Course Schedule (course notes for each section should be read before each class)

Week	Date	Topic
1	Friday January 15	Linear models revisited
2	Friday January 22	Maximum likelihood estimation
3	Friday January 29	Bayesian inference
4	Friday February 5	Poisson models
5	Friday February 12	Binomial models
6	Friday February 19	Introduction to hierarchical models part 1
7	Friday February 26	Introduction to hierarchical models part 2
8	Friday March 4	Project proposals (student presentations)
9	Friday March 11	Project proposals (student presentations)
10	Friday March 18	Constructing hierarchical models (**proposal summaries due**)
11	*Friday March 25*	*SPRING BREAK*
12	Friday April 1	*Work on independent projects*
13	Friday April 8	*Work on independent projects*
14	Friday April 15	*Work on independent projects*
15	Friday April 22	Final student presentations
16	Friday April 29	Final student presentations
17	Friday May 6	Final student presentations

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One week after the initial presentation students will be required to submit a 1-page project proposal that incorporates feedback from the class and

Goals for projects:

- use your own data (or data you know well)
- write out your model (by hand + LaTeX)
- understand all the parameters in your model
- fit the model using Stan
- assess the model
- interpret (and plot) the parameter estimates
- we don't really care about biological implications of you model

Things to keep in mind:

(1) hierarchical data

(2) keep it (relatively) simple

(3) do I have any prior information?

(4) assessing your model

The Experiment

Taricha torosa

Ribeiroia ondatrae

n = 364

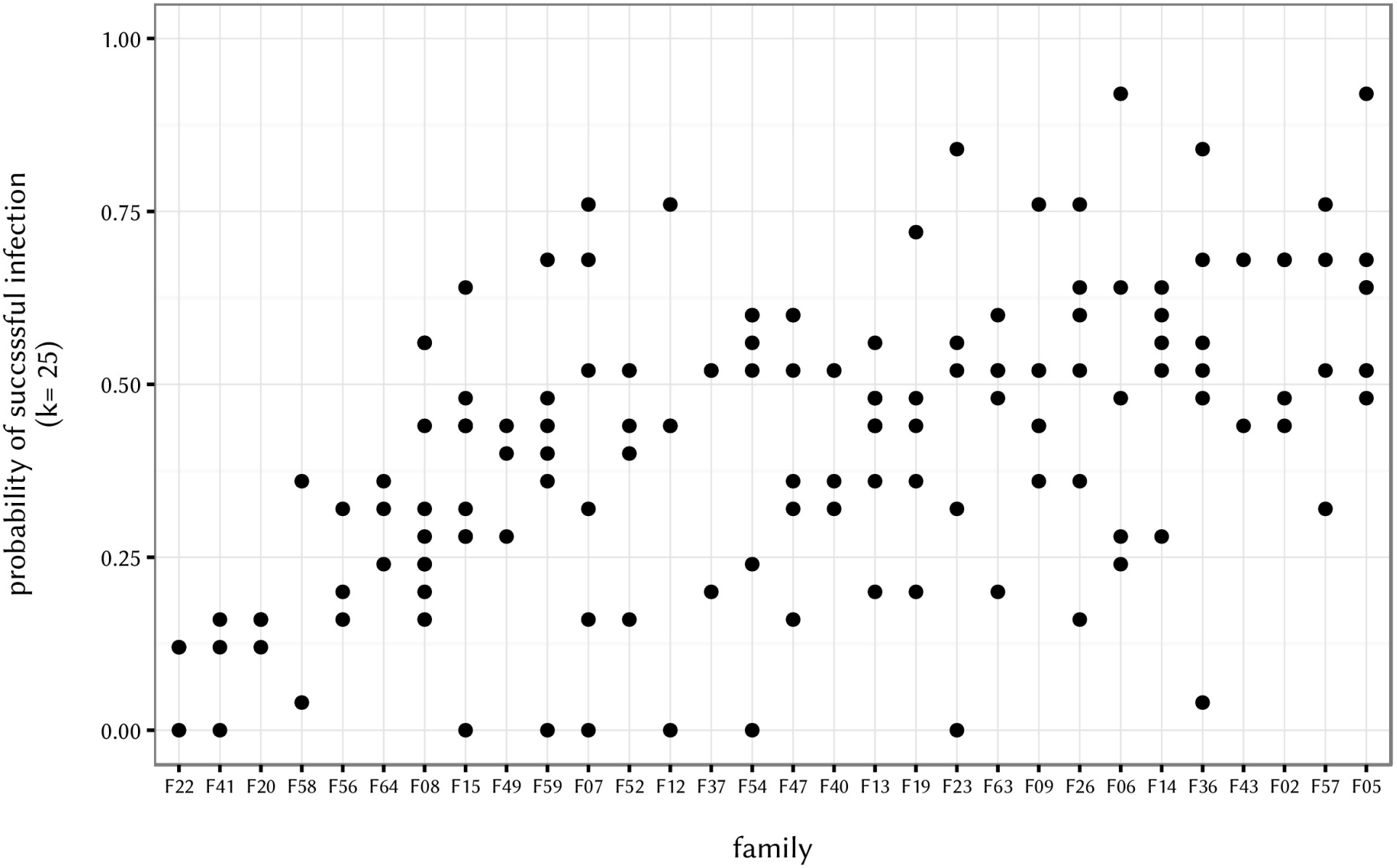
n_families = 30

k = 25 parasites

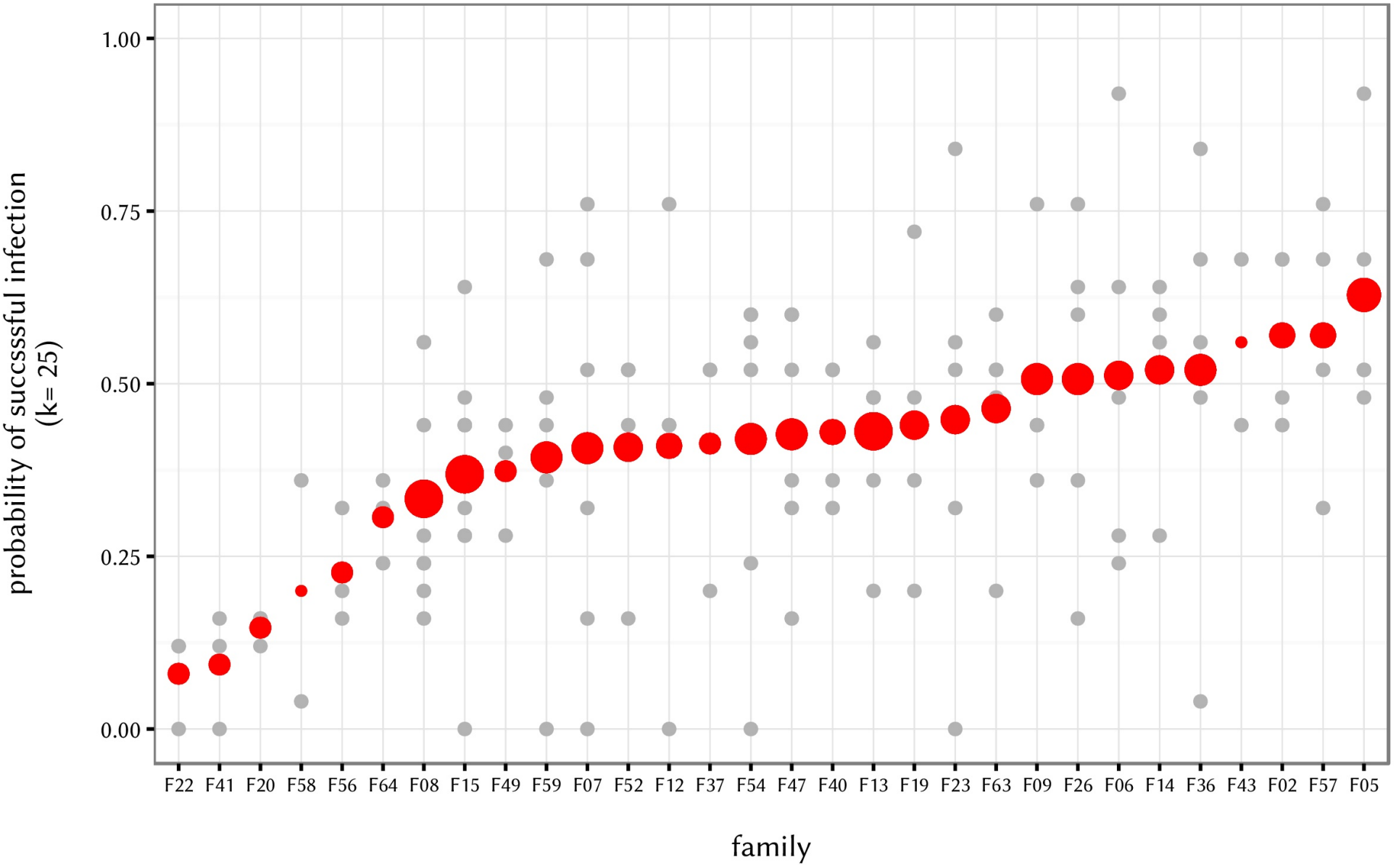
The Question

How much variation in resistance can be attibuted to family relatedness (i.e. heritability)?

The Data


probability of succssful infection
(k= 25)
1.00
0.75
0.50
0.25
0.00
F22 F41 F20 F58 F56 F64 F08 F15 F49 F59 F07 F52 F12 F37 F54 F47 F40 F13 F19 F23 F63 F09 F26 F06 F14 F36 F43 F02 F57 F05
family

The Data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family

The Model

$$y_i \sim Binomial(k, p_i)$$

$$logit(p_i) = \beta_0 + X_i \beta + \alpha_i + \alpha_{j[i]} + \alpha_{wave[i]} + \alpha_{block[i]}$$

$$\beta_0 \sim Normal(logit(0.22), 0.7)$$

$$\beta \sim Normal(0, \phi)$$

$$\alpha \sim Normal(0, \sigma)$$

$$\phi \sim halfNormal(0, 5)$$

$$\sigma \sim halfNormal(0, 5)$$

The Model

repeatability (upper bound estimate on heritability)

$$\sigma_j^2 / \left(\sigma_i^2 + \sigma_j^2 \right)$$