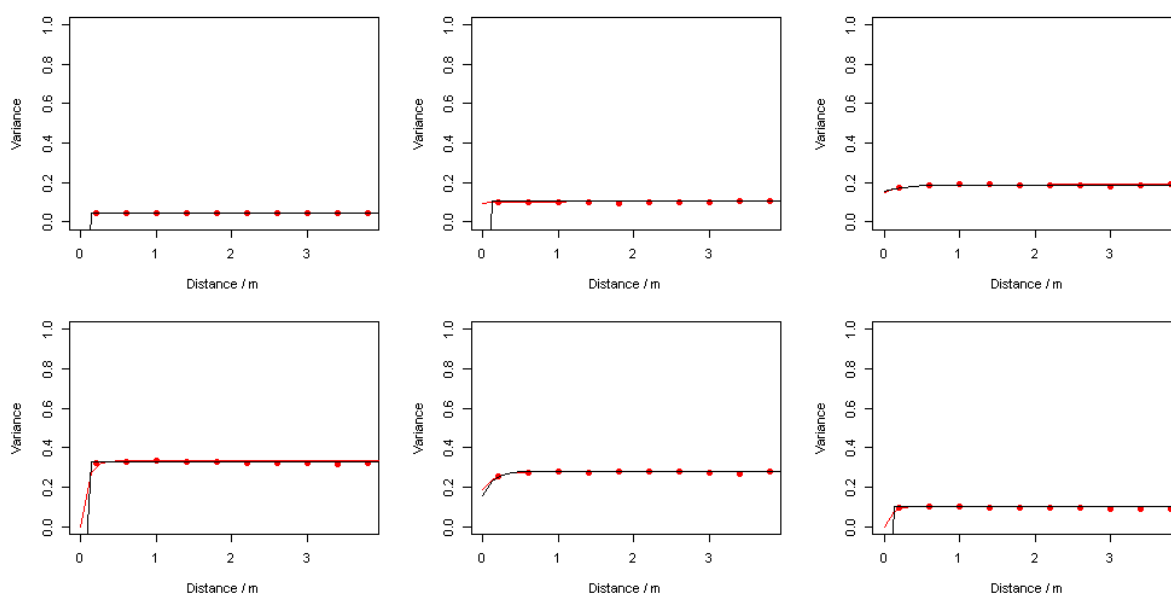


Fig. S34 Resistant variety Victoria wet season 2017. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

Malayantoc – Wet Season 2017

Table S25 Variogram analysis for the susceptible variety at Malayantoc during Wet Season 2017

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.163	1	0.6	1658.58	1964.55
Observation 2	0.495	0.84	0.88	3512.67	3917.99
Observation 3	0.109	0.56	1.56	3511.19	3923.29
Observation 4	0.012	0.36	4.77	3356.57	3641.62
Observation 5	0.082	0.53	3.48	4658.55	5144.53
Observation 6	0.007	0.35	2.39	4973.6	5172.47

Table S26 Variogram analysis for the resistant variety at Malayantoc during Wet Season 2017

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.005	0.38	1.34	3.6	156.14
Observation 2	0.17	0.4	8.49	2366.04	2656.61
Observation 3	0.021	0.24	5.04	2073.15	2249.92
Observation 4	0.007	0.08	1.81	3312.22	3328.39
Observation 5	0.007	0.36	3.42	3881.13	4160.13
Observation 6	0.093	0.61	17.3	3939.92	4596.9

Table S27 Model parameters with no spatial trend assumed

	Susceptible variety			Resistant variety		
	C1	Spatial dependence	Range	C1	Spatial dependence	Range
Observation 1	0.298	1	0.6	0.028	0.39	2.18
Observation 2	1.286	0.84	0.88	0.242	0.4	8.49
Observation 3	0.810	0.56	1.56	0.241	0.45	15.33
Observation 4	1.422	0.64	17.56	0.132	0.13	13.05
Observation 5	2.278	0.53	3.48	1.475	0.54	9.18
Observation 6	2.362	0.44	4.3	2.53	0.61	17.3

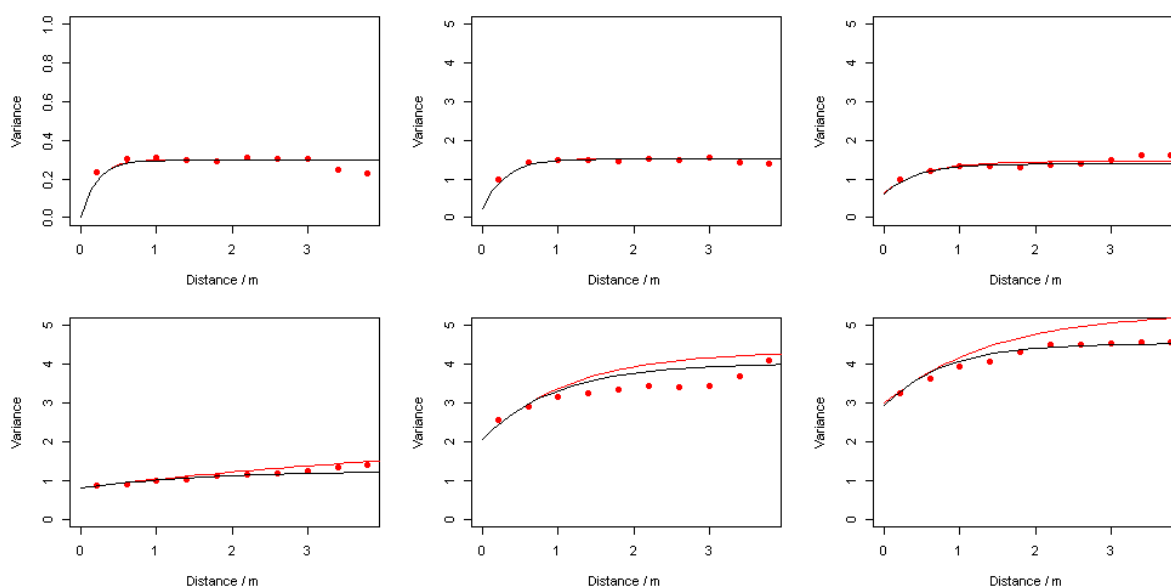


Fig. S35 Susceptible variety Malayantoc wet season 2017. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

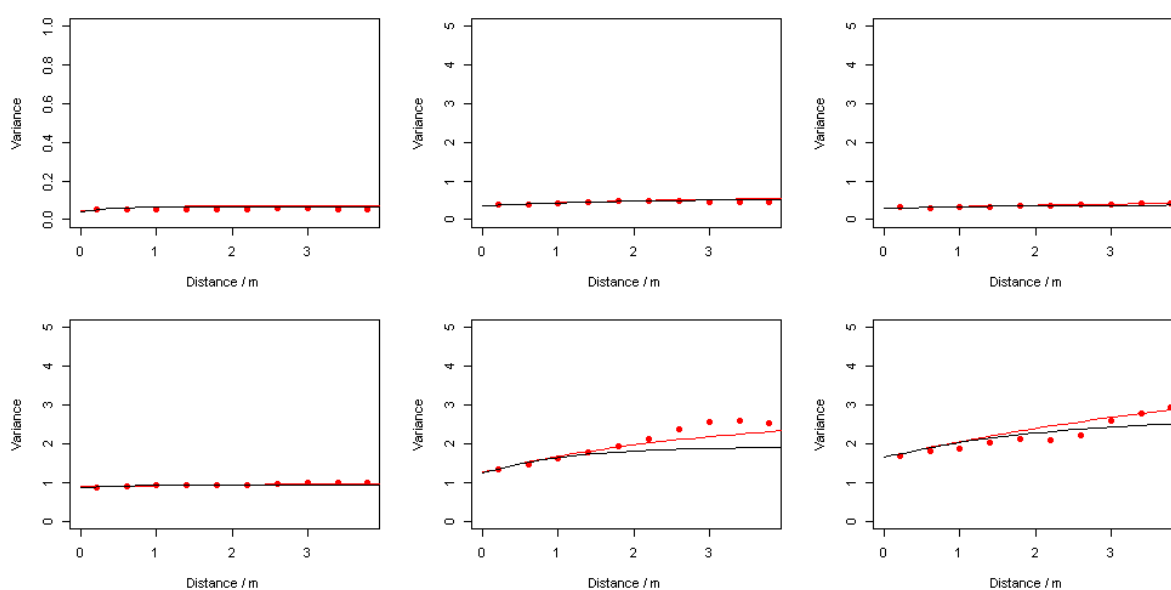


Fig. S36 Resistant variety Malayantoc wet season 2017. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

Maligaya – Wet Season 2017

Table S28 Variogram analysis for the susceptible variety at Maligaya during Wet Season 2017

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.195	0.2	3.08	2685.13	2758.71
Observation 2	0	0.3	1.75	3240.31	3382.76
Observation 3	0.462	0.3	3.73	3766.55	3933.47
Observation 4	0.502	0.29	2.82	5456	5571.66
Observation 5	0.204	0.36	4.49	5827.03	6042.65
Observation 6	0.334	0.35	4.44	5643.03	5814.52

Table S29 Variogram analysis for the resistant variety at Maligaya during Wet Season 2017

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.883	0.22	8.61	2236.3	2502.64
Observation 2	0.107	0.26	8.22	2226.17	2523.8
Observation 3	0.41	0.22	3.69	3552.7	3673.51
Observation 4	0.158	0.15	2.84	5017.18	5087.1
Observation 5	0.002	0.12	1.52	4861.63	4890.21
Observation 6					

Table S30 Model parameters with no spatial trend assumed

	Susceptible variety			Resistant variety		
	C1	Spatial dependence	Range	C1	Spatial dependence	Range
Observation 1	0.199	0.2	3.08	0.099	0.22	8.61
Observation 2	0.449	0.39	3.78	0.120	0.26	8.22
Observation 3	0.492	0.3	3.73	0.286	0.22	3.69
Observation 4	1.896	0.29	2.82	0.640	0.15	2.84
Observation 5	3.923	0.36	4.49	0.571	0.14	4.18
Observation 6	4.310	0.35	4.44	-	-	-

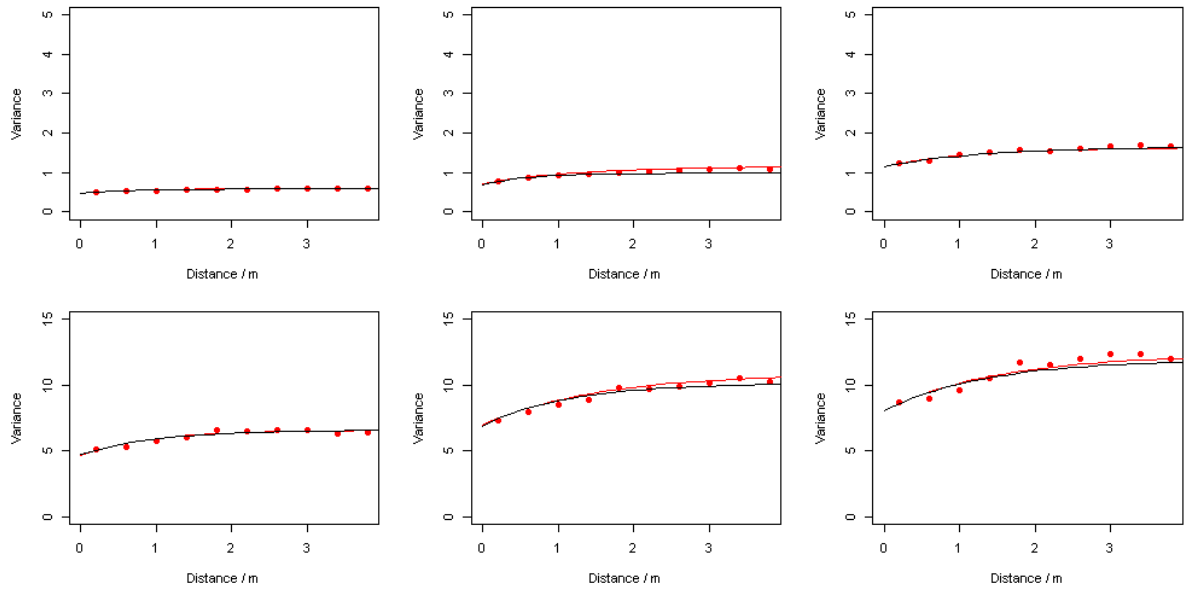


Fig. S37 Susceptible variety Maligaya wet season 2017. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

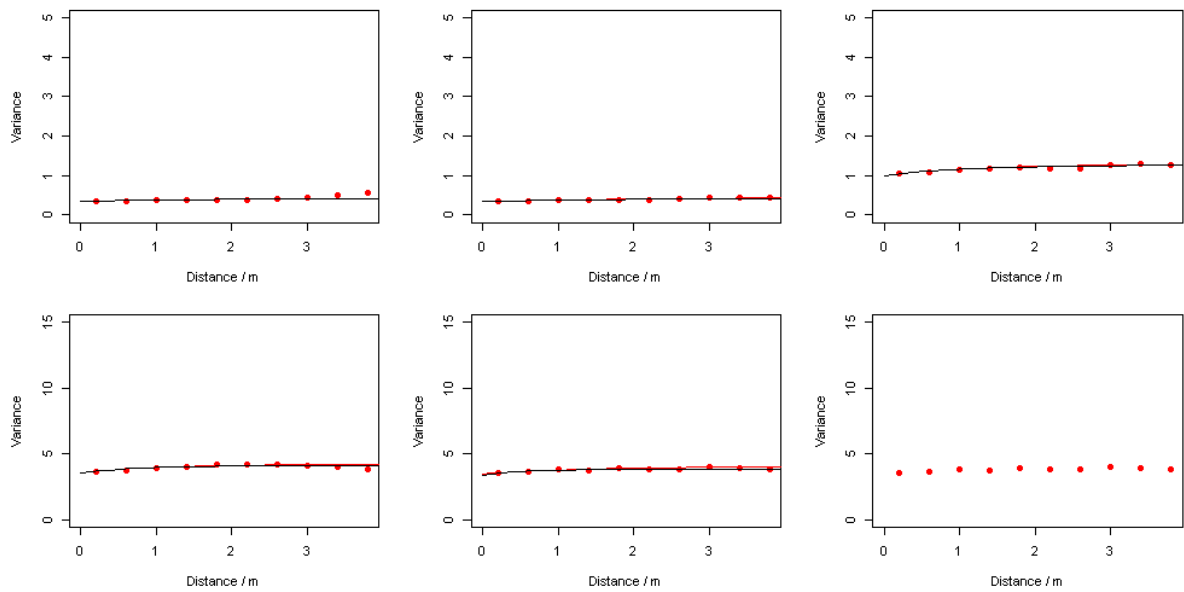


Fig. S38 Resistant variety Maligaya wet season 2017. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

Pila – Dry Season 2018

Table S31 Variogram analysis for the susceptible variety at Pila during Dry Season 2018

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.06	0.8	14.61	2196.85	2563.97
Observation 2	0.151	0.49	3.77	2805.71	3041.51
Observation 3	0.098	0.55	4.51	3067.63	3314.71

Table S32 Variogram analysis for the resistant variety at Pila during Dry Season 2018

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.058	0	0	-424.48	-428.48
Observation 2	0.132	0.3	0.86	987.84	1042.23
Observation 3	0.732	0.45	0.6	1400.93	1457.13

Table S33 Model parameters with no spatial trend assumed

	Susceptible variety			Resistant variety		
	C1	Spatial dependence	Range	C1	Spatial dependence	Range
Observation 1	1.056	0.8	14.61	0	0	0
Observation 2	0.444	0.49	3.77	0.042	0.3	0.86
Observation 3	0.691	0.55	4.51	0.090	0.45	0.6

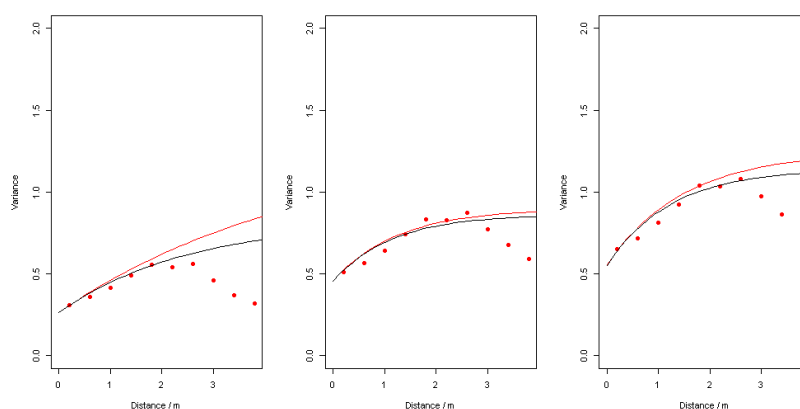


Fig. S39 Susceptible variety Pila Dry season 2018. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

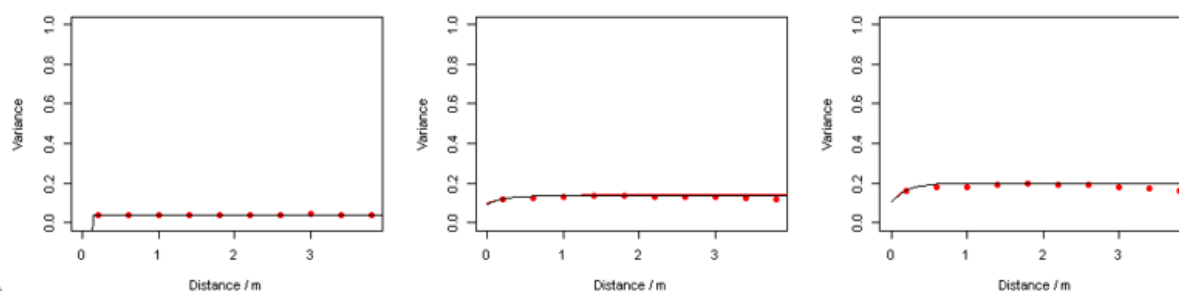


Fig. S40 Resistant variety Pila Dry season 2018. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

Victoria – Dry Season 2018

Table S34 Variogram analysis for the susceptible variety at Victoria during Dry Season 2018

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.48	0	0	1259.99	1255.99
Observation 2	0.123	0.27	0.6	746.43	768.23
Observation 3	0.118	0.45	11.35	2308.62	2395.78
Observation 4	0.081	0.67	11.82	2825.66	2979.97
Observation 5	0.728	0.43	5.8	3300.69	3436.05
Observation 6	0.161	0.77	21.8	3353.39	3612.51

Table S35 Variogram analysis for the resistant variety at Victoria during Dry Season 2018

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.763	0	0	-2228.22	-2232.22
Observation 2	1	0.04	5.11	-1469.88	-1466.4
Observation 3	0.086	0	0	32.01	28.01
Observation 4**	0.198	1	0.29	99.32	131.26
Observation 5	0.028	0.64	0.52	1886.94	1971.89
Observation 6	0.009	0.48	0.86	1945.69	2051.73

Table S36 Model parameters with no spatial trend assumed

	Susceptible variety			Resistant variety		
	C1	Spatial dependence	Range	C1	Spatial dependence	Range
Observation 1	0	0	0	0	0	0
Observation 2	0.030	0.27	0.6	0.001	0.04	5.11
Observation 3	0.287	0.45	11.35	0	0	0
Observation 4	0.232	0.36	1.51	0.046	0.29	0.54
Observation 5	0.573	0.43	5.8	0.184	0.6	0.57
Observation 6	2.494	0.77	21.8	0.154	0.45	1.04

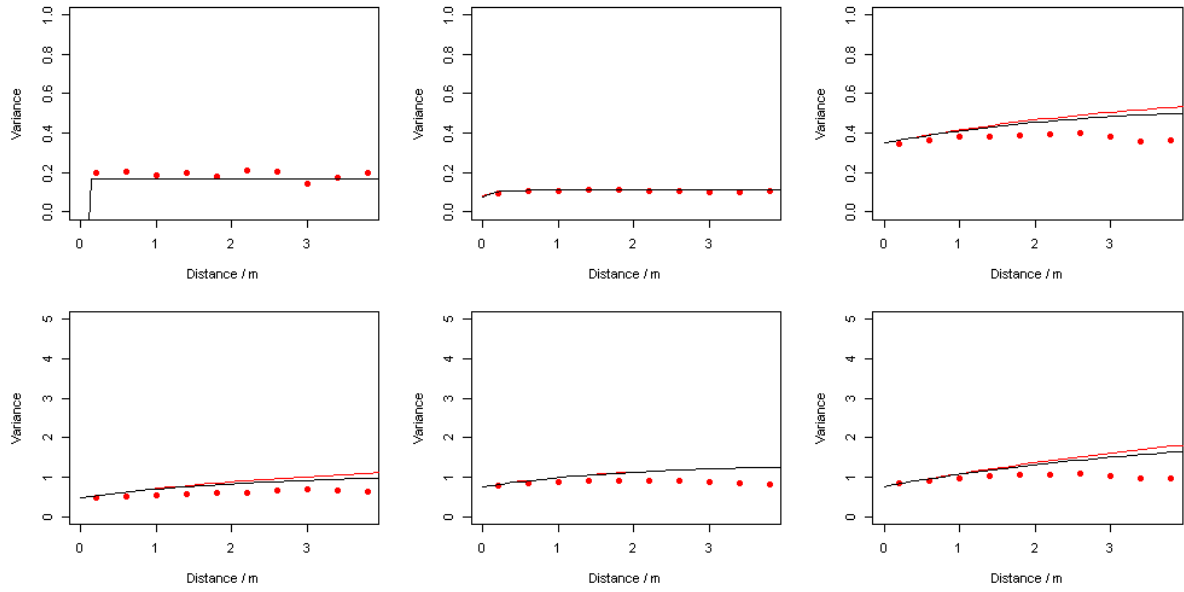


Fig. S41 Susceptible variety Victoria Dry season 2018. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

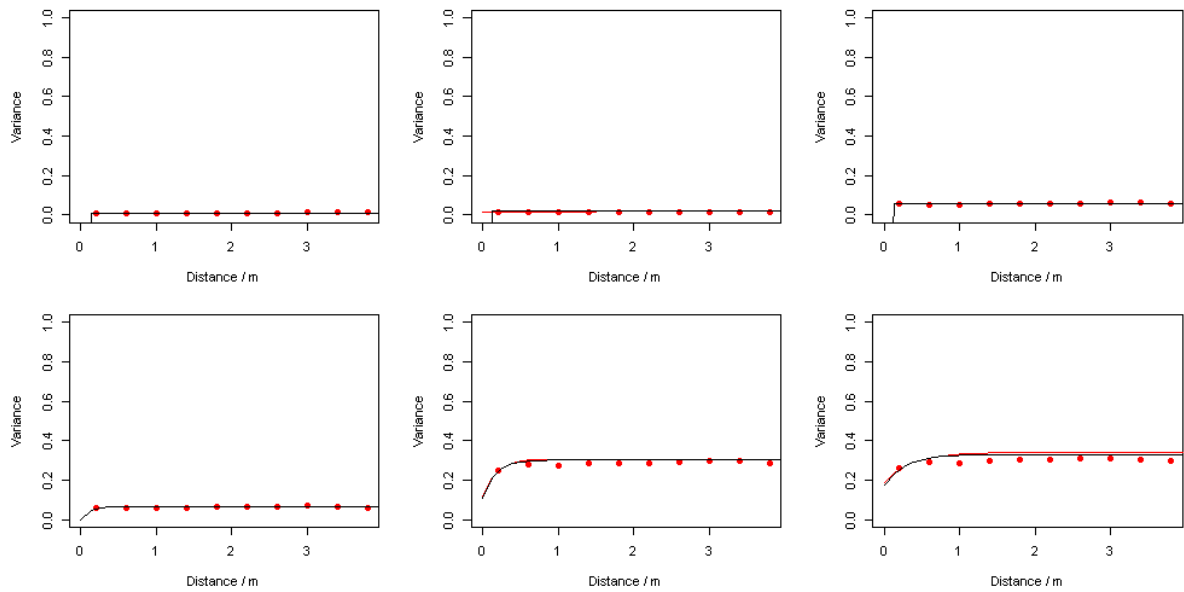


Fig. S42 Resistant variety Victoria Dry season 2018. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

Malayantoc – Dry Season 2018

Table S37 Variogram analysis for the susceptible variety at Malayantoc during Dry Season 2018

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.656	0.09	4.51	761.25	793.82
Observation 2	0.129	0.16	4.44	1713.92	1800.62
Observation 3	0.946	0.05	5.73	2189.52	2205.47
Observation 4	0.073	0.14	6.69	1718.37	1780.95
Observation 5	0.901	0.18	7.69	2745.06	2912.73
Observation 6	0.931	0.24	10.93	2606.77	2884.89
Observation 7	0.098	0.16	1.84	2977.07	3026.05
Observation 8	0.234	0.19	13.69	4835.24	5033.14

Table S38 Variogram analysis for the resistant variety at Malayantoc during Dry Season 2018

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.93	0.08	5.89	1510.08	1569.49
Observation 2	0.968	0.12	4.04	1424.53	1495.93
Observation 3	0.933	0	0	1220.46	1216.46
Observation 4	0.127	0.04	5.15	811.83	825.83
Observation 5	0.001	0	0	2026.65	2022.65
Observation 6	0.459	0.18	4.7	2782.53	2896.51
Observation 7	0.039	0.15	9.27	3060.65	3151.12
Observation 8	0.047	0.17	4.86	4213.73	4304.57

Table S39 Model parameters with no spatial trend assumed

	Susceptible variety			Resistant variety		
	C1	Spatial dependence	Range	C1	Spatial dependence	Range
Observation 1	0.011	0.09	4.51	0.018	0.08	5.89
Observation 2	0.043	0.16	4.44	0.024	0.12	4.04
Observation 3	0.020	0.05	5.73	0	0	0
Observation 4	0.036	0.14	6.69	0.005	0.04	5.15
Observation 5	0.118	0.18	7.69	0.020	0.06	31.76
Observation 6	0.151	0.24	10.93	0.115	0.18	4.7
Observation 7	0.118	0.16	1.84	0.487	0.41	37.38
Observation 8	0.735	0.19	13.69	0.791	0.3	12.78

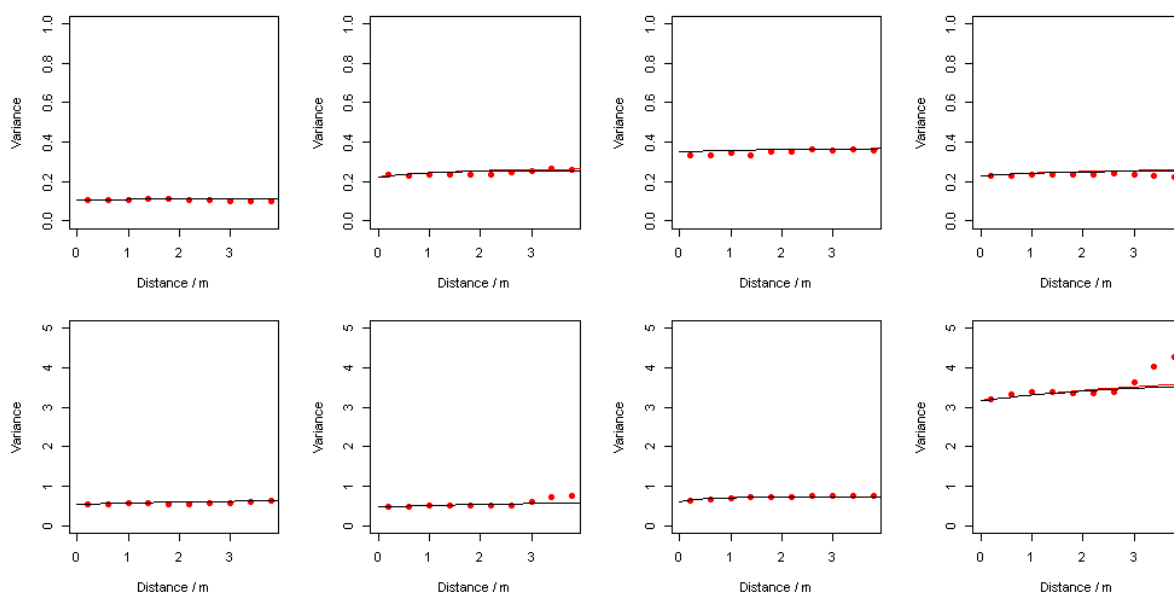


Fig. S43 Susceptible variety Malayantoc Dry season 2018. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

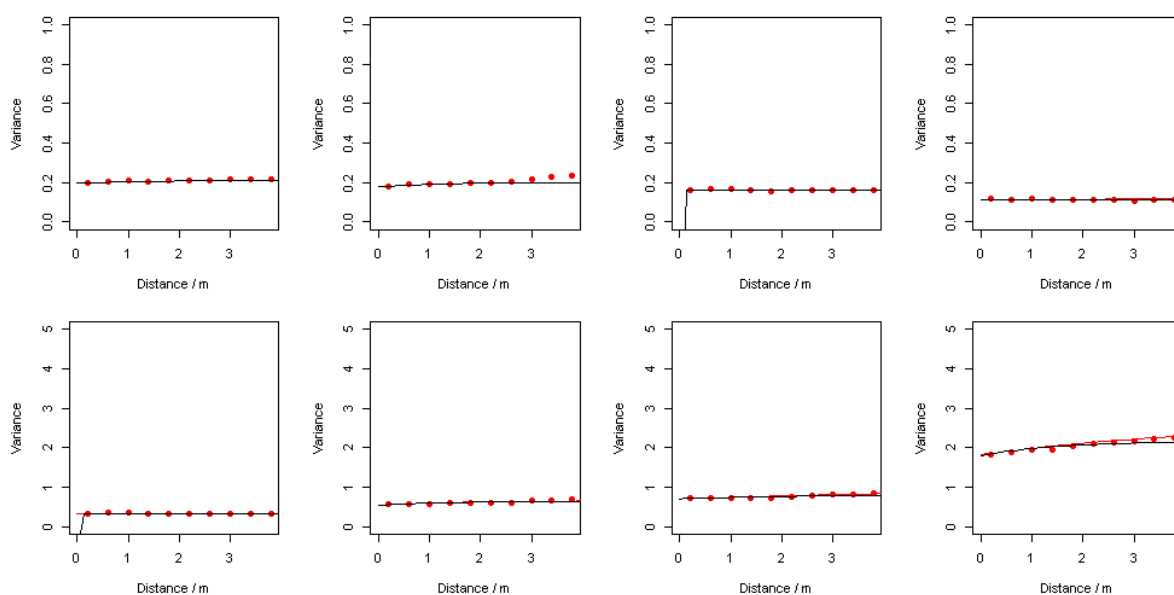


Fig. S44 Resistant variety Malayantoc Dry season 2018. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

Maligaya – Dry Season 2018

Table S40 Variogram analysis for the susceptible variety at Maligaya during Dry Season 2018

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.001	0.23	0.59	1365.15	1381.99
Observation 2	0.059	0.13	1.63	2081.57	2117.21
Observation 3	0.196	0.16	1.74	2118.82	2159.19
Observation 4	0.834	0.18	2.2	3131.95	3211.19
Observation 5	0.574	0.25	3.64	3616.09	3815.35
Observation 6	0.099	0.31	9.39	3615.8	4008.59
Observation 7	0.216	0.57	19.93	4412	5171.17
Observation 8	0.083	0.24	7.84	3385.01	3568.87

Table S41 Variogram analysis for the resistant variety at Maligaya during Dry Season 2018

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.994	0.03	3.36	142.44	148.63
Observation 2	1	0.07	1.52	1528.34	1536.29
Observation 3	0.074	0.62	34.87	2674.36	3599.72
Observation 4	0.778	0.15	5.1	3263.55	3362.79
Observation 5	0.256	0.29	9.37	3164.15	3472.79
Observation 6	0.185	0.39	13.5	4144.53	4657.78
Observation 7	0.005	0.2	1.93	4356.26	4431.11
Observation 8	0.132	0.36	17.21	3250.4	3530.77

Table S42 Model parameters with no spatial trend assumed

	Susceptible variety			Resistant variety		
	C1	Spatial dependence	Range	C1	Spatial dependence	Range
Observation 1	0.028	0.15	1.62	0.002	0.03	3.36
Observation 2	0.046	0.13	1.63	0.014	0.07	1.52
Observation 3	0.055	0.16	1.74	0.776	0.62	34.87
Observation 4	0.150	0.18	2.2	0.147	0.15	5.1
Observation 5	0.350	0.25	3.64	0.307	0.29	9.37
Observation 6	0.480	0.31	9.39	1.066	0.39	13.5
Observation 7	2.652	0.57	19.93	0.725	0.27	4.83
Observation 8	0.521	0.24	7.84	0.673	0.36	17.21

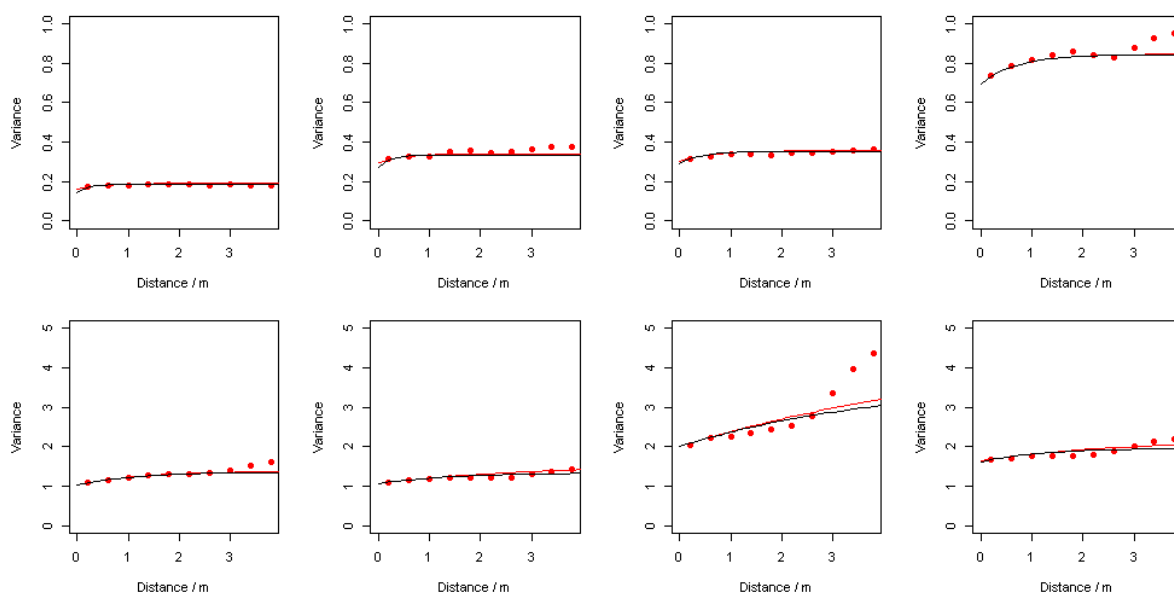


Fig. S45 Susceptible variety Maligaya Dry season 2018. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

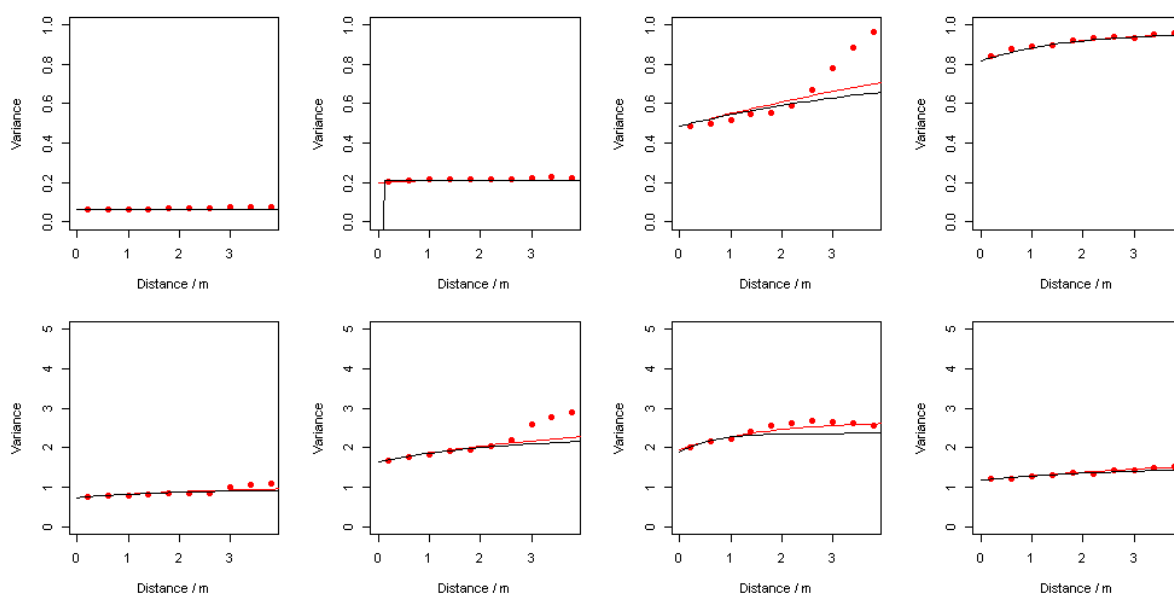


Fig. S46 Resistant variety Maligaya Dry season 2018. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

Pila – Wet Season 2018

Table S43 Variogram analysis for the susceptible variety at Pila during Wet Season 2018

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.223	0	0	-518.34	-522.34
Observation 2	0.045	0	0	311.77	307.77
Observation 3	0.029	0	0	788.38	784.38

Table S44 Variogram analysis for the resistant variety at Pila during Wet Season 2018

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.015	0	0	-1945.86	-1949.86
Observation 2	0.076	0	0	-1401.55	-1405.55
Observation 3	0.227	0	0	-1205.29	-1209.29

Table S45 Model parameters with no spatial trend assumed

	Susceptible variety			Resistant variety		
	C1	Spatial dependence	Range	C1	Spatial dependence	Range
Observation 1	0	0	0	0	0	0
Observation 2	0	0	0	0	0	0
Observation 3	0	0	0	0	0	0

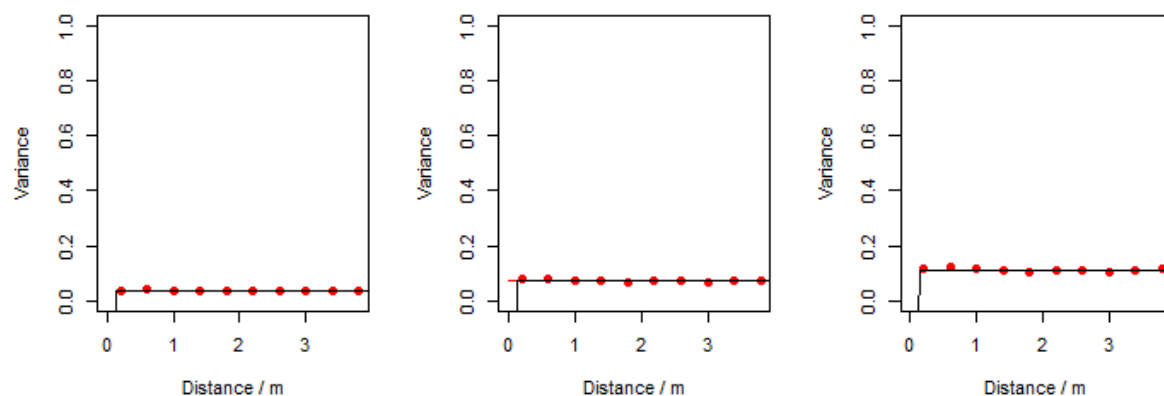


Fig. S47 Susceptible variety Pila wet season 2018. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

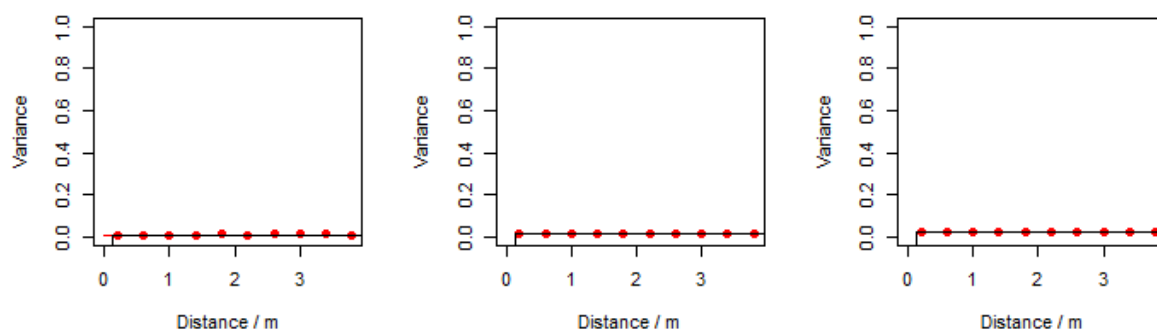


Fig. S48 Resistant variety Pila wet season 2018. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

Victoria – Wet Season 2018

Table S46 Variogram analysis for the susceptible variety at Victoria during Wet Season 2018

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.085	0.02	2.13	430.59	429.47
Observation 2	1	0.08	1.47	1648.99	1659.81
Observation 3	0.056	0.12	4.02	2795.97	2850.74
Observation 4	0.001	1	0.31	3340.88	3374.39
Observation 5	0.102	0.71	0.52	3749.47	3829.93
Observation 6	0.082	0.66	0.54	3688.01	3763.81

Table S47 Variogram analysis for the resistant variety at Victoria during Wet Season 2018

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.046	0	0	-472.56	-476.56
Observation 2	0.243	0.3	0.35	182.75	186.48
Observation 3	0.338	0	0	785.09	781.09
Observation 4	0.038	0	0	1203.05	1199.05
Observation 5	0.226	0	0	1342.66	1338.66
Observation 6	0.038	0	0	1272.43	1268.43

Table S48 Model parameters with no spatial trend assumed

	Susceptible variety			Resistant variety		
	C1	Spatial dependence	Range	C1	Spatial dependence	Range
Observation 1	0.002	0.02	2.13	0	0	0
Observation 2	0.018	0.08	1.47	0.020	0.3	0.35
Observation 3	0.079	0.12	4.02	0	0	0
Observation 4	0.190	0.18	4.61	0	0	0
Observation 5	1.032	0.71	0.52	0	0	0
Observation 6	0.905	0.66	0.54	0	0	0

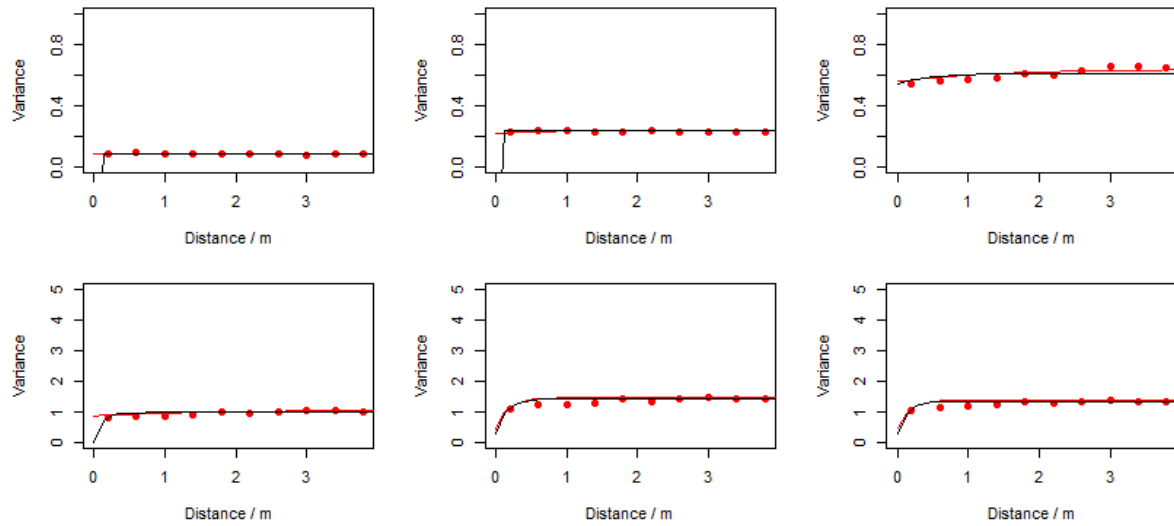


Fig. S49 Susceptible variety Victoria wet season 2018. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

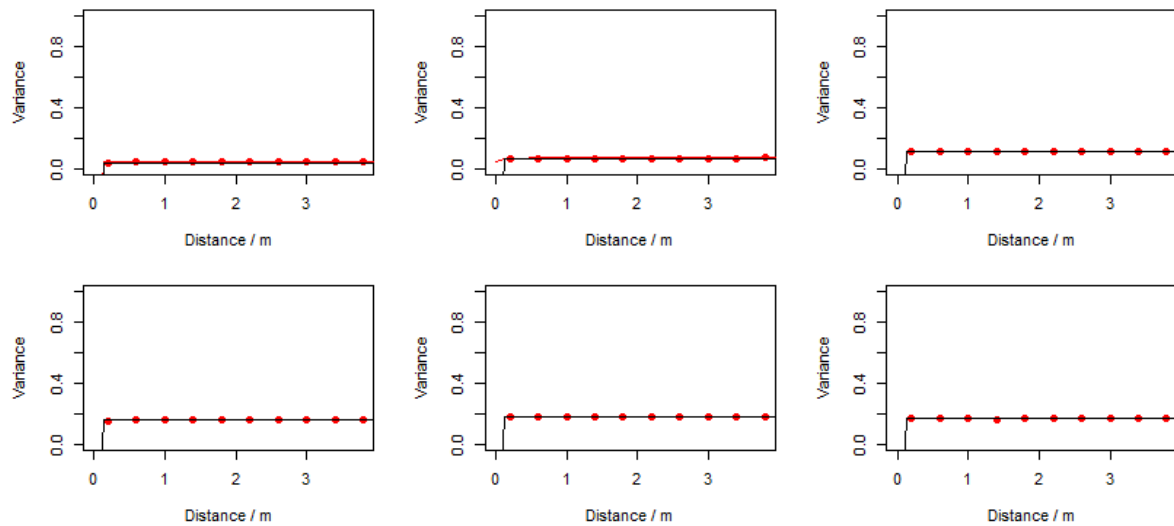


Fig. S50 Resistant variety Victoria wet season 2018. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

Malayantoc – Wet Season 2018

Table S49 Variogram analysis for the susceptible variety at Malayantoc during Wet Season 2018

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.06	0.47	8.04	3499.78	3731.61
Observation 2	0.091	0.22	7.19	3921.86	4155.61
Observation 3	0.034	0.07	4.3	4701.06	4721.71
Observation 4	0.001	0.2	3.76	3645.8	3785.13
Observation 5	0.027	0.34	1.1	3659.48	3773.76
Observation 6	0.279	0.49	8.28	3774.79	4230.63

Table S50 Variogram analysis for the resistant variety at Malayantoc during Wet Season 2018

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.036	0.21	5.83	2479.76	2653.11
Observation 2	0.184	0.22	4.66	2990.32	3191.94
Observation 3	0.001	0.21	2.55	3266.18	3374.41
Observation 4	0.011	0.19	2.68	3601.21	3701.07
Observation 5	0.301	0.15	3.96	2289.39	2412.4
Observation 6	0.069	0.51	2.33	4886.93	5311.3

Table S51 Model parameters with no spatial trend assumed

	Susceptible variety			Resistant variety		
	C1	Spatial dependence	Range	C1	Spatial dependence	Range
Observation 1	0.805	0.47	8.04	0.257	0.38	15.13
Observation 2	0.400	0.22	7.19	0.180	0.22	4.66
Observation 3	0.542	0.16	16.07	0.425	0.35	8.62
Observation 4	1.856	0.63	35.55	0.346	0.25	4.86
Observation 5	0.469	0.33	1.44	0.064	0.15	3.96
Observation 6	1.087	0.49	8.28	2.442	0.51	2.33

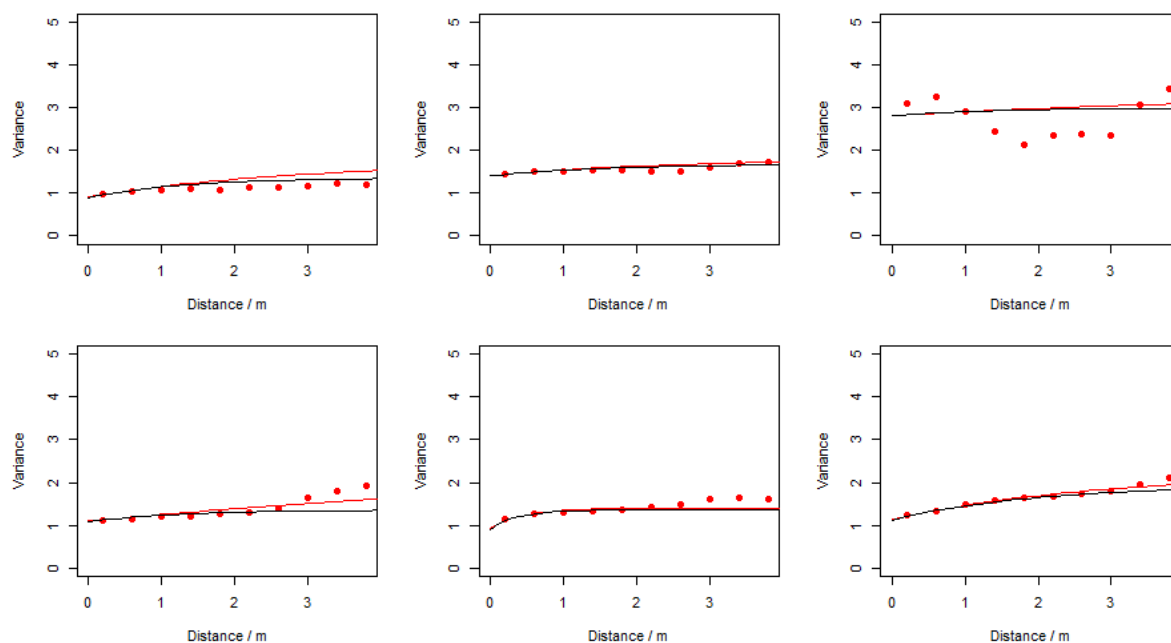


Fig. S51 Susceptible variety Malayantoc wet season 2018. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

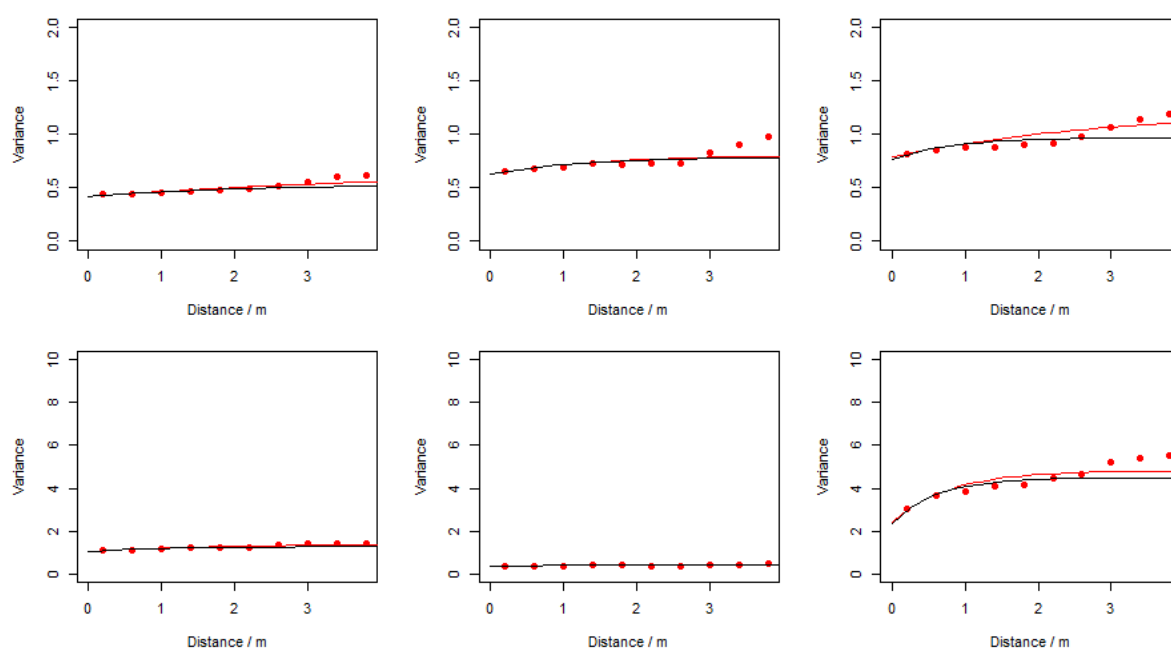


Fig. S52 Resistant variety Malayantoc wet season 2018. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

Maligaya – Wet Season 2018

Table S52 Variogram analysis for the susceptible variety at Maligaya during Wet Season 2018

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.021	0.23	1.26	2580.83	2647.42
Observation 2	0.288	0.2	1	3014.17	3050.62
Observation 3	0.031	0.15	1.23	3040.51	3072.08
Observation 4	0.079	0.45	8.6	3102.08	3651.12
Observation 5	0.311	0.22	2.86	2539.58	2645.2
Observation 6	0.959	0.37	3.26	3470.61	3688.79

Table S53 Variogram analysis for the resistant variety at Maligaya during Wet Season 2018

variable	P value for spatial trend*	Spatial dependence	Range	AIC Spatial	AIC Nugget
Observation 1	0.047	0.38	0.91	2597.19	2712.26
Observation 2	0	0.43	0.61	2598.04	2664.2
Observation 3	0.283	0.2	2.07	3240.02	3327.92
Observation 4	0.02	0.04	3.61	2478.71	2488.05
Observation 5	0.506	0.08	2.04	1770.58	1786.7
Observation 6	0.168	0.13	2.16	1990.86	2029.98

Table S54 Model parameters with no spatial trend assumed

	Susceptible variety			Resistant variety		
	C1	Spatial dependence	Range	C1	Spatial dependence	Range
Observation 1	0.122	0.22	2.18	0.214	0.38	1.03
Observation 2	0.149	0.2	1	0.219	0.39	0.92
Observation 3	0.115	0.15	1.97	0.187	0.2	2.07
Observation 4	0.550	0.45	8.6	0.064	0.12	20.14
Observation 5	0.123	0.22	2.86	0.024	0.08	2.04
Observation 6	0.509	0.37	3.26	0.055	0.13	2.16

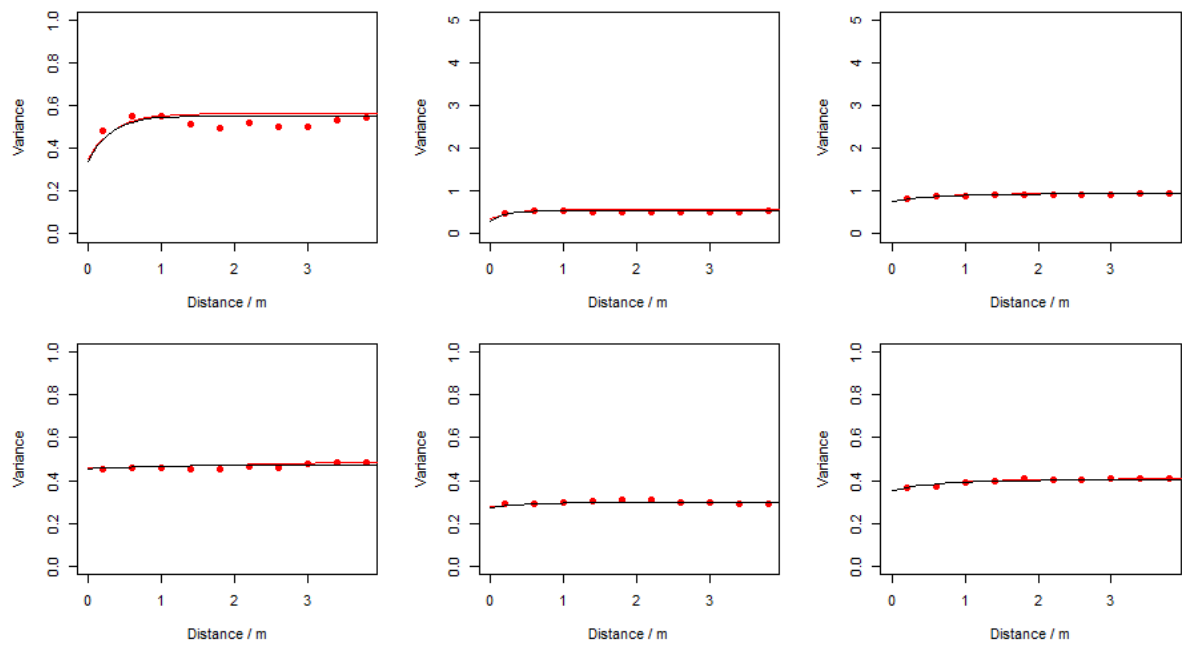


Fig. S53 Susceptible variety Maligaya wet season 2018. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

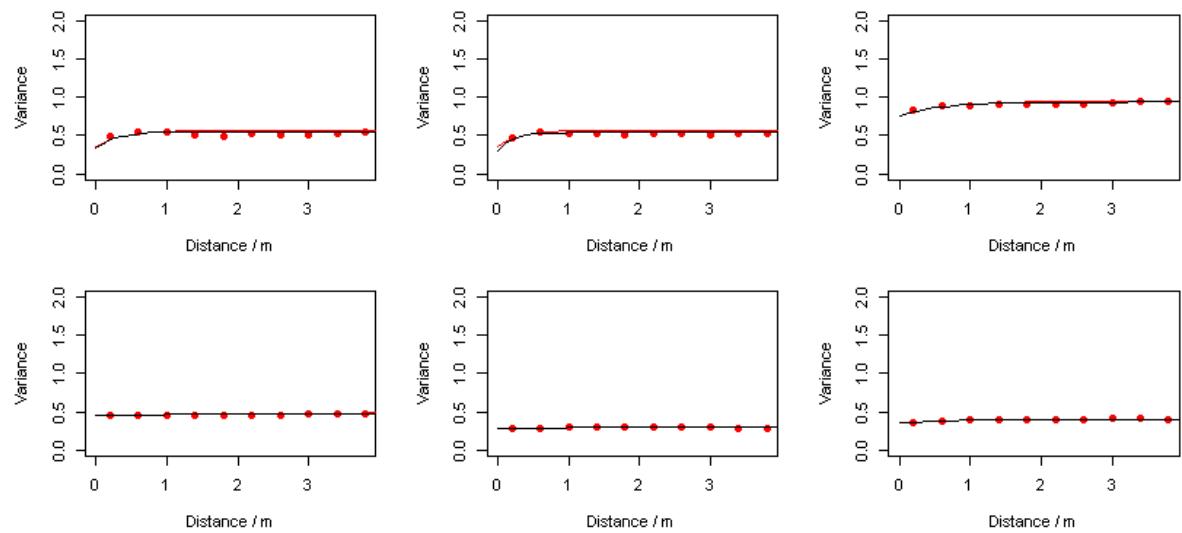


Fig. S54 Resistant variety Maligaya wet season 2018. The points show the empirical variogram calculated using the method of moments. Black line shows model with trend and red model without trend.

Predictions of the spatially correlated variance

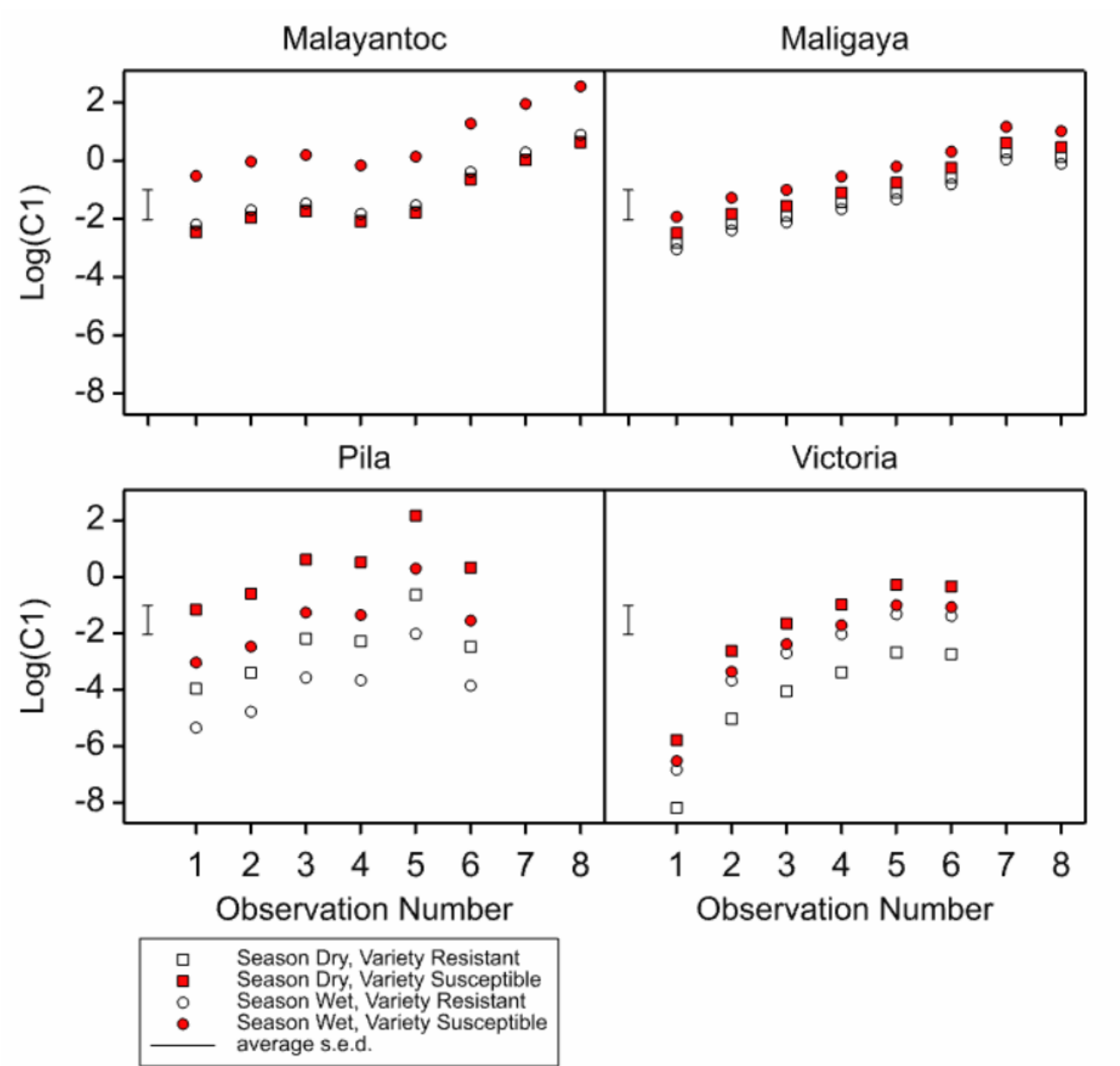


Fig. S55 Predictions of the spatially correlated variance (quantified by the C_1 parameter of the variogram) for each site and season.