# The effect of phenotypic plasticity on the invasion success of the New Zealand mudsnail

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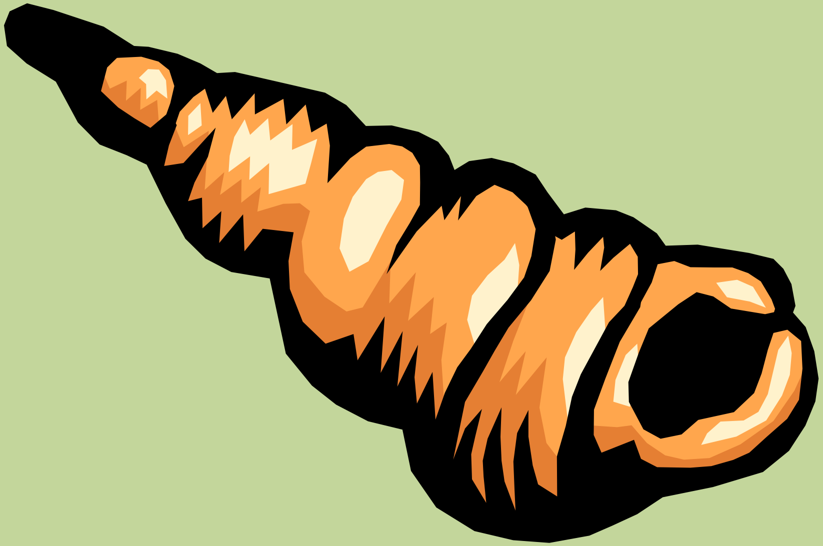
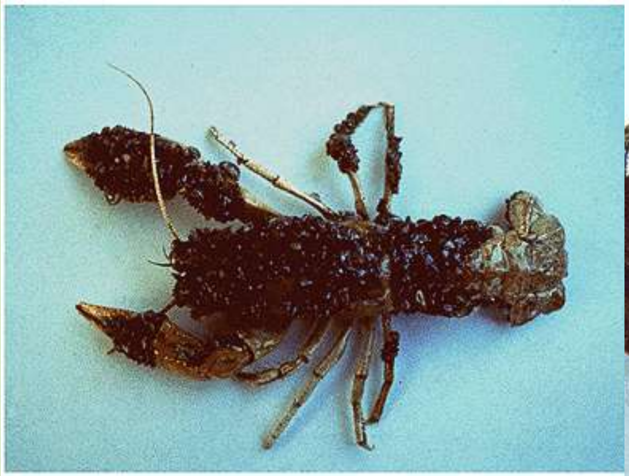
# Overview

- Background
  - Invasive species, New Zealand mudsnail, phenotypic plasticity
- Experimental Design
- Results and Discussion
- Questions



# Invasive species

- Invasive species are the second greatest cause of extinction in all systems.
- According to a review of conservation research from 1984-2004, there has been a lack of research for non-native species that become invasive.



http://el.erdc.usace.army.mil/zebra/zmis/zmishelp/means_of_zebra_mussel_dispersal.htm

U.S. Army Corps of Engineers

http://www.wwpatenaude.com/wzmussel.htm

# What causes invasion?

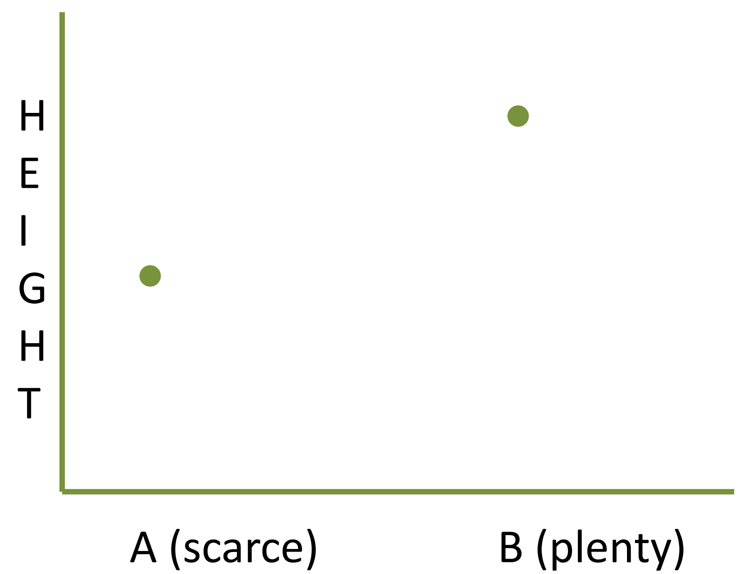
- Species specific traits
  - Life history
  - Dispersal mode
  - Phenotypic plasticity
- Community traits
  - Escape from coevolved enemies

# Phenotypic plasticity

- Phenotypic plasticity – phenotype variation due to environment.

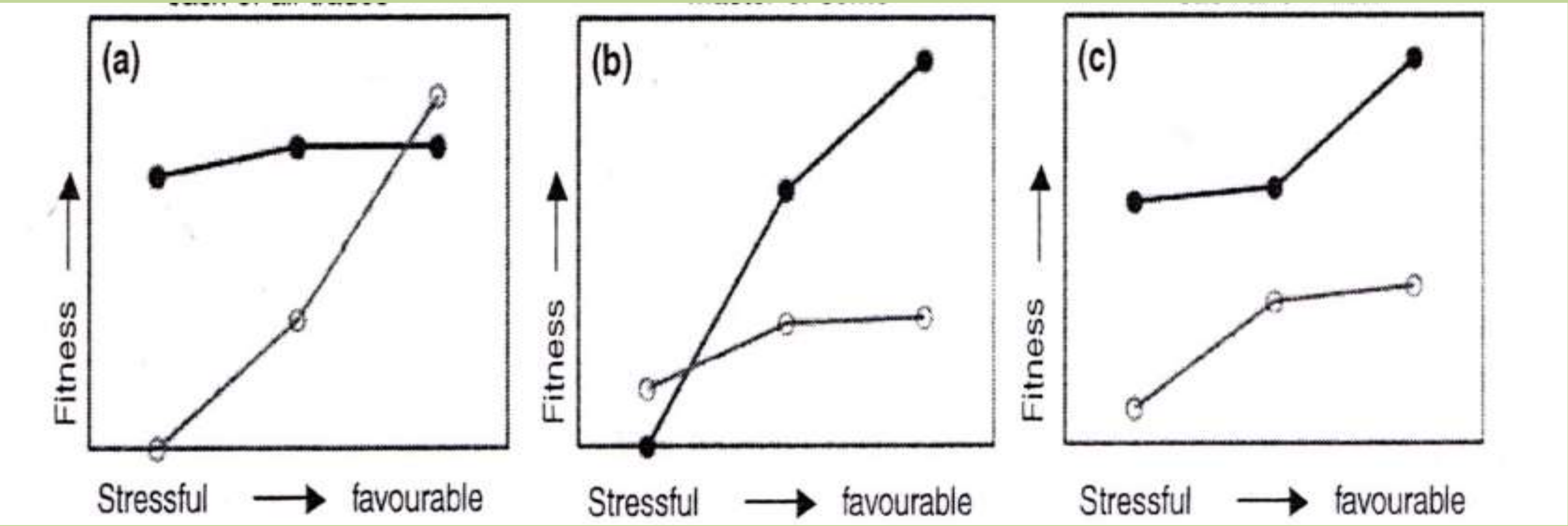
Genotype (DNA) → Phenotype (Physical representation)

http://www.abc.net.au/science/news/img/health/twins270307.jpg



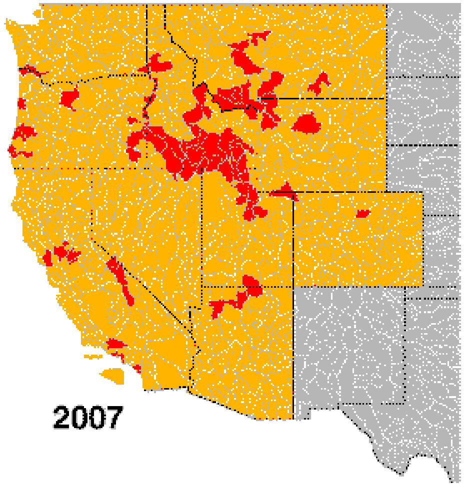
# Phenotypic plasticity

If these specific traits respond to improve an organism's fitness, then plasticity could be a reason for an invasive species' successful domination in its new environment (Richards, et. al 2006).



# New Zealand mudsnail

- *Potamopyrgus antipodarum* was discovered in western United States in 1987.




- They can occur in densities of 500,000 snails per square meter; aggressive consumers (Hall et. al, 2006)
- Parthenogenetic

# Experimental Design

- Investigated the effect of phosphorus (P) and density on the specific growth rate (SGR) of *P. antipodarum.*
- ……More to come.

# Methods

- Collected animals

*Pyrgulopsis idahoensis*

*P. antipodarum*

# Methods

- Cultured algae—how we manipulated dietary phos.

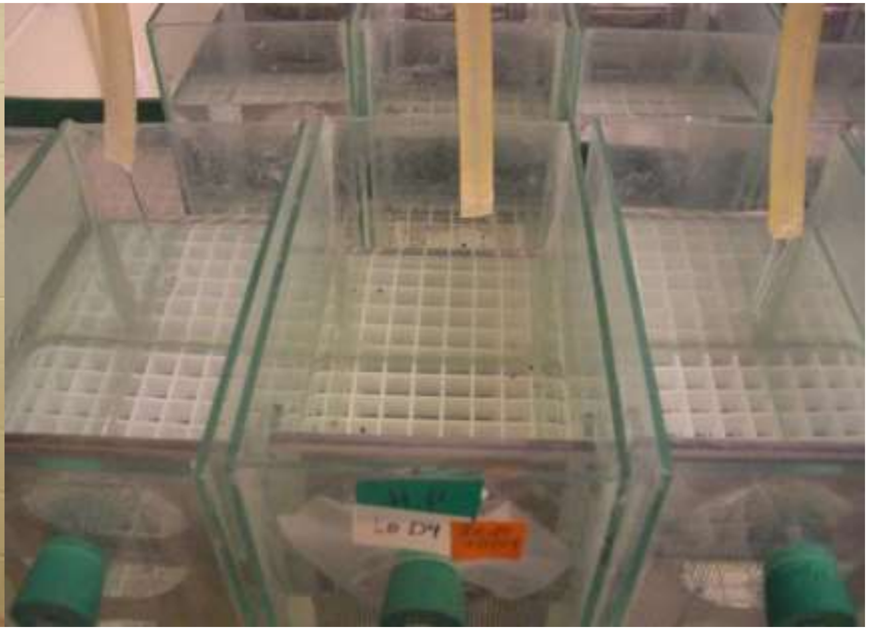
*Scenedesmus acutus*
High P: 0.8ml of phos per L
Low P: 0.2ml of phos per L

# Methods

- Manipulated density levels
  - Low density: 15 *P. antipodarum* 11 *P. idahoensis*
  - High density: 15 *P. antipodarum* 44 *P. idahoensis*
- Environments
  - Low and high density (stressful)
  - Low (stressful) and high phosphorous

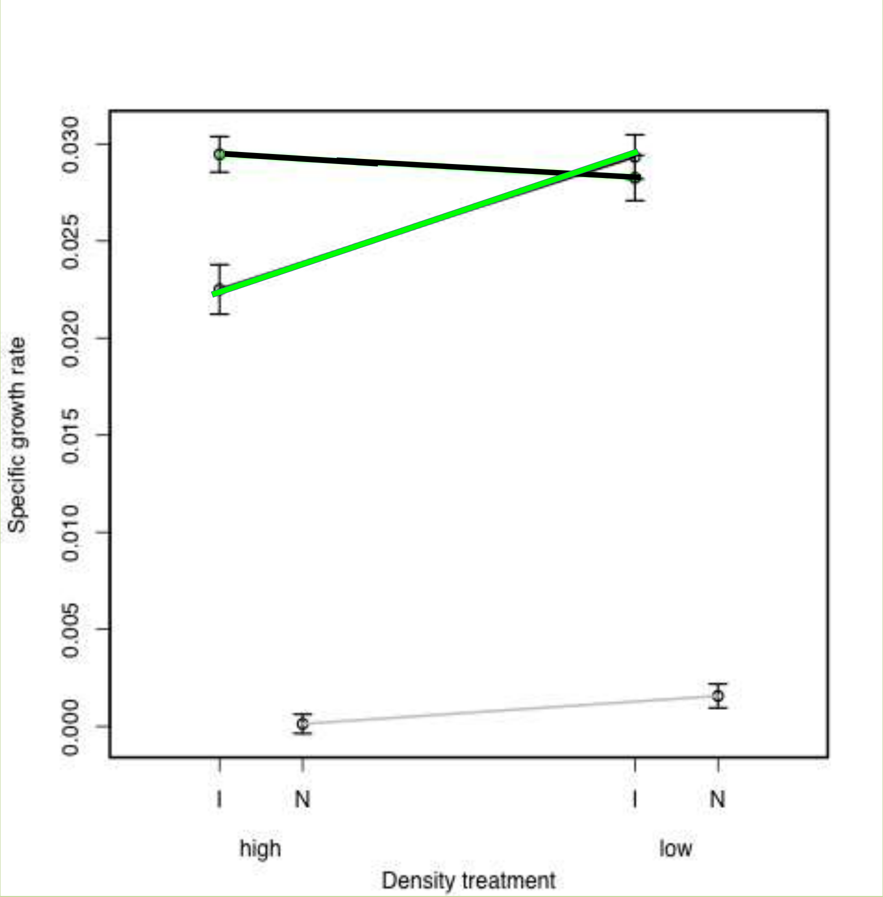
# Methods

- The experiment ran for six weeks.
  - *P. antipodarum* were measured in weeks 0, 2, 4, 5, and 6.
  - *P. antipodarum* were fed three times a week.
  - At week 6, *P. antipodarum* were dissected to count the eggs.



# Experimental Design (Summer 2008)

- Investigated the effect of different levels of phosphorus and snail density to the specific growth rate (SGR) of *P. antipodarum* and compared it to a native species, *Pyrgulopsis idahoensis*.




Invasive:

Lo P

Hi P

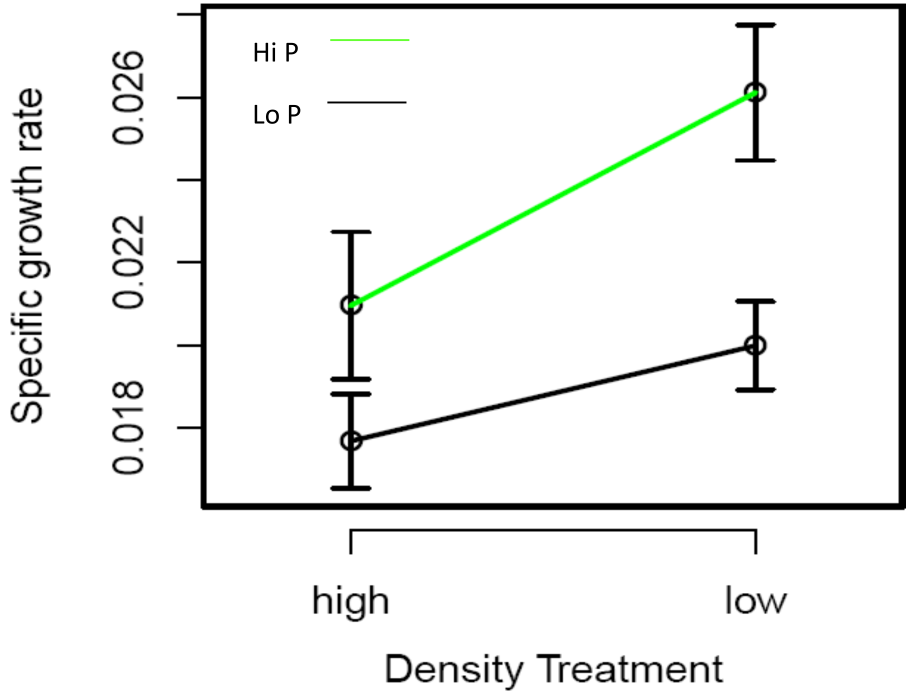
native

# Experimental Design

- Investigated the effect of phos and density on the SGR of *P. antipodarum.*
- Investigated how levels of P affected brooding.
  - Hypothesis: *P. antipodarum* with access to high levels of phosphorus allocated it to reproduction instead of growth.

# Results and Discussion

Both phosphorus and density affect SGR of the invasive snail




Phosphorus: P = 0.001

Density: P = 0.017

Phosphorus by Density: P = 0.323

Summer 2009

# Results and Discussion

Logistic regression shows that only length significantly affected the probability of brooding

Phosphorus: P = 0.815

Density: P = 0.451

Length: P < 0.001

Phosphorus by Density: P = 0.963

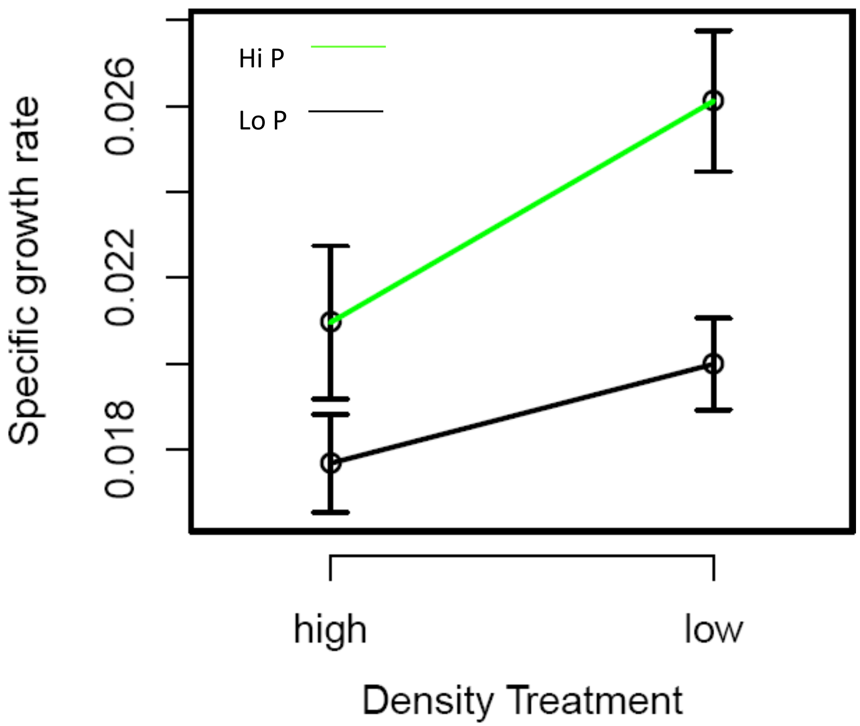
Brooding probability in each treatment

| Treatment | Brooding Probability |
|---|---|
| Hi P | 20% |
| Lo P | 6.6% |

***Length significantly affects brooding. Since growth is dependent upon P, it makes P indirectly related to brooding probability. Thus, the trade-off between reproduction and growth is unlikely.

# Results and Discussion

## SGR of *P. antipodarum* as a function of P and density

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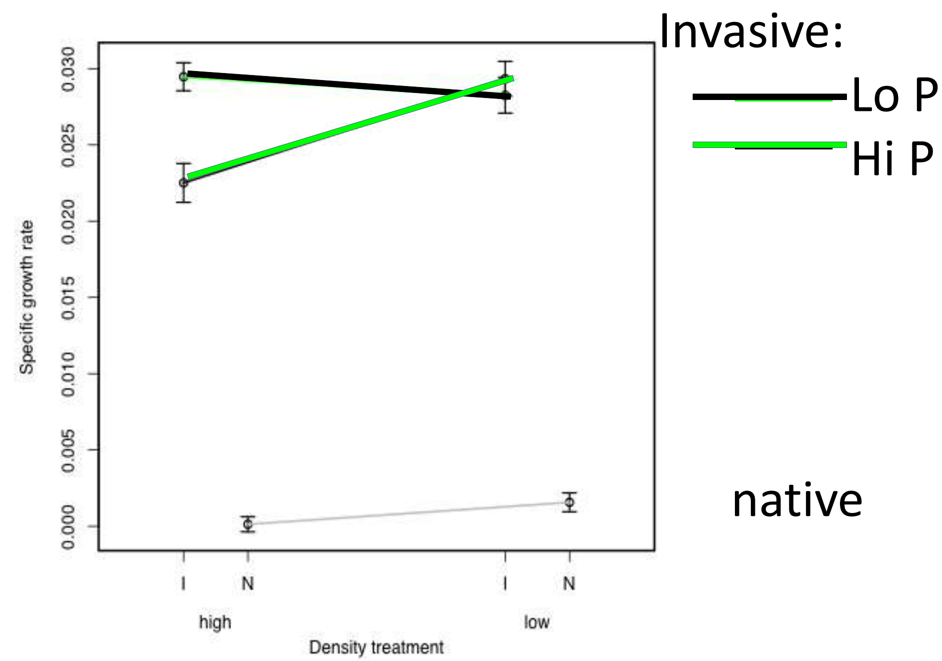


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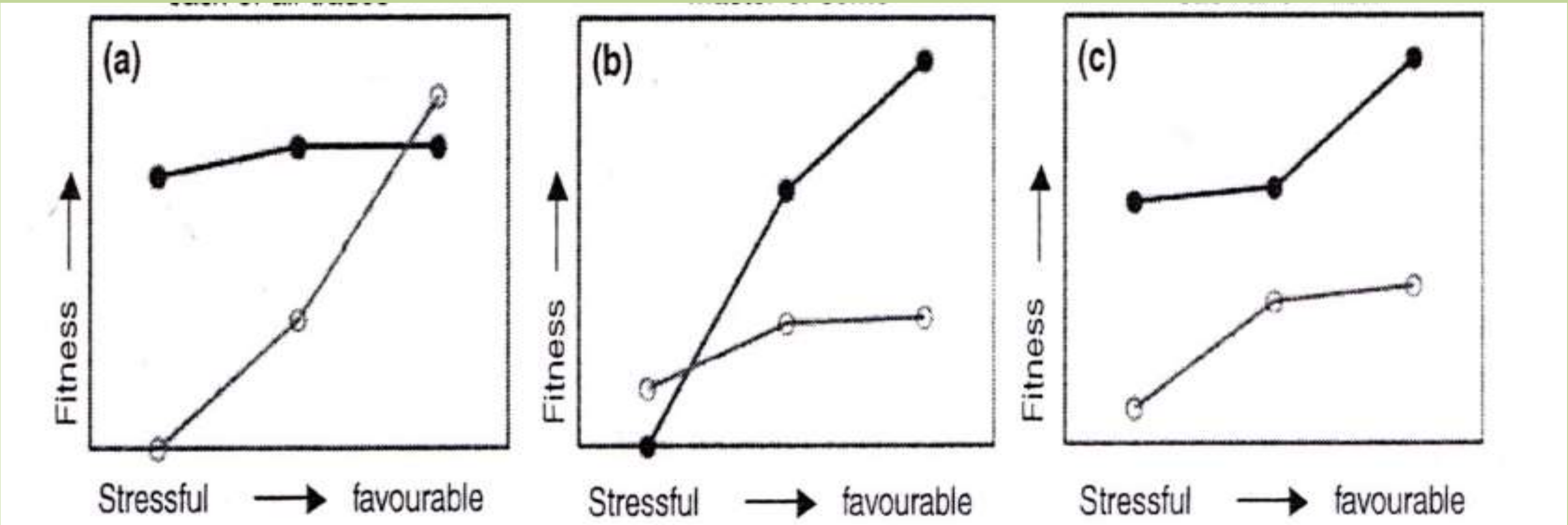
# Phenotypic plasticity



# Questions?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