



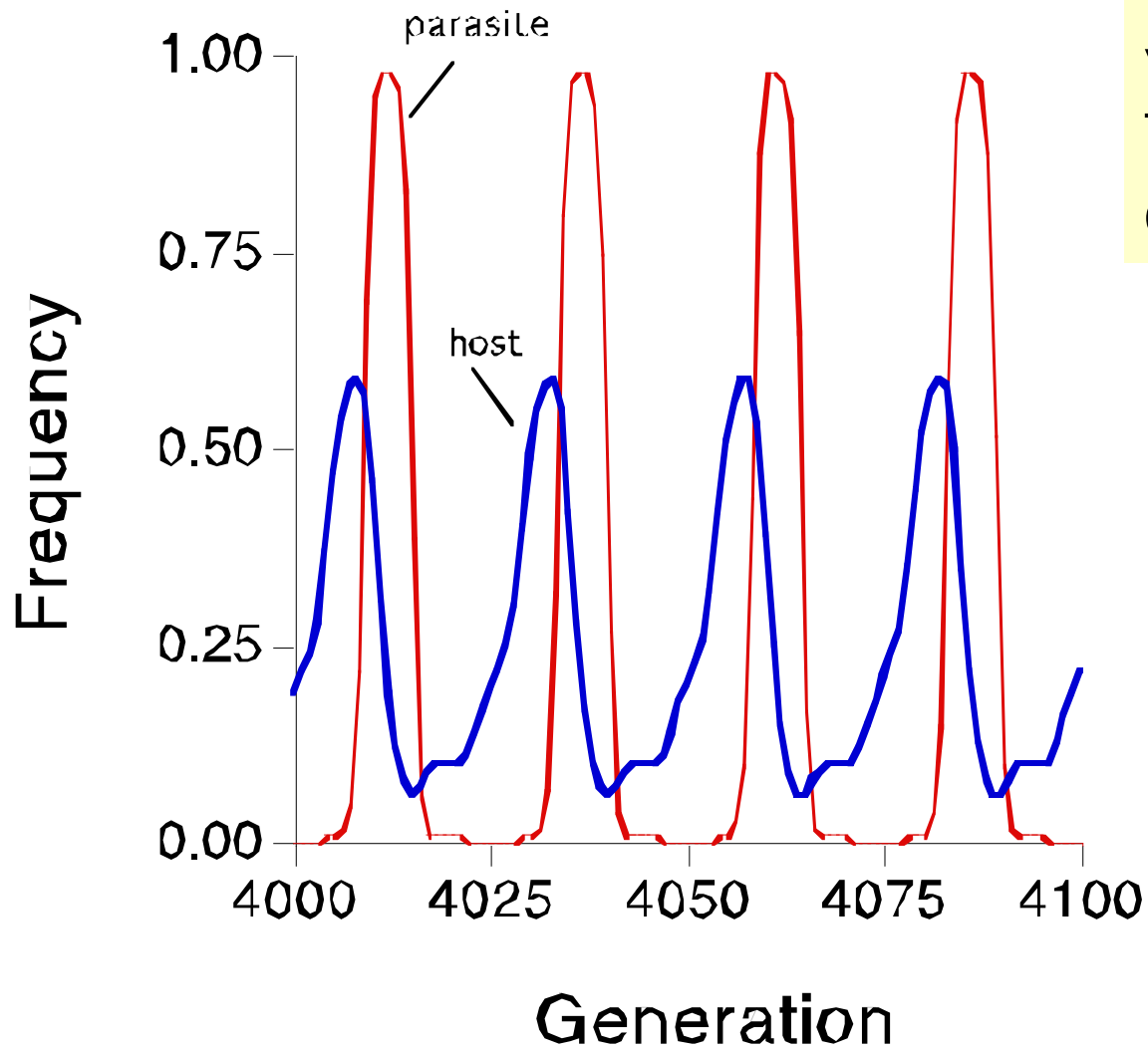
the red queen in playing cards

a laboratory exercise

Key concepts:

- Host-parasite coevolution
- Rare advantage
- Maintenance of variation

The **Red Queen** hypothesis: selection against common genotypes maintains genetic variation through time.



“Now, **here**, you see, it takes all the running you can do to keep in the same place.”

Carrol (1872)



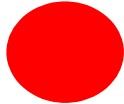
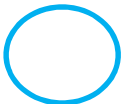
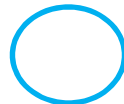
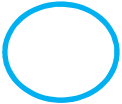
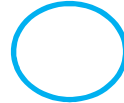
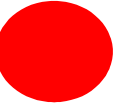
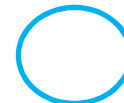


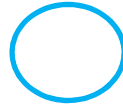




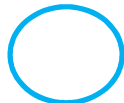
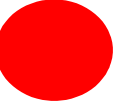
Prediction: parasites maintain variation in their host population

Assumption: parasites match specific host genotypes

Matching alleles

host

parasite

	A	B	C	D
A				
B				
C				
D				








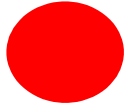


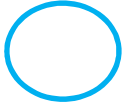








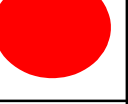




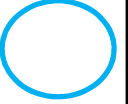

Prediction: parasites maintain variation in their host population

Assumption: parasites match specific host genotypes

Matching alleles

host

parasite

 infection
 healthy

You need

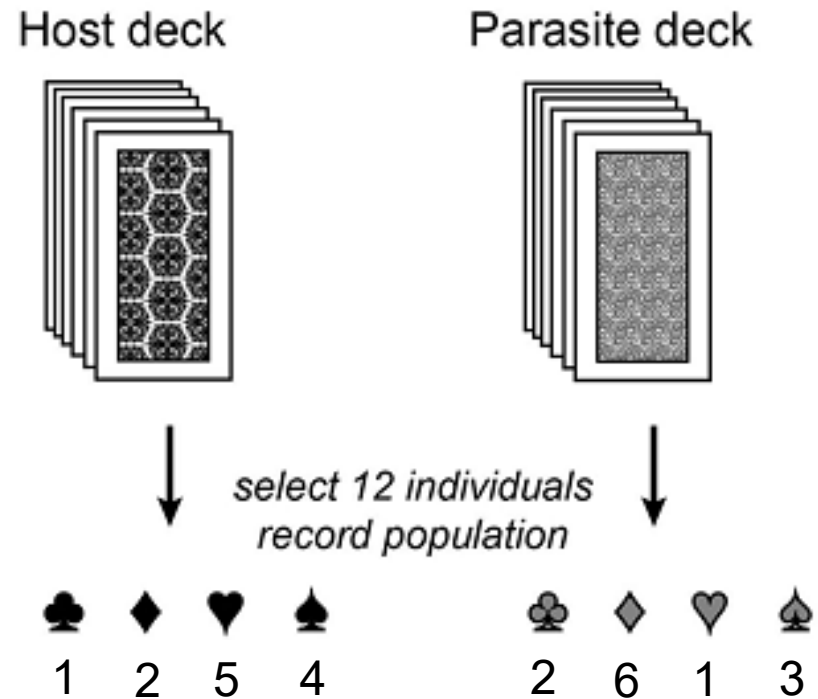
- Teams of three:
 - Recorder
 - Host
 - Parasite
- Computers
- Data sheet – in Excel or Google Sheets
- Handout with instructions and questions
- Blue and Red Deck
 - Note your group number

Set-up: Establish starting populations

1. Host-parasite contact
2. Infection and selection
3. Reproduction
4. Population size regulation

Set-up: Establish starting populations

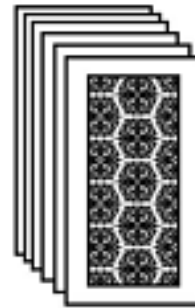
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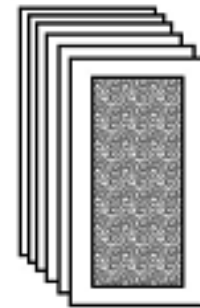
Set-up: Establish starting populations

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Host deck



Parasite deck



↓ select 12 individuals
record population



What's your group's number?
Find the matching tab

Counts		HOST				PARASITE				
Generation	Spades	Clubs	Diamonds	Hearts	Sum	Spades	Clubs	Diamonds	Hearts	Sum
0					0					0
1					0					0
2					0					0
3					0					0
4					0					0
5					0					0
6					0					0
7					0					0

Group1 | Group2 | Group3 | Group4 | Group5 | Group6 | Group7 | Group8

READY

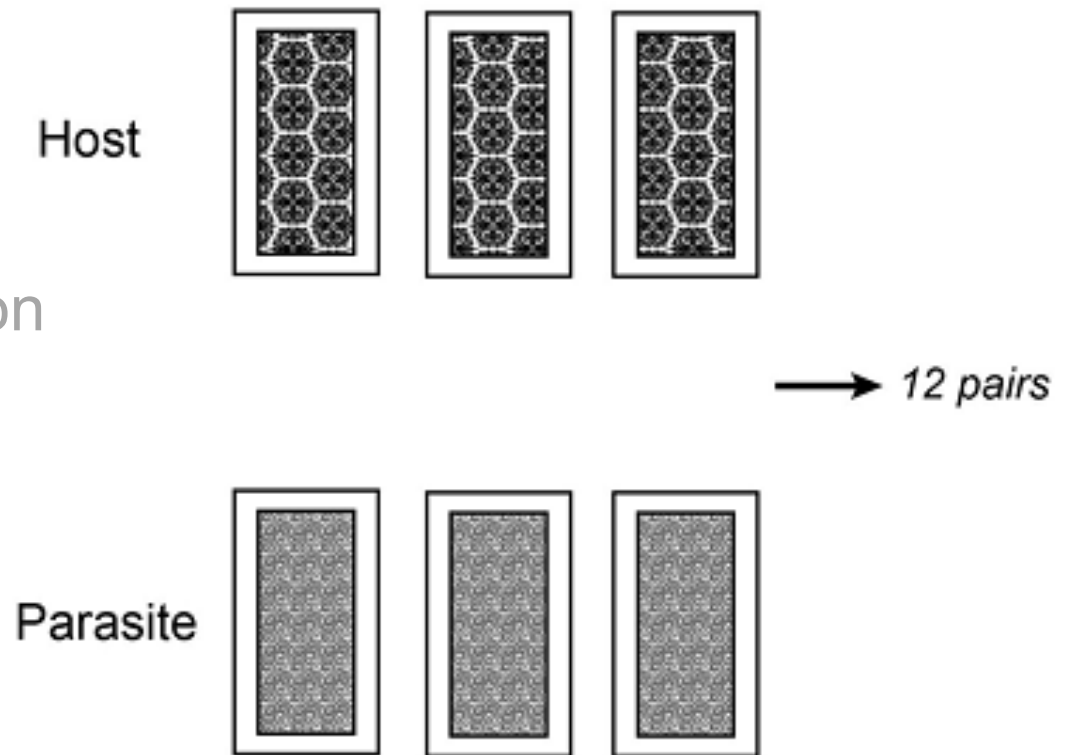
Set-up: Establish starting populations

1. Host-parasite contact

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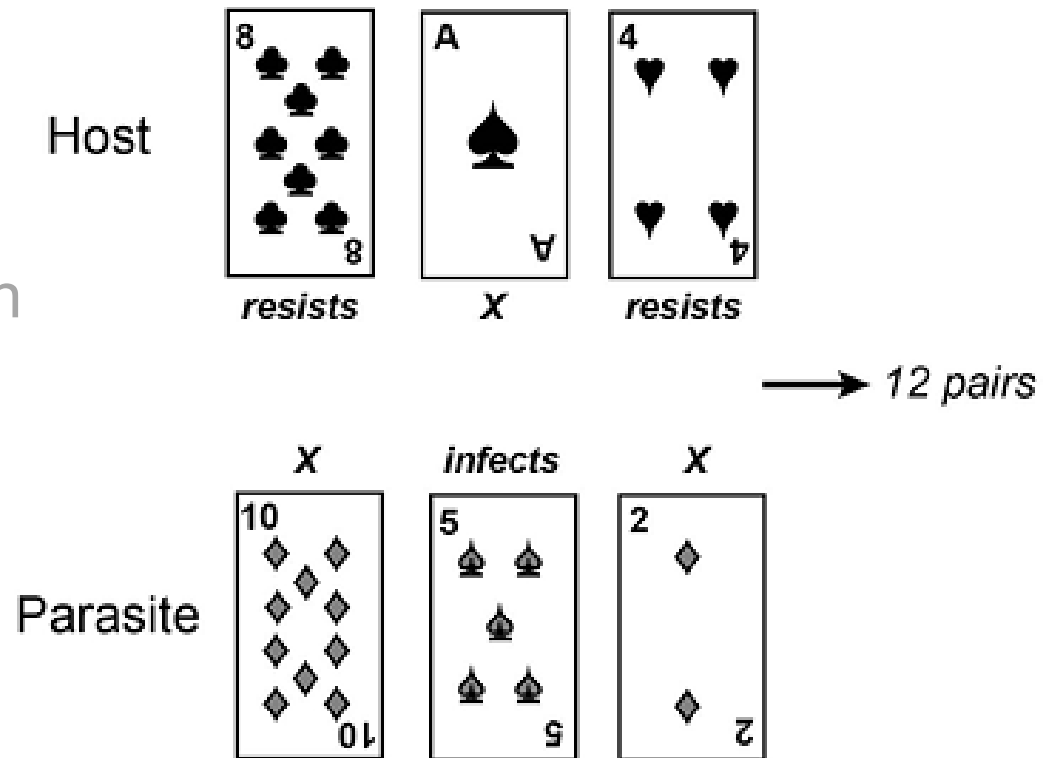
Set-up: Establish starting populations

1. Host-parasite contact

2. Infection and selection

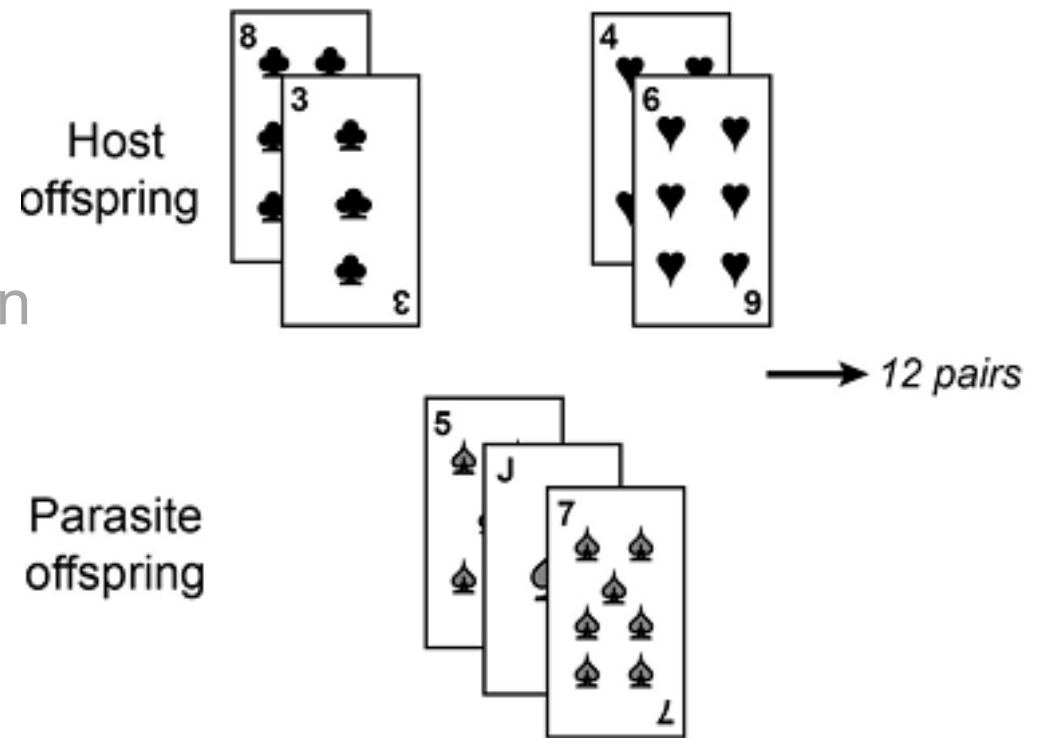
3. Reproduction

4. Population size regulation



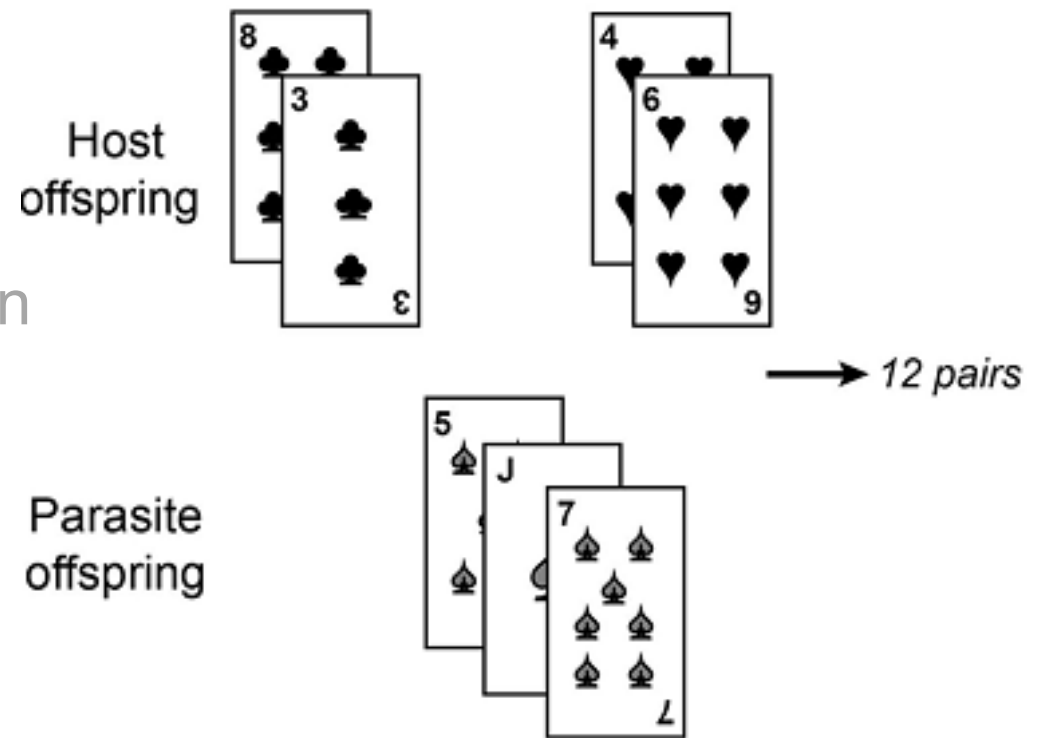
Set-up: Establish starting populations

1. Host-parasite contact
2. Infection and selection
- 3. Reproduction**
4. Population size regulation



Set-up: Establish starting populations

1. Host-parasite contact
2. Infection and selection
- 3. Reproduction**
4. Population size regulation



Too few matching cards in reserve?

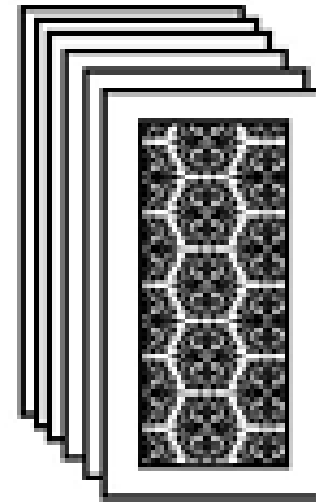
Mutation: randomly select additional offspring

Set-up: Establish starting populations

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4. Population size regulation

Fewer than 12 offspring?

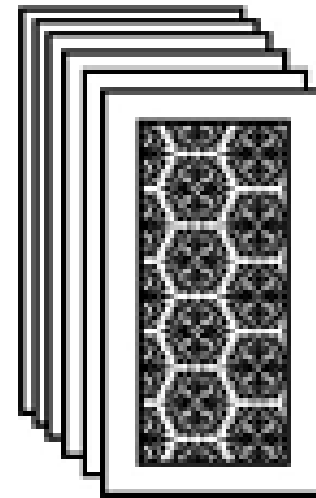


Sample randomly from reserves
Immigration

Set-up: Establish starting populations

1. Host-parasite contact
2. Infection and selection
3. Reproduction
- 4. Population size regulation**

More than 12 offspring?



Randomly discard to reserve
Carrying capacity

Set-up: Establish starting populations

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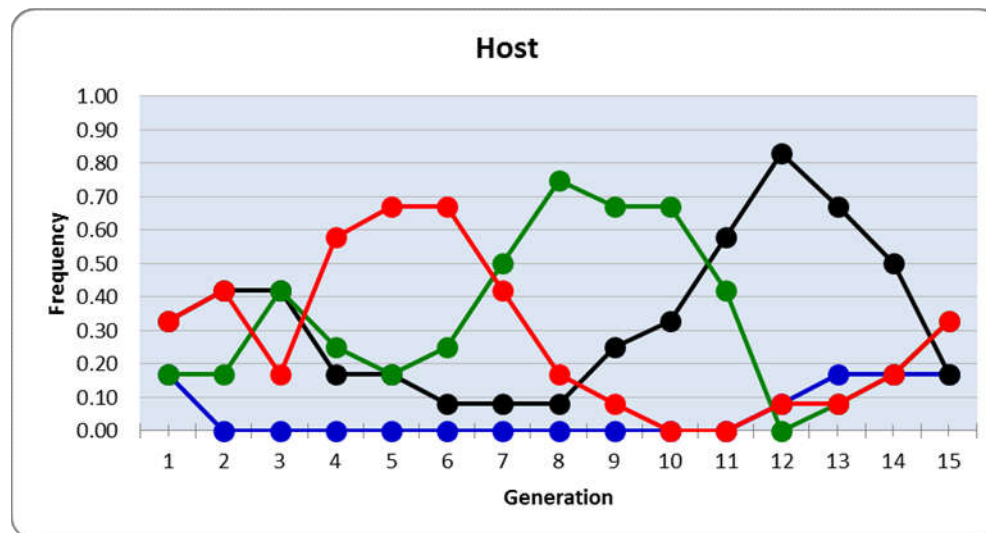
Repeat for 15 rounds

Set-up: Establish starting populations

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Repeat for 15 rounds

And plot your data for you – watch for oscillations through time!

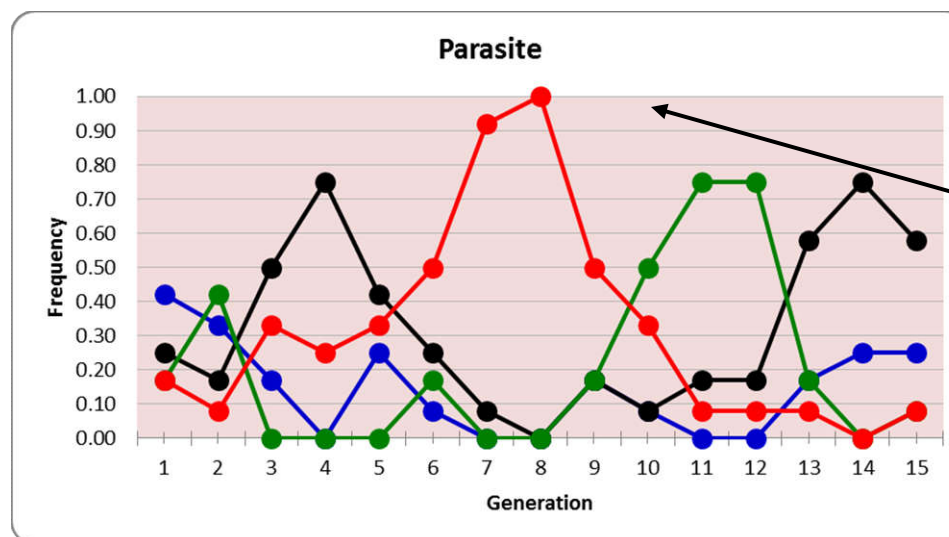


Set-up: Establish starting populations

1. Host-parasite contact
2. Infection and selection
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4. Population size regulation

Repeat for 15 rounds

Look for time lags – peak in a parasite genotype after peak in matching host genotype



Peak at gen. 8
See prior slide for host peak at gen. 6