effectOfIndividualInputs

Andy South

2016-01-29

Investigation into effects of individual inputs on time to reach resistance thresholds.

version 2 - in progress

Based on 1000 runs with all inputs varying at once which explains the variability at particular input values.

Within each figure the plots are divided into 6 sub-plots according to the insecticide use strategy and when the resistance threshold is reached

1. insecticide 1 : sole use
2. insecticide 2 : sole use
3. Mixture 1 : threshold reached for either insecticide in mixture
4. Mixture 2 : once threshold reached for either insecticide in mixture, switch to sole use of other until it too reaches threshold
5. Mixture 3 : threshold reached for both insecticides in mixture
6. Sequential : sole use of one insecticide, switch to other when threshold reached until it too reaches threshold

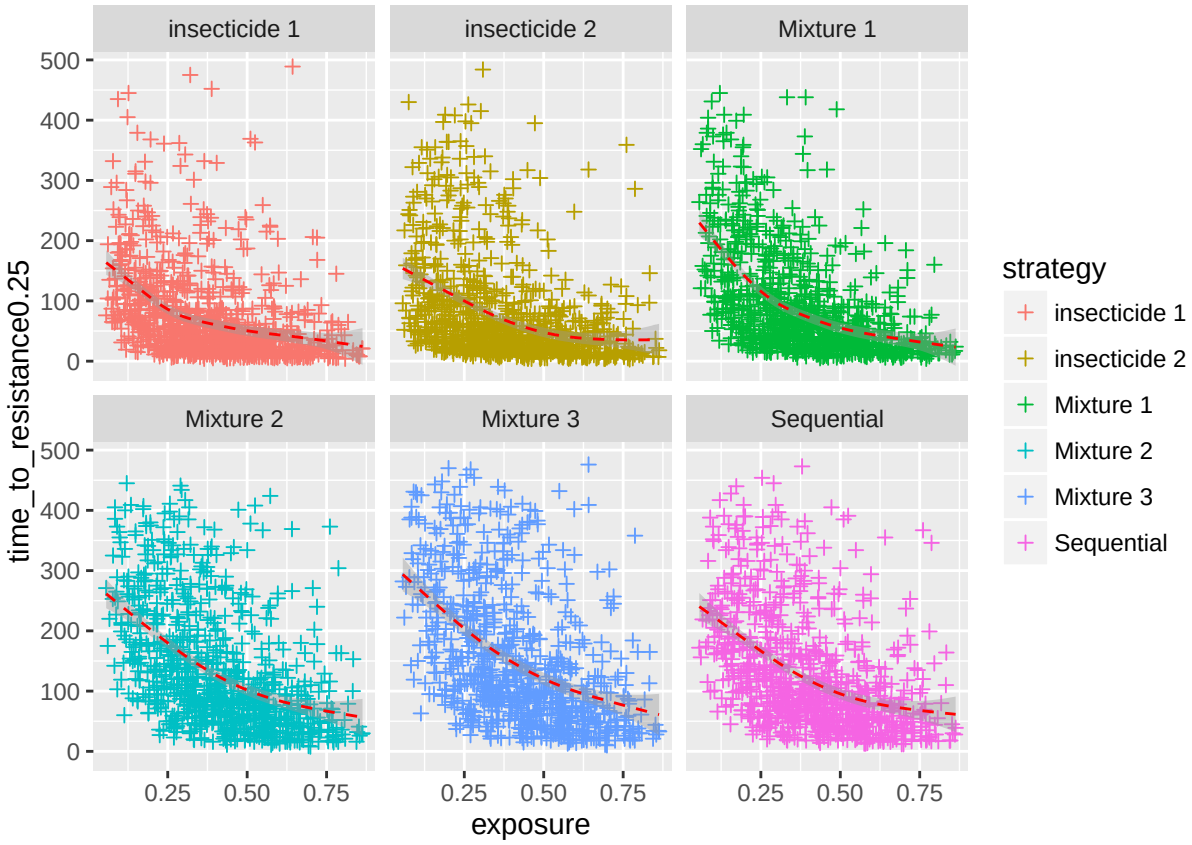
These plots show gen_cP0.2, which is the number of generations to reach 20% resistance.

Red dashed lines are a smoothed mean.

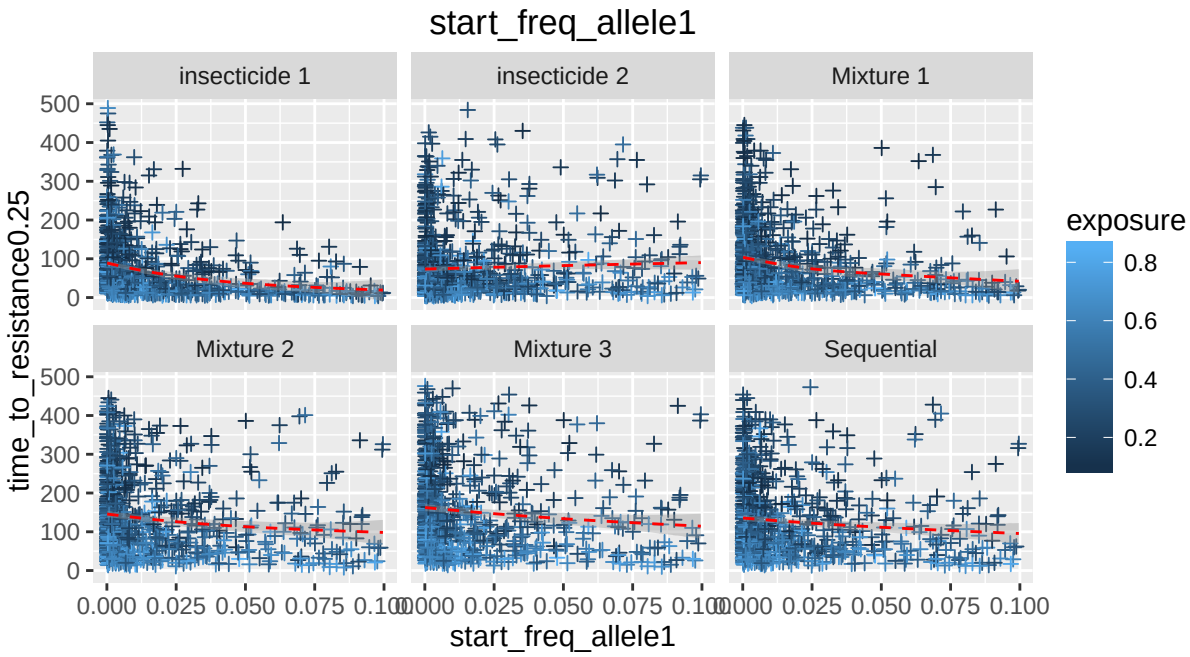
Runs where resistance thresholds have not been reached have been removed.

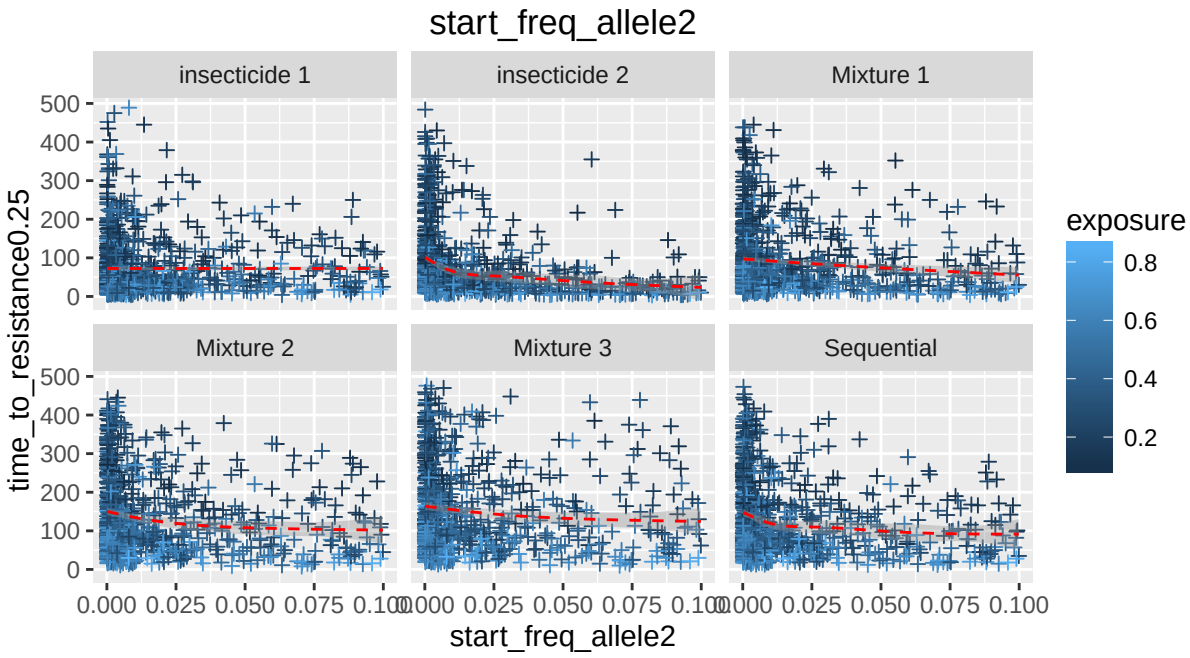
Previous plots showed a set of points at 1000 generations. The model is run for 500 generations, any runs which have not reached the resistance threshold by this time are given a value of 1000. This has little effect on questions of whether mixtures or sequential use is better.

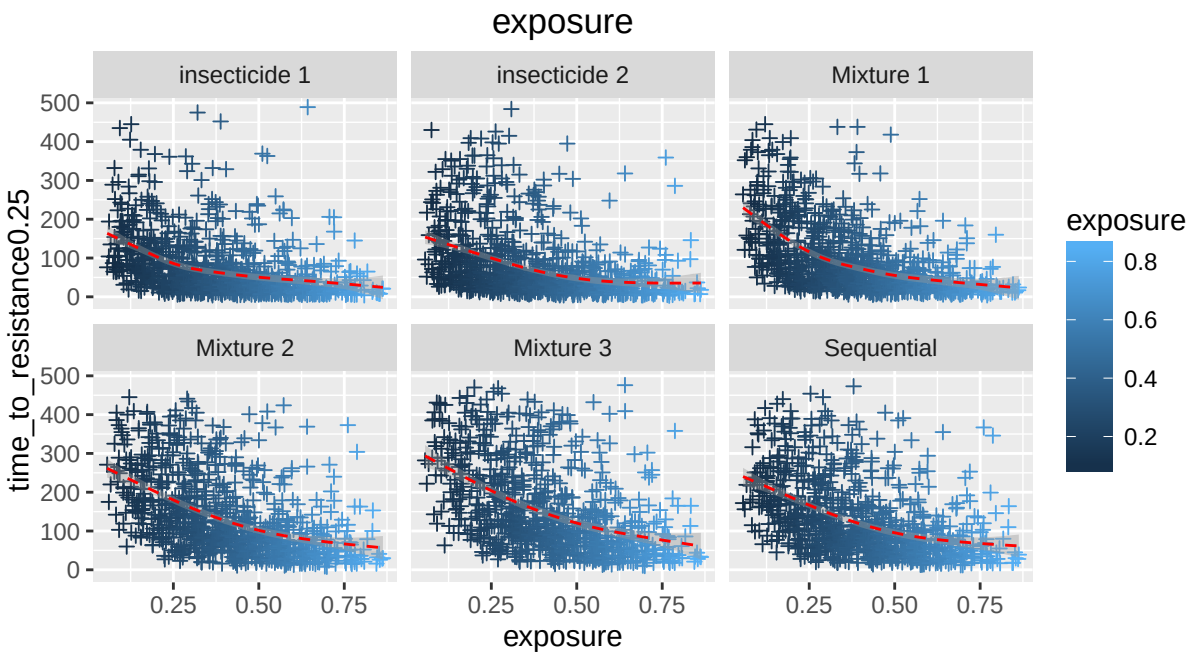
This plot shows exposure which has the most noticeable pattern.

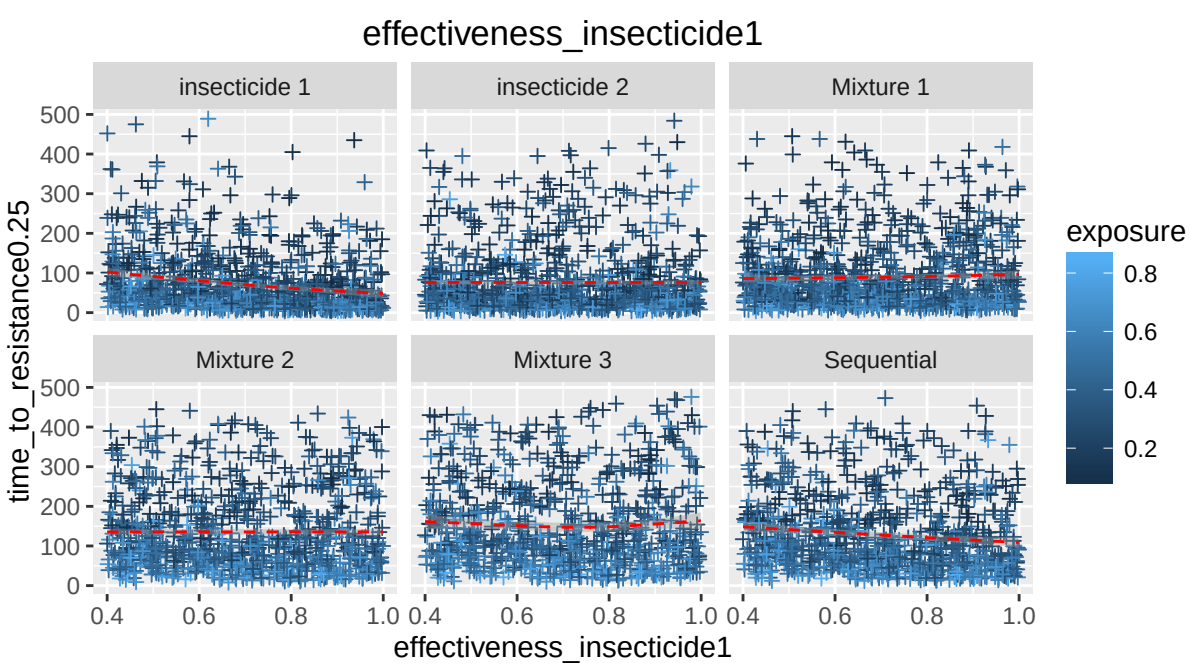


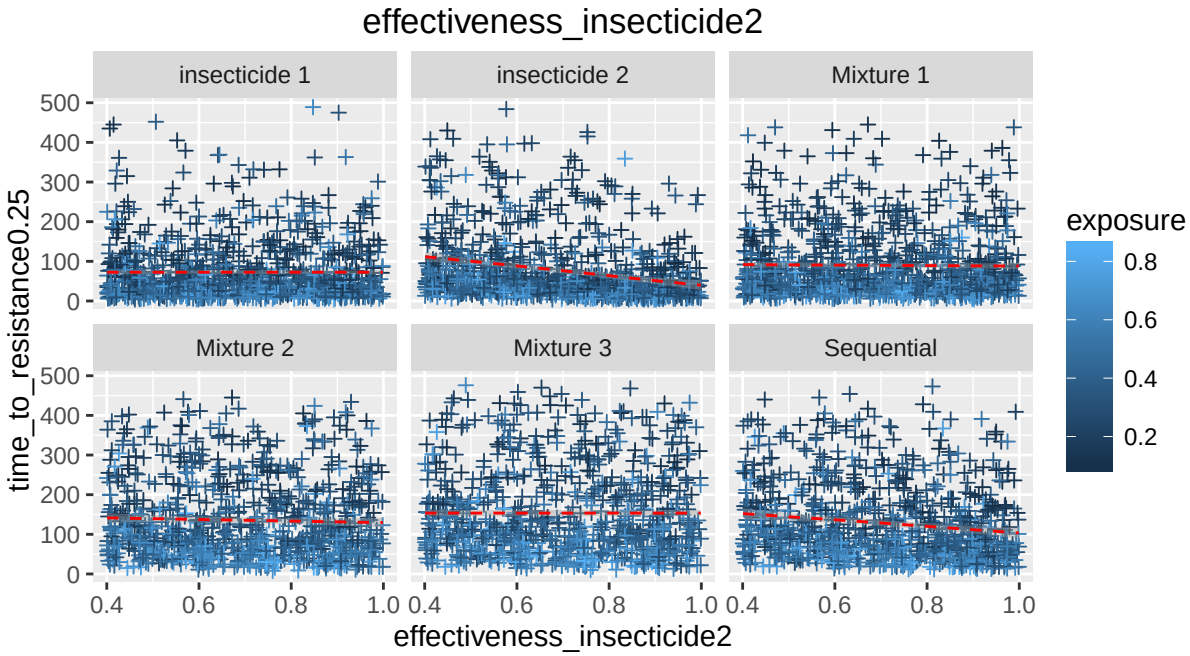
In the following plots all inputs are plotted individually, the points are coloured by exposure, which allows us to see that, even as other inputs change, low times to resistance are associated with high exposure.

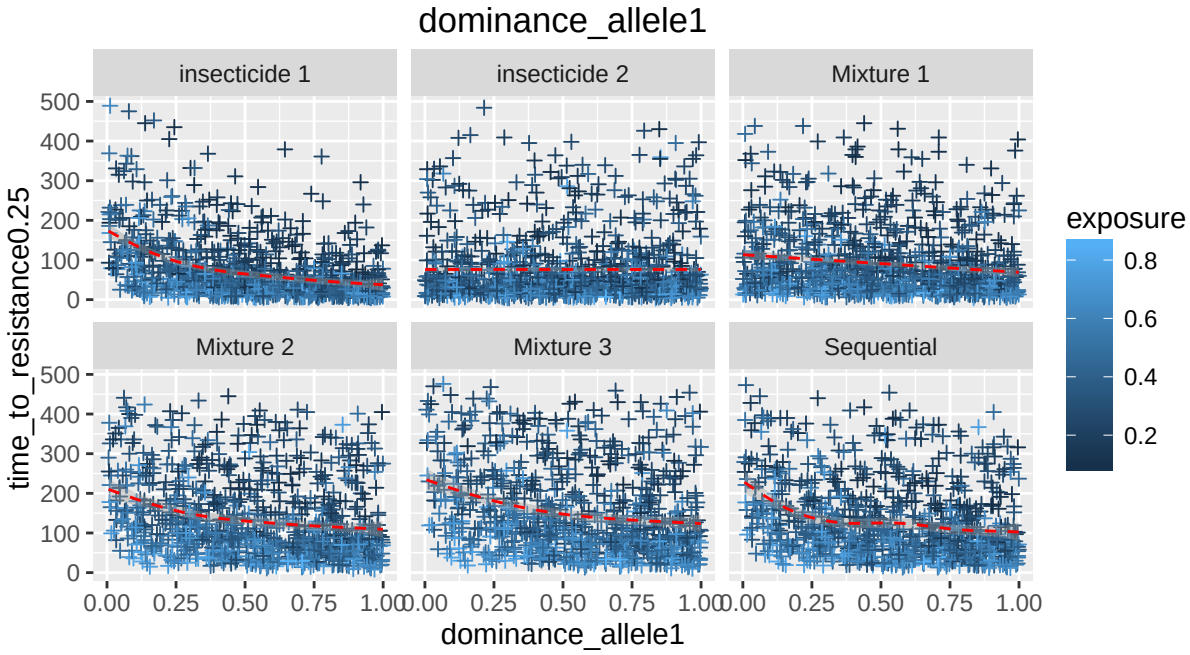


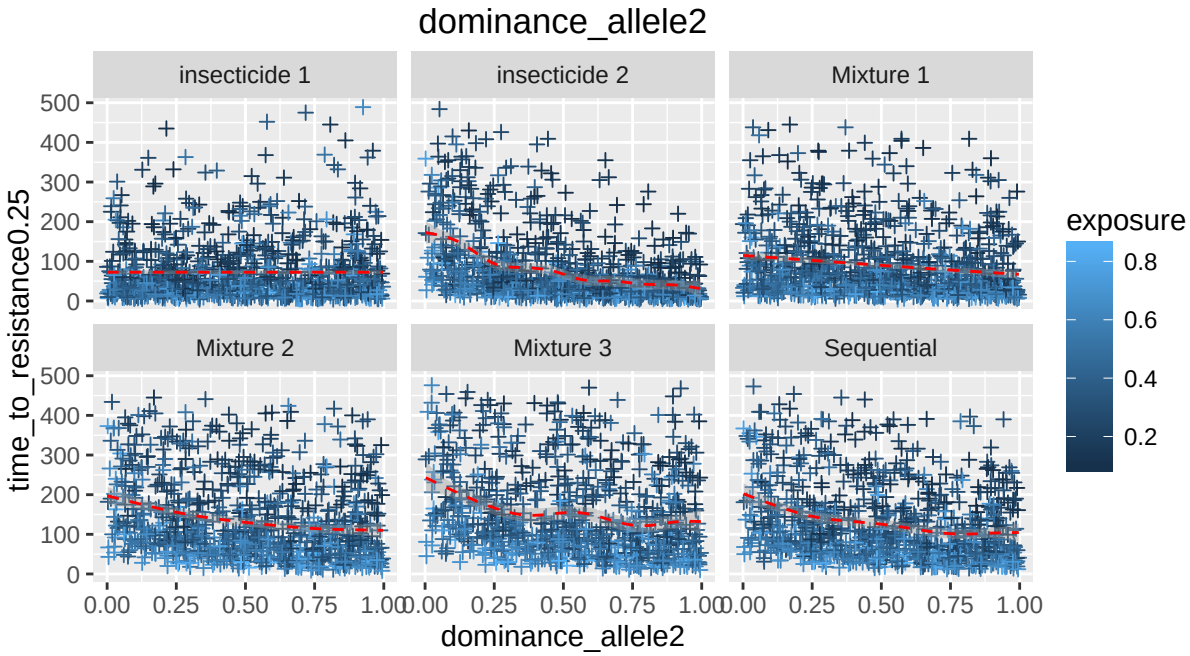


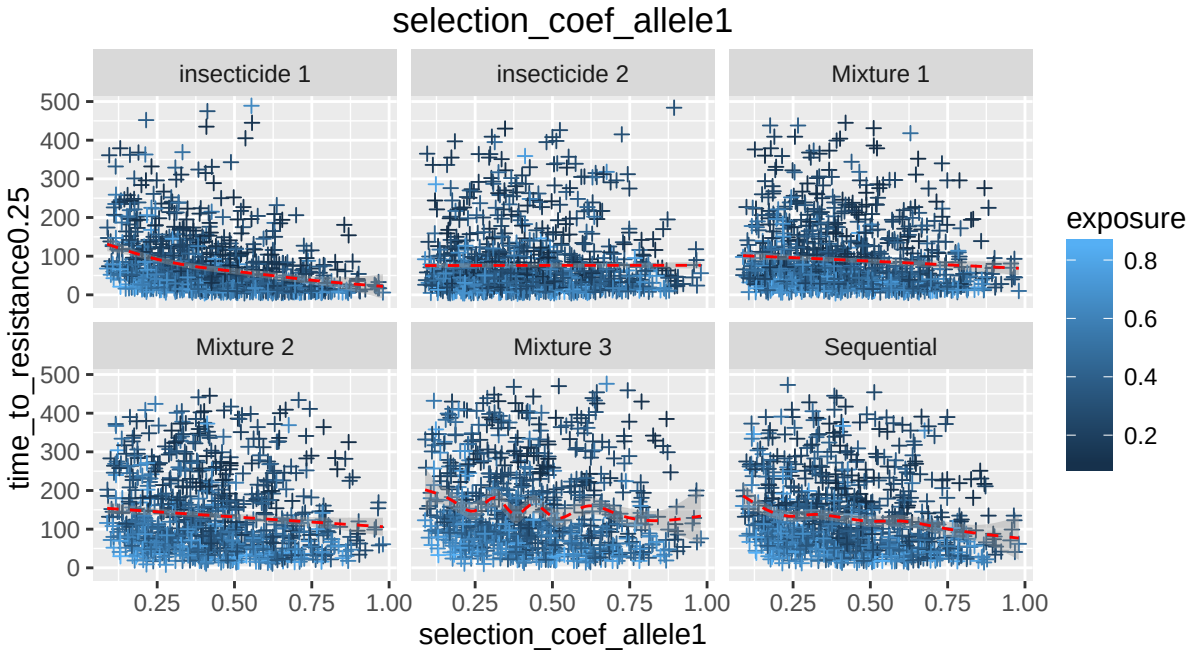

exposure
insecticide 1
insecticide 2
Mixture 1
Mixture 2
Mixture 3
Sequential
time_to_resistance0.25
exposure
0.2
0.4
0.6
0.8
0
100
200
300
400
500
0.25
0.50
0.75

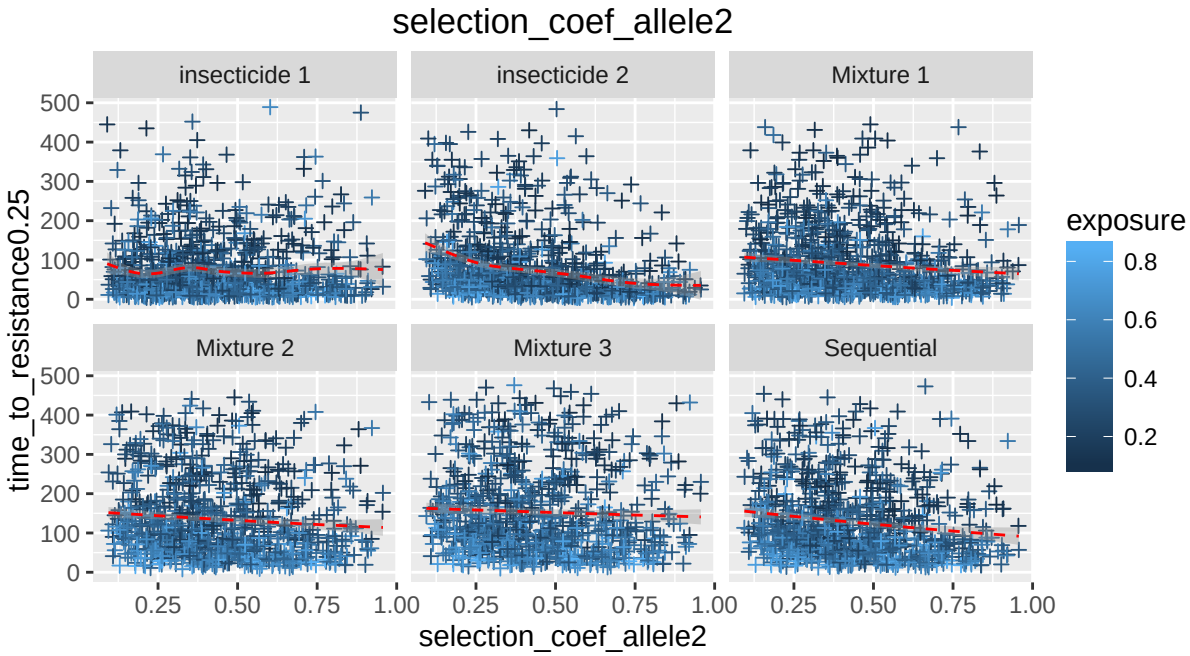

effectiveness_insecticide1
insecticide 1
insecticide 2
Mixture 1
Mixture 2
Mixture 3
Sequential
time_to_resistance0.25
exposure
0.2
0.4
0.6
0.8
0
100
200
300
400
500
0.4
0.6
0.8
1.0

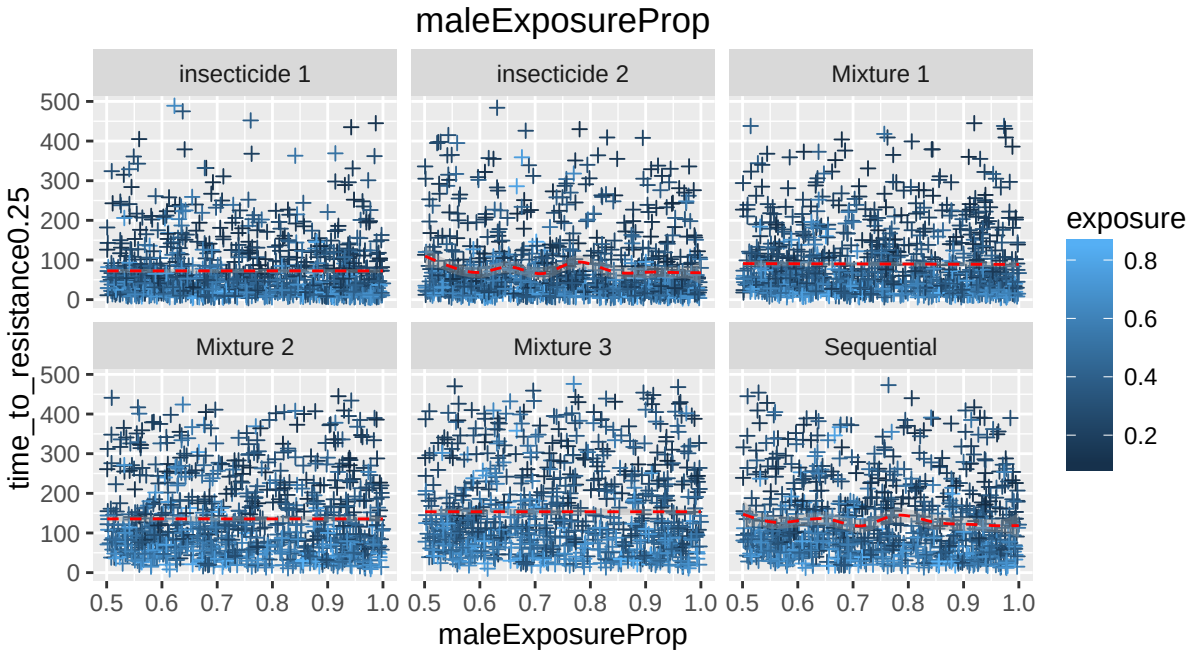

effectiveness_insecticide2
insecticide 1
insecticide 2
Mixture 1
Mixture 2
Mixture 3
Sequential
time_to_resistance0.25
0
100
200
300
400
500
0.4
0.6
0.8
1.0
effectiveness_insecticide2
exposure
0.8
0.6
0.4
0.2

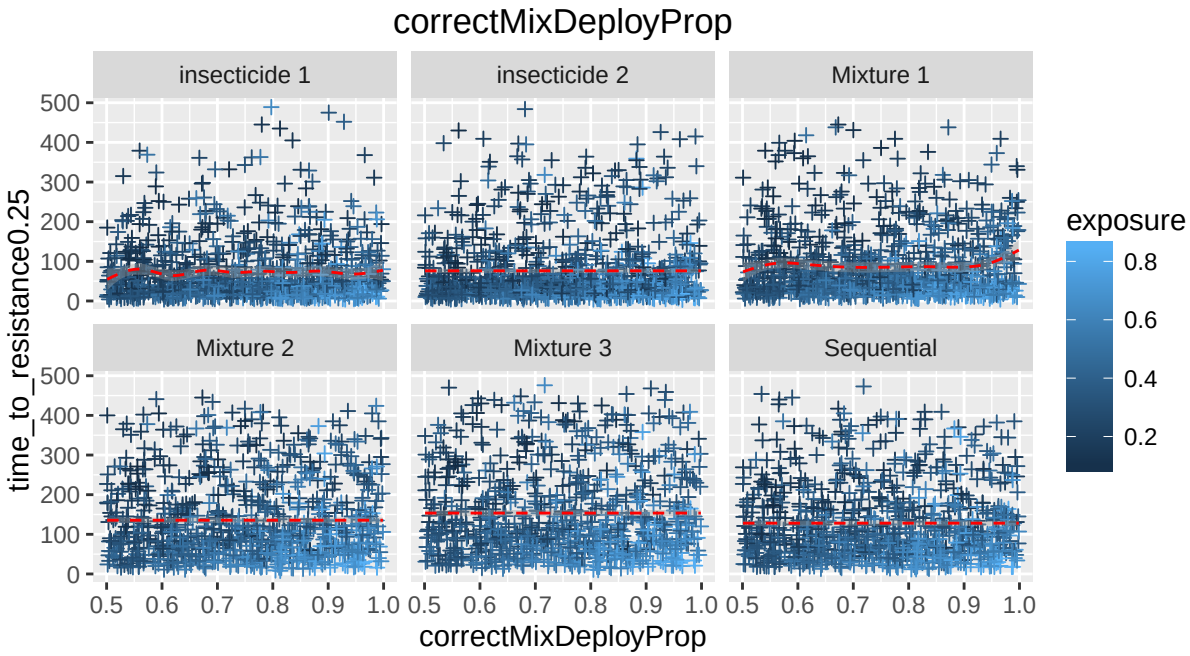

dominance_allele1
insecticide 1
insecticide 2
Mixture 1
Mixture 2
Mixture 3
Sequential
time_to_resistance0.25
0
100
200
300
400
500
0.00
0.25
0.50
0.75
1.00
dominance_allele1
exposure
0.8
0.6
0.4
0.2

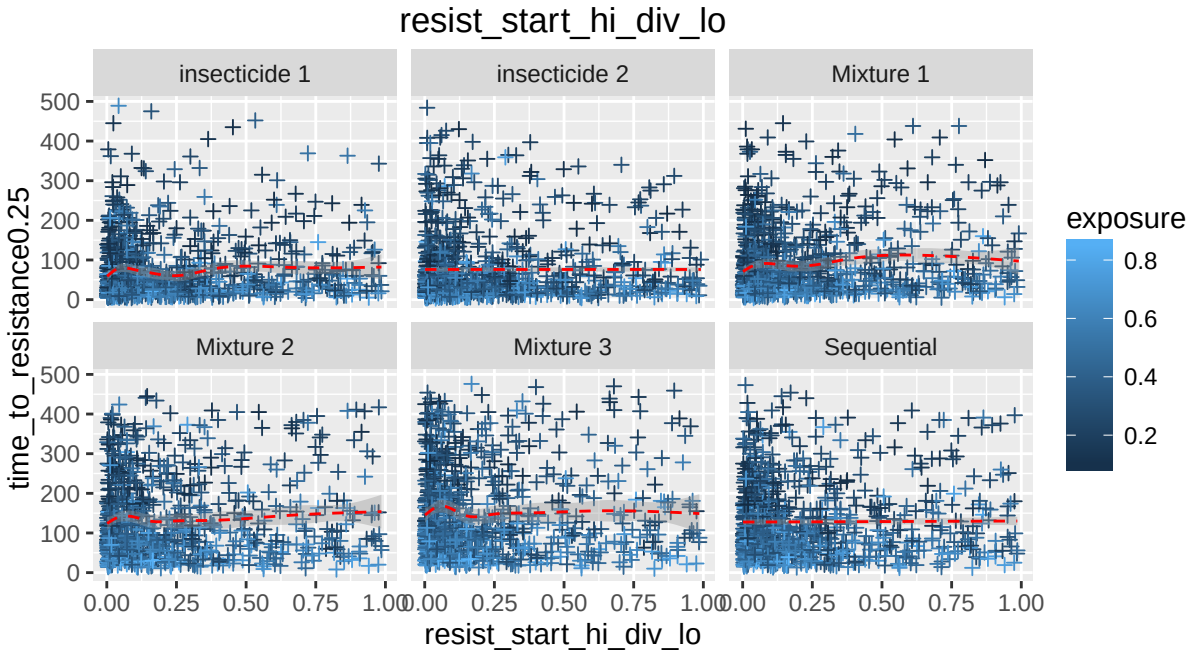

dominance_allele2
insecticide 1
insecticide 2
Mixture 1
Mixture 2
Mixture 3
Sequential
time_to_resistance0.25
dominance_allele2
exposure
0.8
0.6
0.4
0.2

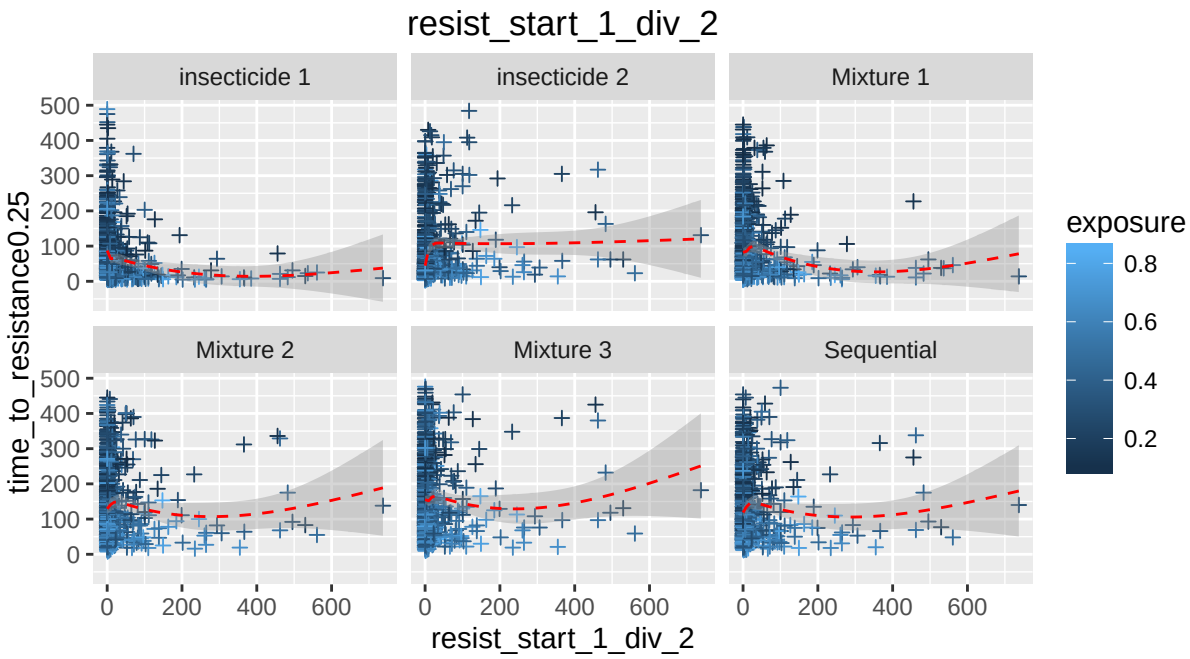

selection_coef_allele1
insecticide 1
insecticide 2
Mixture 1
Mixture 2
Mixture 3
Sequential
time_to_resistance0.25
selection_coef_allele1
exposure
0.8
0.6
0.4
0.2


selection_coef_allele2
insecticide 1
insecticide 2
Mixture 1
Mixture 2
Mixture 3
Sequential
time_to_resistance0.25
0
100
200
300
400
500
0.25
0.50
0.75
1.00
selection_coef_allele2
exposure
0.8
0.6
0.4
0.2

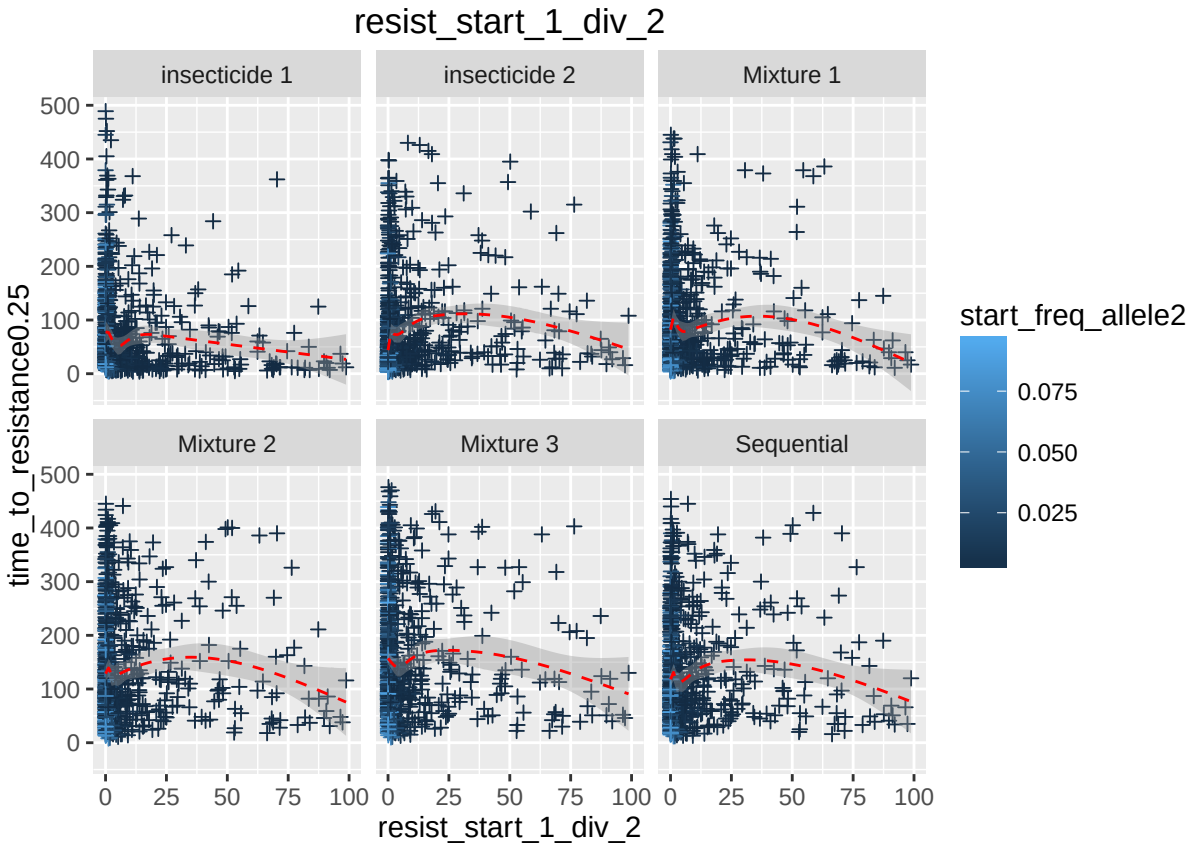

maleExposureProp
insecticide 1
insecticide 2
Mixture 1
Mixture 2
Mixture 3
Sequential
time_to_resistance0.25
0
100
200
300
400
500
0.5
0.6
0.7
0.8
0.9
1.0
maleExposureProp
exposure
0.8
0.6
0.4
0.2


correctMixDeployProp
insecticide 1
insecticide 2
Mixture 1
Mixture 2
Mixture 3
Sequential
time_to_resistance0.25
correctMixDeployProp
exposure
0.8
0.6
0.4
0.2

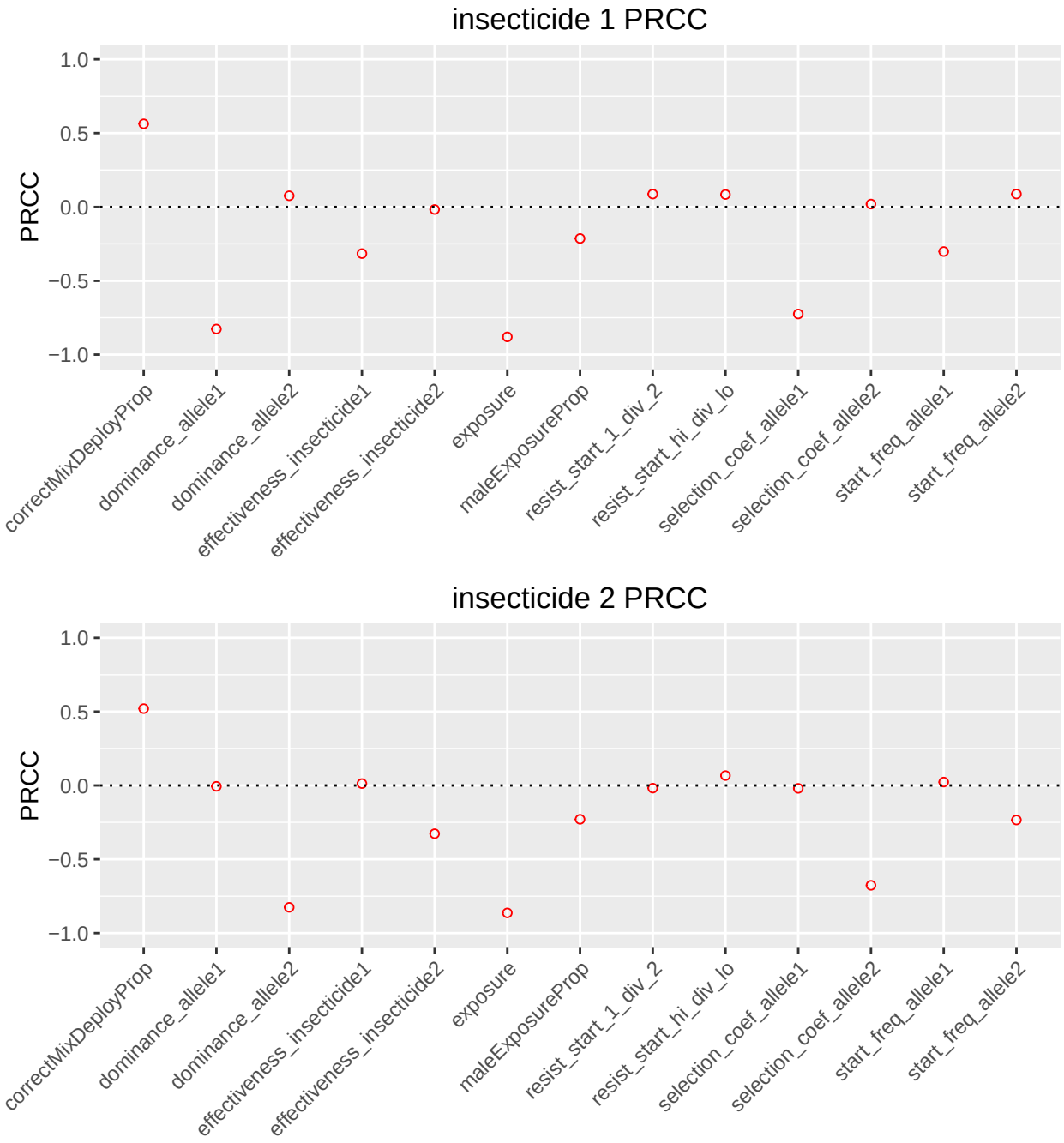

resist_start_hi_div_lo
insecticide 1
insecticide 2
Mixture 1
Mixture 2
Mixture 3
Sequential
time_to_resistance0.25
resist_start_hi_div_lo
exposure
0.8
0.6
0.4
0.2

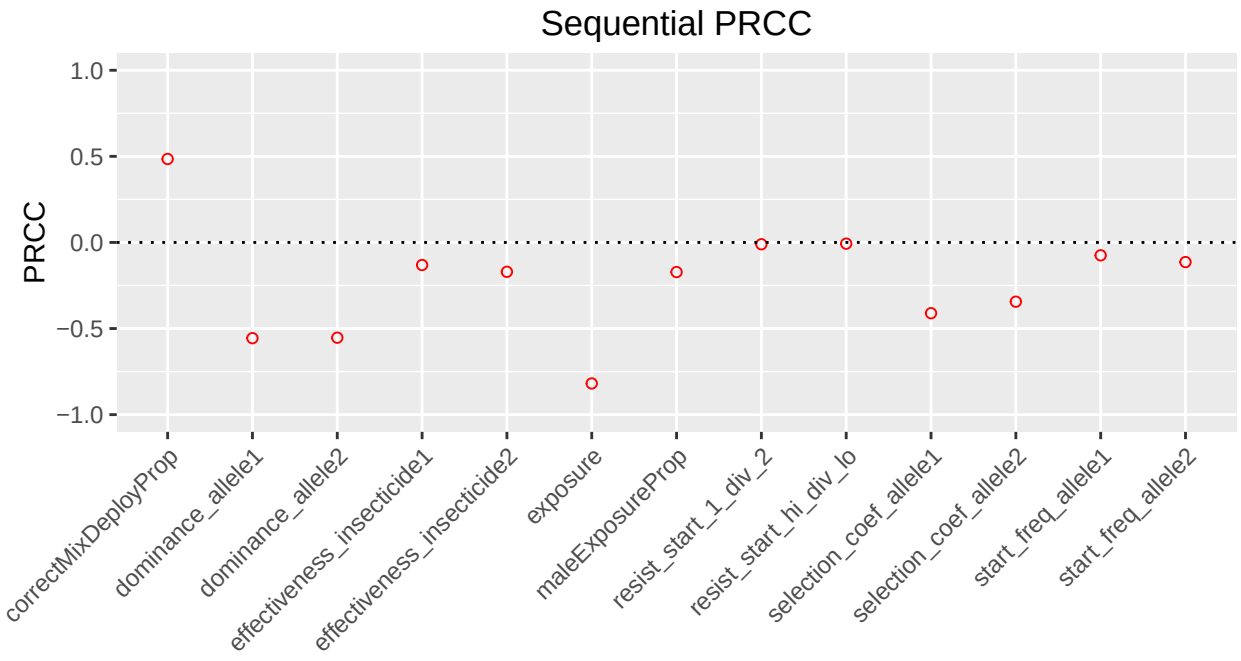

resist_start_1_div_2
insecticide 1
insecticide 2
Mixture 1
Mixture 2
Mixture 3
Sequential
time_to_resistance0.25
resist_start_1_div_2
exposure
0.8
0.6
0.4
0.2
0
100
200
300
400
500
0
200
400
600

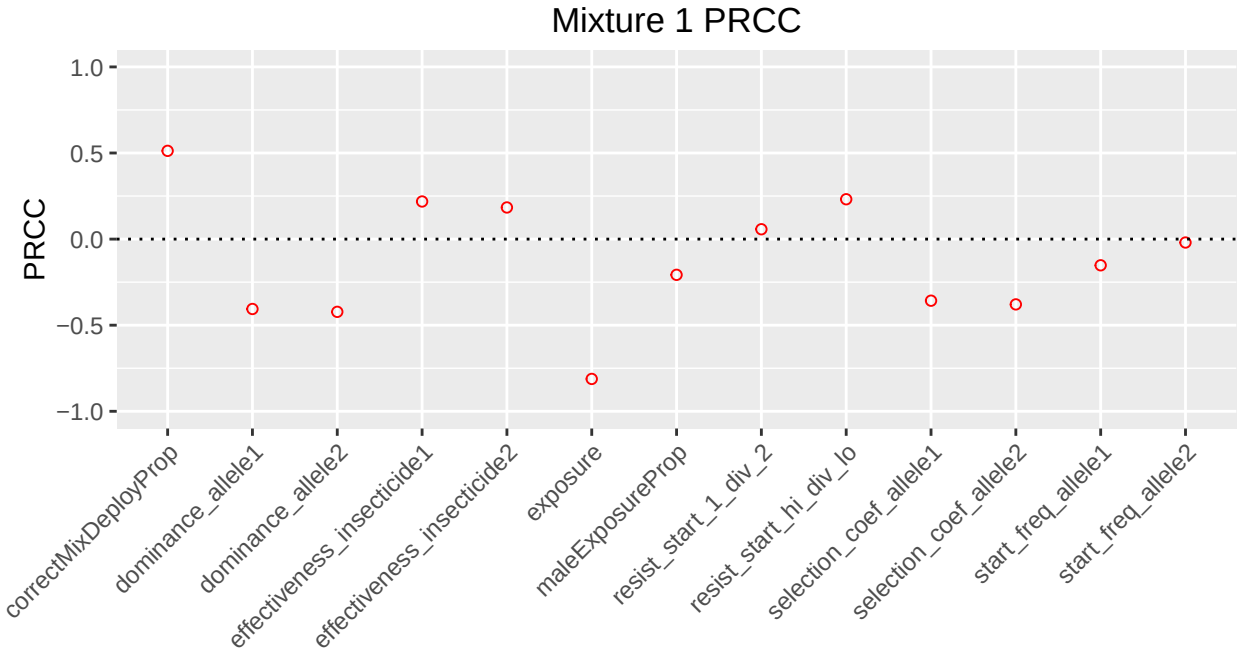
Looking more closely at effect of the ratio between the level of resistance to the first insecticide divided by that of the second one. Restricting the x axis to lower values.

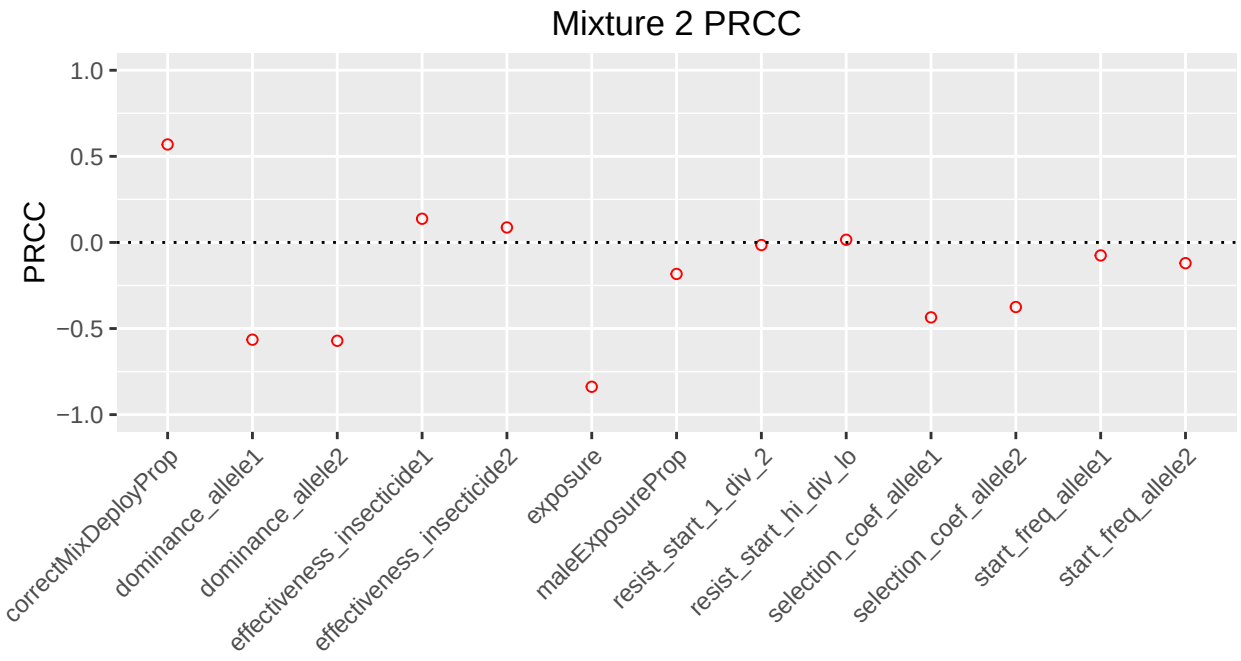


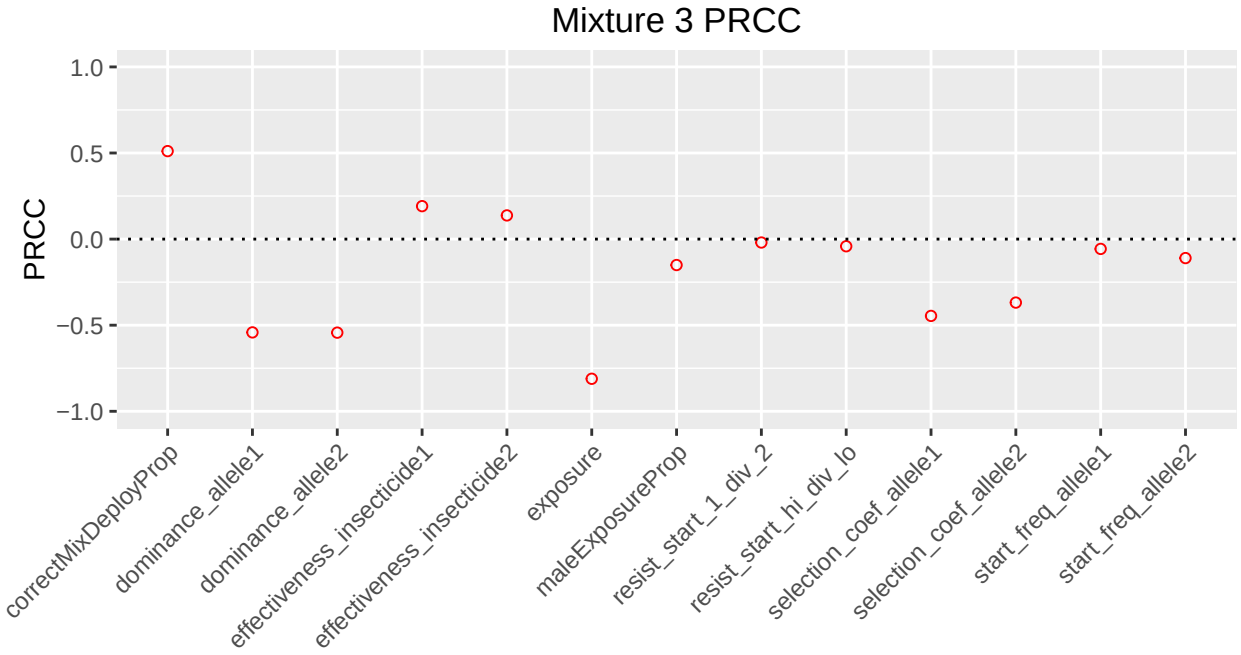
trying a PRCC analysis using the package sensitivity




Sequential PRCC
PRCC
1.0
0.5
0.0
−0.5
−1.0
correctMixDeployProp
dominance_allele1
dominance_allele2
effectiveness_insecticide1
effectiveness_insecticide2
exposure
maleExposureProp
resist_start_1_div_2
resist_start_hi_div_lo
selection_coef_allele1
selection_coef_allele2
start_freq_allele1
start_freq_allele2


Mixture 1 PRCC
PRCC
1.0
0.5
0.0
−0.5
−1.0
correctMixDeployProp
dominance_allele1
dominance_allele2
effectiveness_insecticide1
effectiveness_insecticide2
exposure
maleExposureProp
resist_start_1_div_2
resist_start_hi_div_lo
selection_coef_allele1
selection_coef_allele2
start_freq_allele1
start_freq_allele2


Mixture 2 PRCC
PRCC
1.0
0.5
0.0
−0.5
−1.0
correctMixDeployProp
dominance_allele1
dominance_allele2
effectiveness_insecticide1
effectiveness_insecticide2
exposure
maleExposureProp
resist_start_1_div_2
resist_start_hi_div_lo
selection_coef_allele1
selection_coef_allele2
start_freq_allele1
start_freq_allele2


Mixture 3 PRCC
PRCC
1.0
0.5
0.0
−0.5
−1.0
correctMixDeployProp
dominance_allele1
dominance_allele2
effectiveness_insecticide1
effectiveness_insecticide2
exposure
maleExposureProp
resist_start_1_div_2
resist_start_hi_div_lo
selection_coef_allele1
selection_coef_allele2
start_freq_allele1
start_freq_allele2