Group 7

Gobbling up your pollinator

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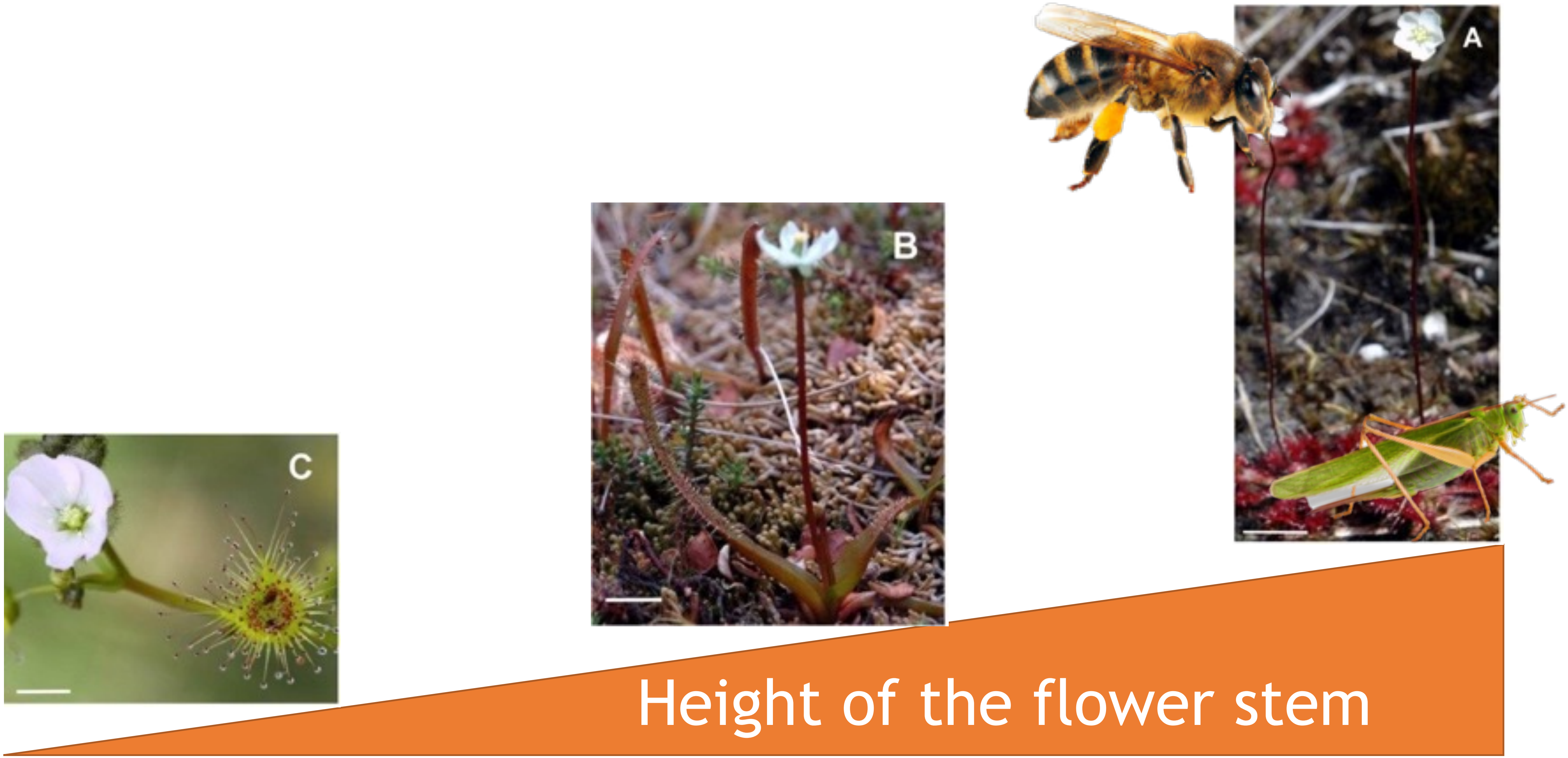
CARNIVOROUS PLANTS

The biological problem

The biological problem



The biological problem

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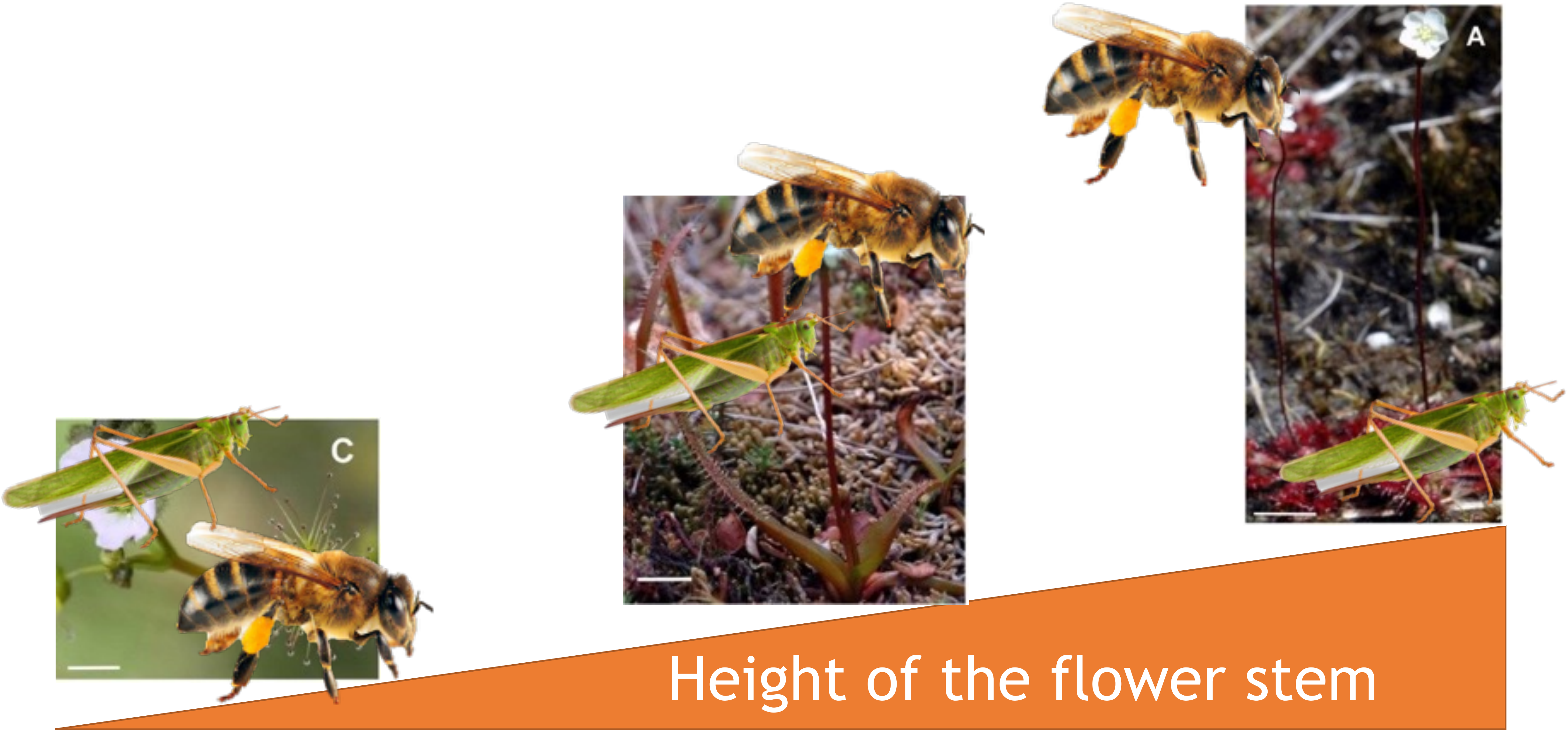
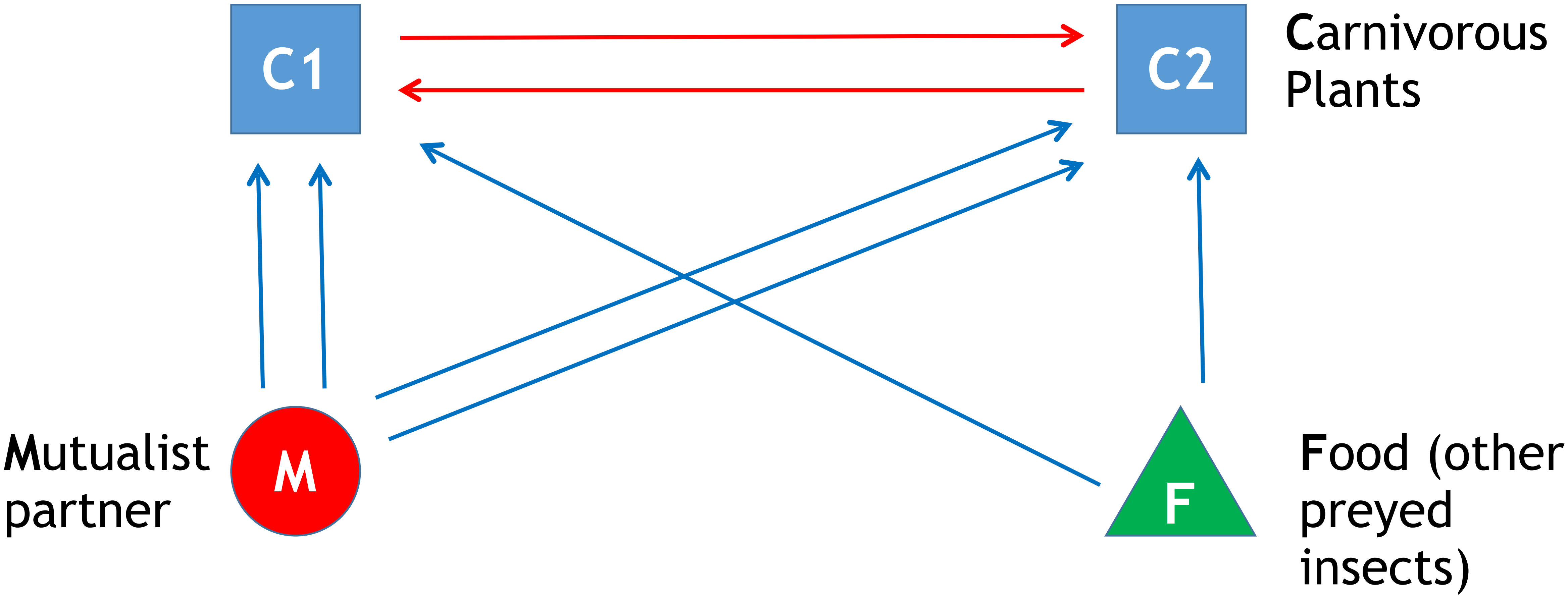


The system


C1
C2
Carnivorous Plants
M
Mutualist partner
F
Food (other preyed insects)

The questions

- 1. Can two species of carnivorous plants with different prey capture strategies coexist sharing the same pollinators and prey populations?

- 2. Is there a relationship between the pressure of competition and the existence of strategies that leads to coexistence?

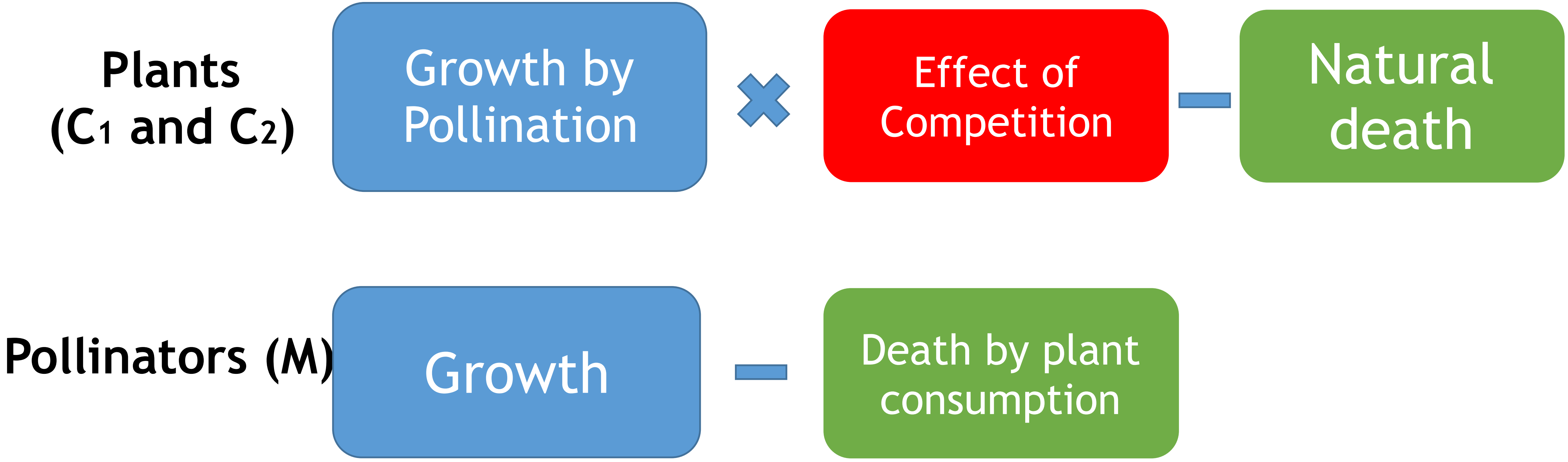
Assumptions

- Plant (natural) death is equal ($\mu_1=\mu_2$)
- Handling time is equal between plants ($h_1=h_2$)
- Plant carrying capacity is equal ($K_1=K_2$)
- Insects preyed (*Food*) are not limiting plant population growth, (F is constant) they're highly abundant
- There’s no structure in plant populations
- Plants only reproduce by sexual reproduction
- Pollinators are generalist (pollinator have many resources)

The model

System of 3 differential equations to describe the population of two plant species with contrasting prey capture strategies and the population of mutualistic pollinators

The model


Plants
(C_1 and C_2)
Growth by Pollination
×
Effect of Competition
−
Natural death
Pollinators (M)
Growth
−
Death by plant consumption

$$
\begin{cases}
\frac{dC_1}{dt} = r_1(M,F)MC_1\left(1 - \frac{C_1}{K_1} - g_{12}\frac{C_2}{K_1}\right) - \mu C_1 \\
\frac{dC_2}{dt} = r_2(M,F)MC_2\left(1 - \frac{C_2}{K_2} - g_{21}\frac{C_1}{K_2}\right) - \mu C_2 \\
\frac{dM}{dt} = r_m M\left(1 - \frac{M}{K_m}\right) - \left(\frac{(1-p_1)MC_1}{1+h_1 M} + \frac{(1-p_2)MC_2}{1+h_2 M}\right)
\end{cases}
$$

Plants (C_1 and C_2): Growth by Pollination × Effect of Competition − Natural death

Pollinators (M): Growth − Death by plant consumption

Growth Death

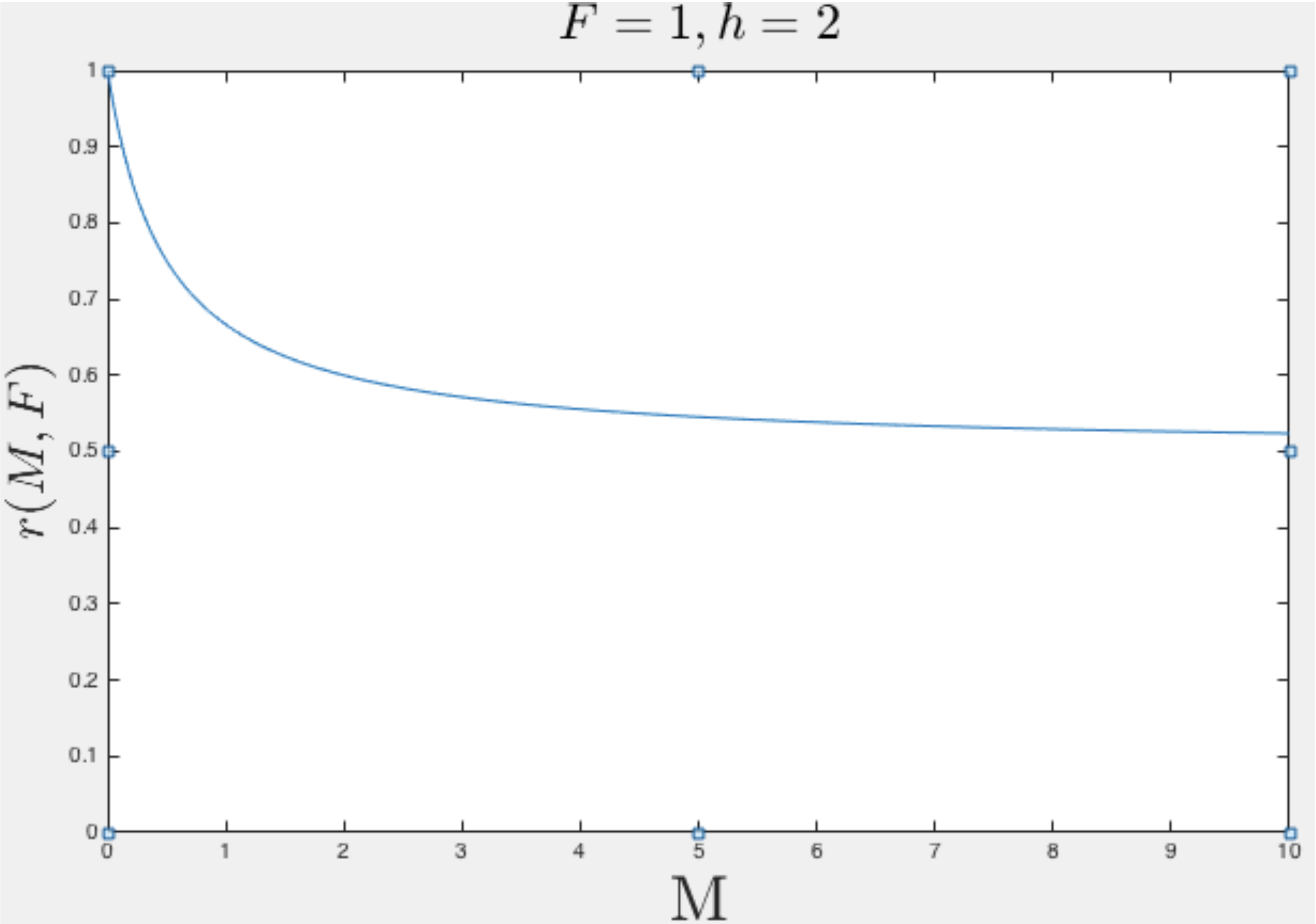
$$\frac{dC_1}{dt} = r_1(M,F)MC_1\left(1 - \frac{C_1}{K_1} - g_{12}\frac{C_2}{K_1}\right) - \mu C_1$$

Pollination Inter-specific Competition

$$r_1(M,F) = r_1 p_1\left(\frac{(1-p_1)C_1M + F}{1 + h_1 M}\right)$$

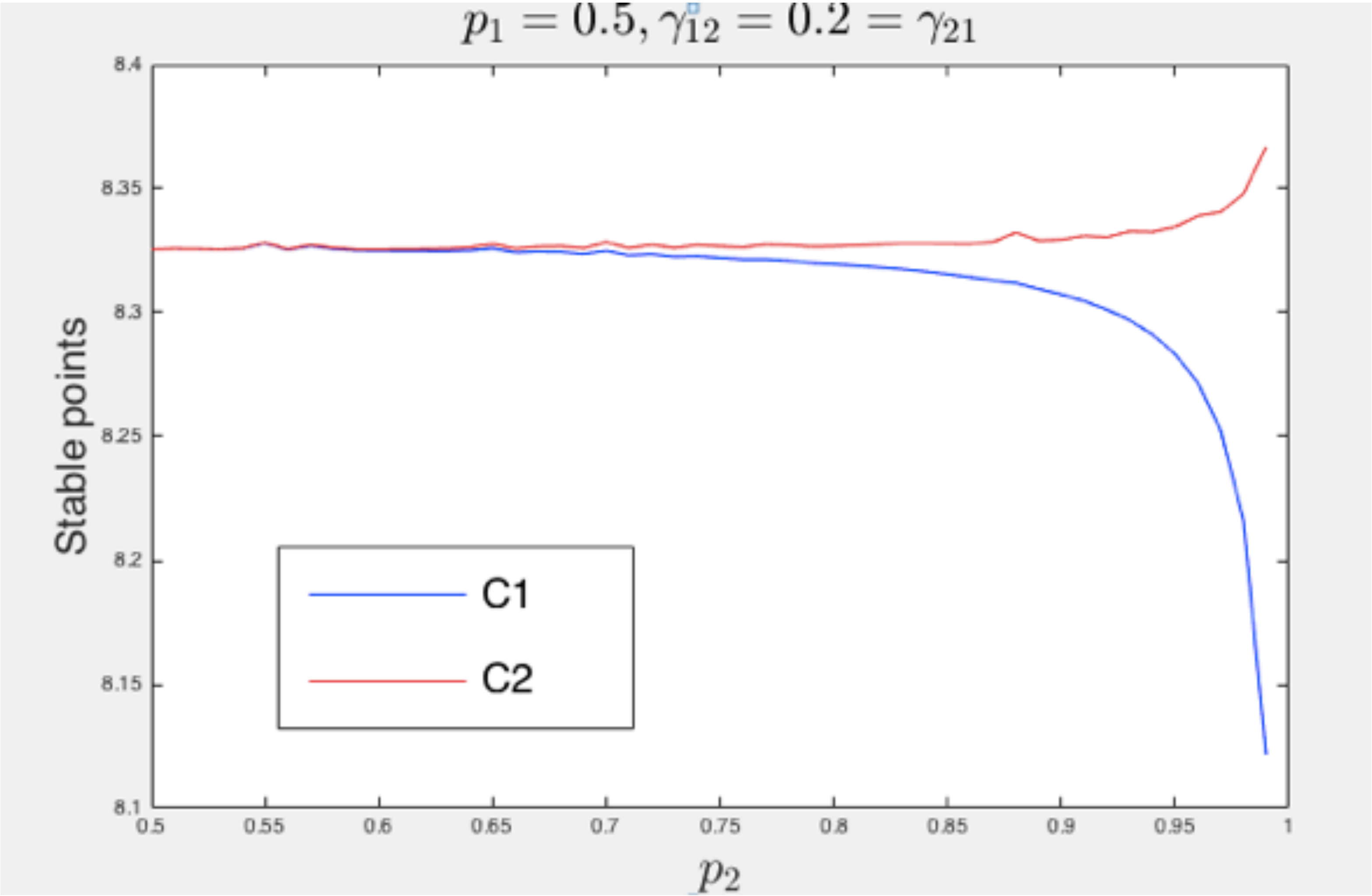
Regulation by feeding

Trade-off factor



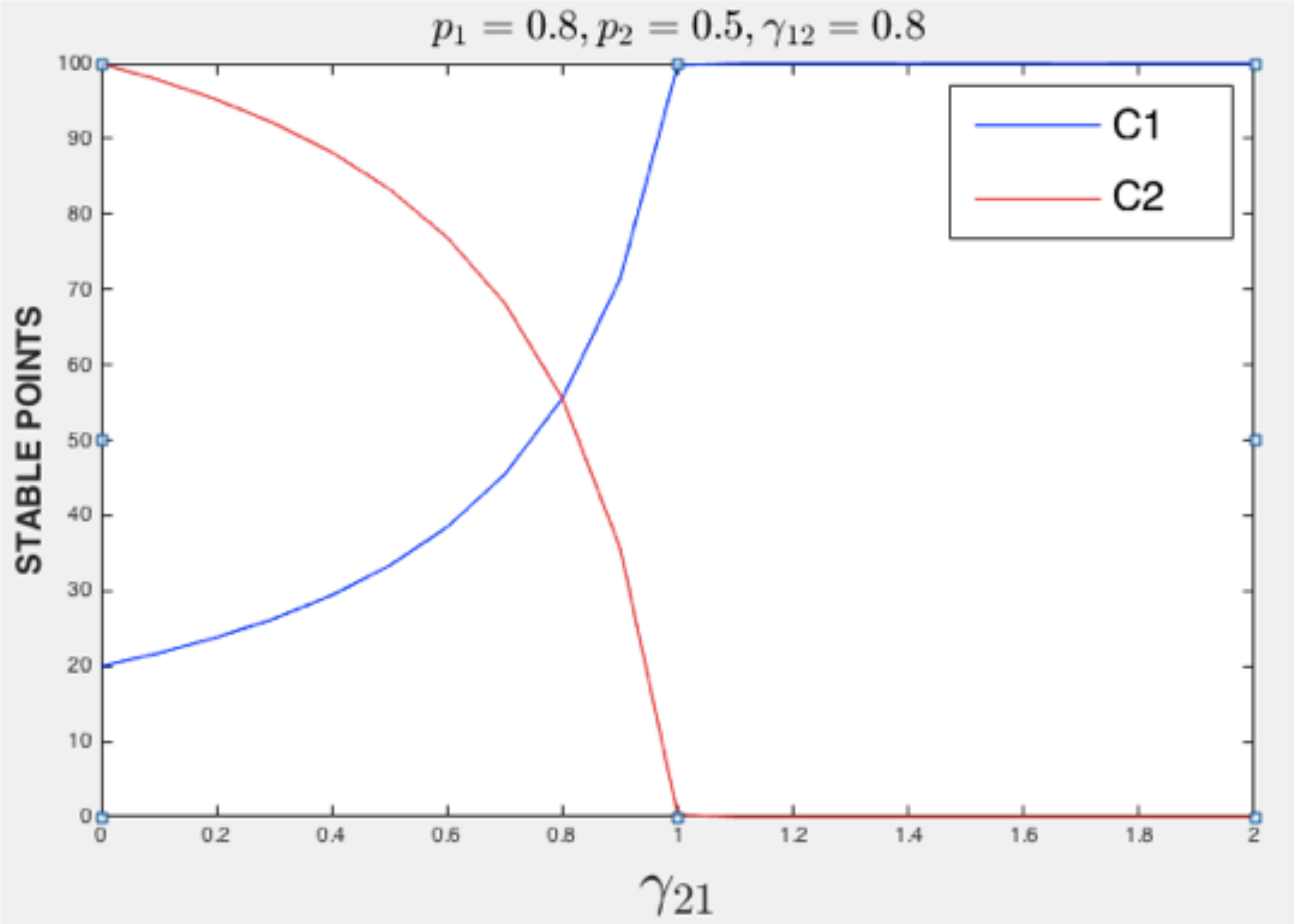
Question 1

Can two species of carnivorous plants with different prey capture strategies coexist sharing the same pollinators and prey populations?



Question 2

Is there a relationship between the pressure of competition and the existence of strategies that leads to coexistence?



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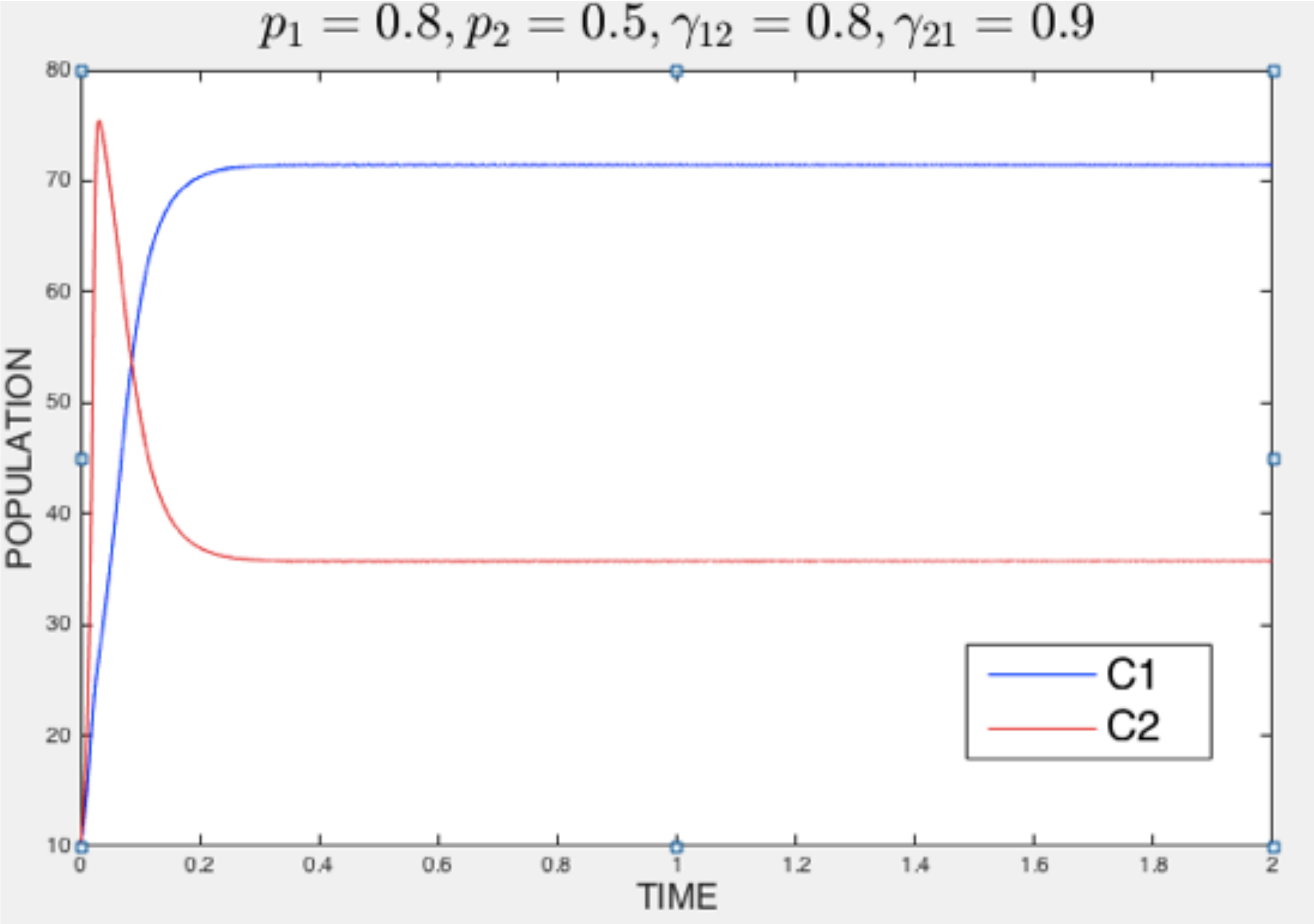

Conclusions

1. If plants compete at the same rate, a large enough difference in strategies leads to coexistence.

2. Good strategies lead to coexistence in many different enviroments (competition for resourses). Although the difference of competition is high, the plant with a better strategy to avoid eating polinators overcomes the other specie.