

# Immediate alteration of behaviorally mediated trait in response to predators



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木曾実習 自由研究発表

# Introduction

Animals often alter their body traits to protect from predators

Water fleas

non-induced  
(without predator)

Horned  
(with predator)

Plasticity of head horn in response to predator  
(Pfenning 2010 TREE)

Tadpole

non-induced  
(without predator)

Bulgy  
(with predator)

Bulgy  
(with predator)

Plasticity of body bulge in response to predator  
(Kishida et al. 2007 Anim.Ecol.)

# Introduction

Phenotypic plasticity against predators



potentially important for trophic interaction,  
diversification and speciation

Shift of trophic interaction



Diversification and Speciation

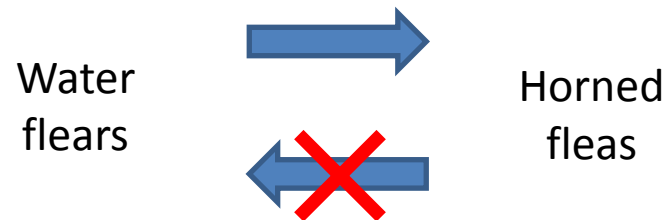
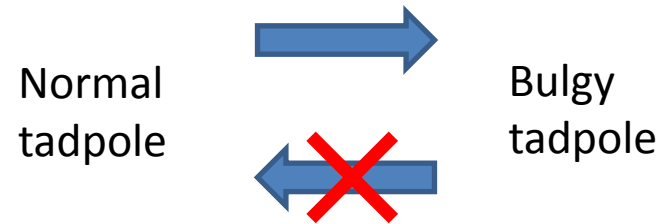


# Introduction

Morphological plasticity



Often take time and irreversible



# Introduction

Behavioural plasticity



Can be change quickly and reversible

External structure is extended phenotype of behaviour!  
(intermediate trait between behavioural and morphological ones)



Behaviorally mediated morphology  
(quickly changeable)



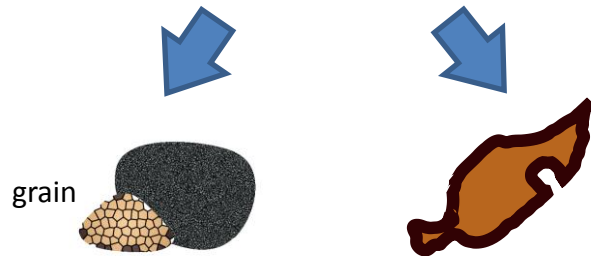
different expression of speciation and/or trophic interaction

# Introduction

Some caddis species change case material in response to predators

ボエイロら (2006)

エグリトビケラ的一种



Which chose?

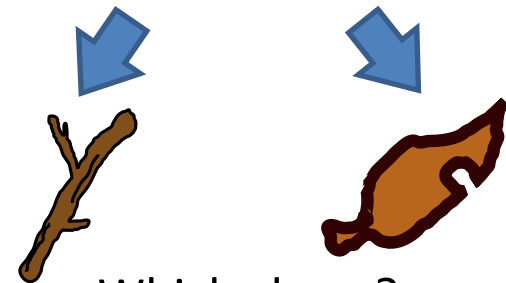
Presence of predators  
(chemical cue)



Use sands rather than leaves  
(rigid)

ボエイロ (2011)

アシエダ的一种



Which chose?

Presence of predators  
(chemical cue)



Use twigs rather than leaves  
(rigid)

# Hypothesis and aim of this study

Predators may also induce high motivation of case making (especially when the case is damaged)



Hypothesis

Under presence of predators, larvae extend their cases quickly when larval case is damaged



I tested the hypothesis with labo experiment



Oh no! It's emergence time!

# Material & Method

Larvae was forced to rebuild their cases with provided material

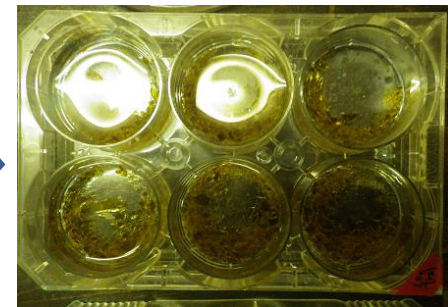
Study species

*Perissoneura paradoxa* & *Psilotreta kisoensis*  
(Odontoceridae)



Make similar cases from sediment sands

Preparation of case material



Blast to bits

Mixing well

2ml of grass bits  
in 3.5cm  $\phi$ well



# Material & Method

Larvae was forced to rebuild their cases with provided material

Study species from Akashio River

*Perissoneura paradoxa* & *Psilotreta kisoensis*  
(Odontoceridae)



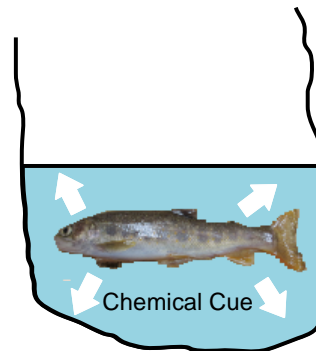
Make similar cases from sediment sands

Preparation of chemical cue

Char from Akashio River



*Salvelinus leucomaenis*



4 hours soaking  
In river water



10ml River Water (control)



4ml River Water + 6ml Chemical Cue

# Material & Method

I forced to rebuild larval cases with provided material with/without predator

Study species from Akashio River

*Perisoneura paradoxa* & *Psilotreta kisoensis*  
(Odontoceridae)



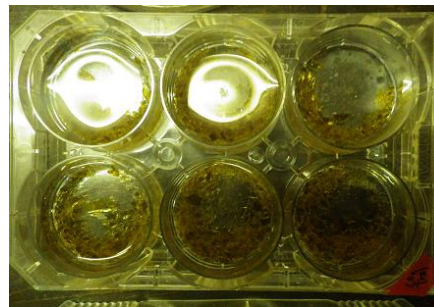
Make similar cases from sediment sands

Preparation of case damaged larvae ~ Rebuilding experiment

Remove 40% of fore-part



Larva remains in here.



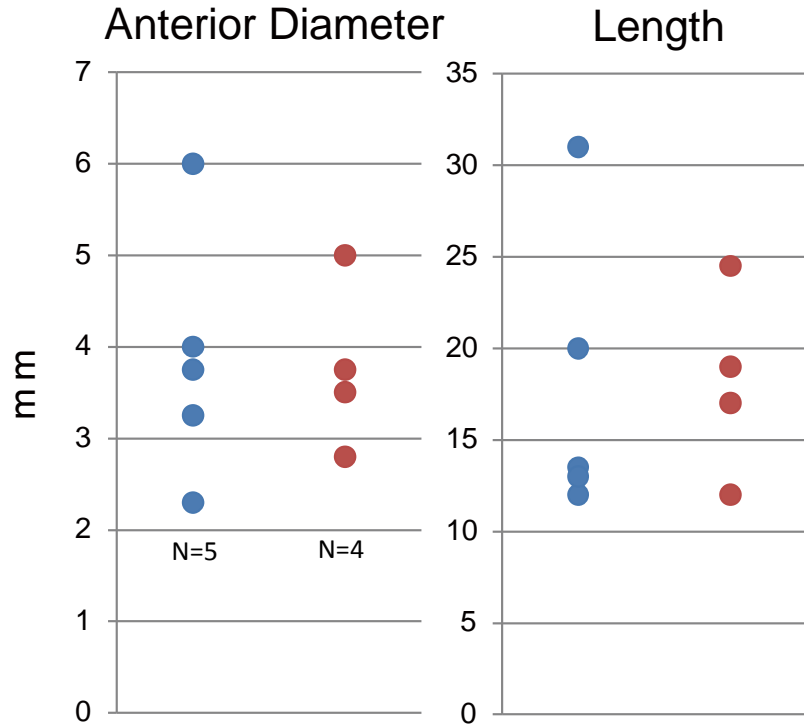
Rebuild in these wall  
22 hours



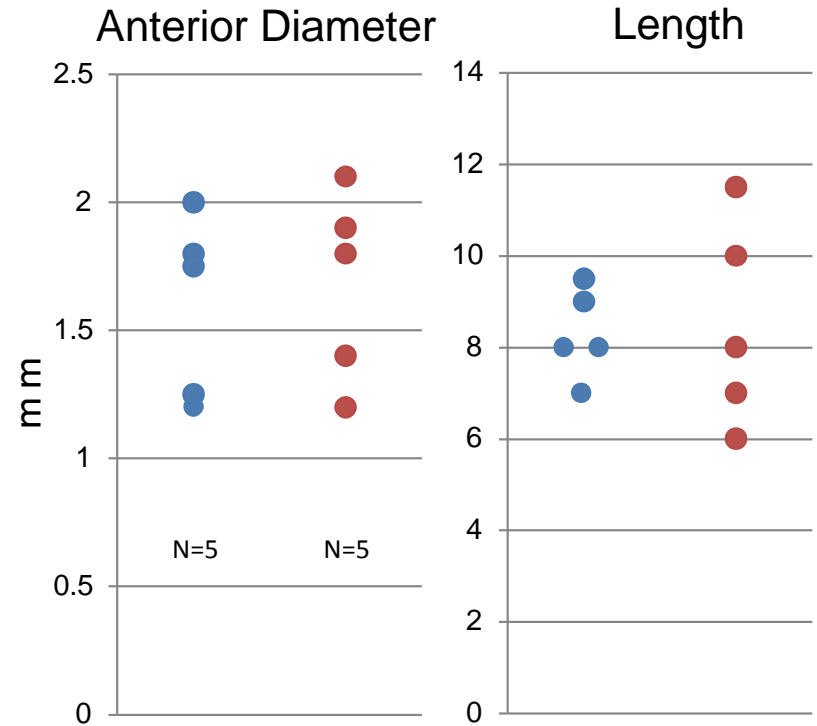
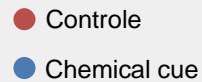
Newly added materials  
were counted  
(in number)

# Result

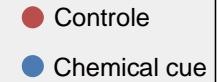
## Characteristics their case



*Pe. paradoxa*



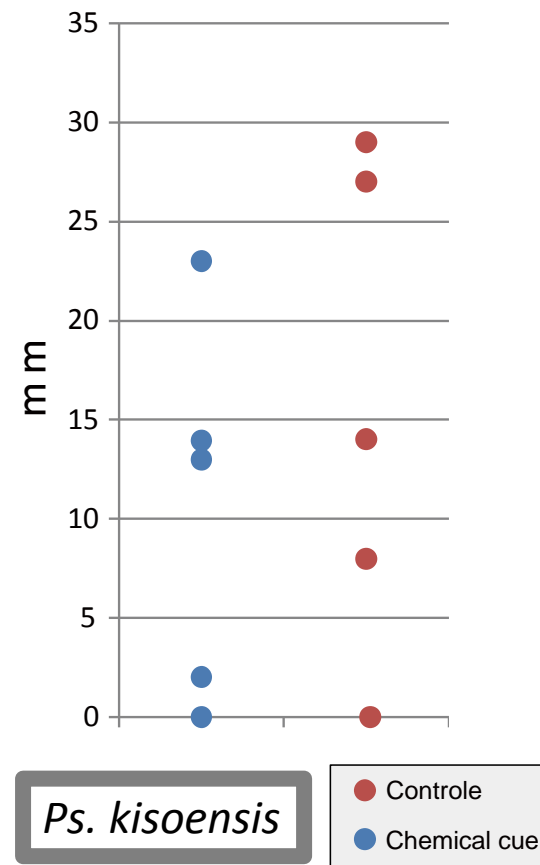
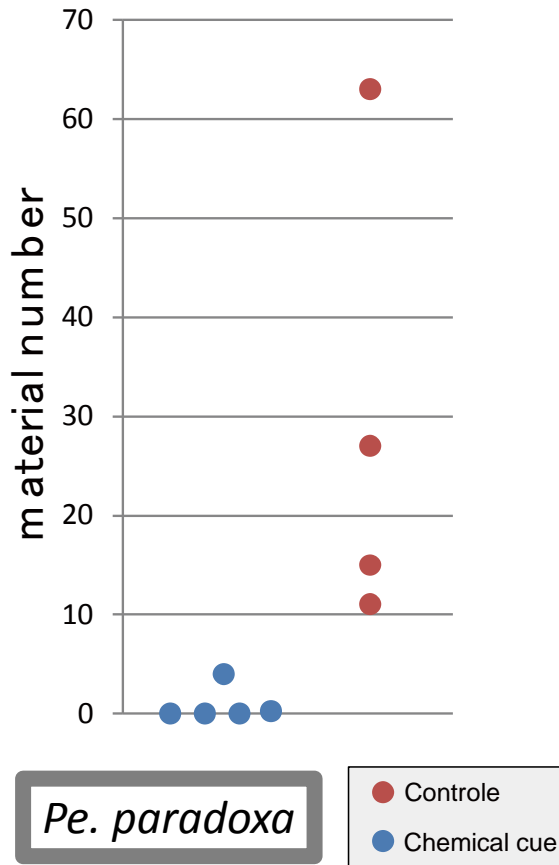
*Ps. kisoensis*



1. No differences between two treatment (t-test)
2. *Pe. paradoxa* is much larger than *Ps. kisoensis*

# Main Result

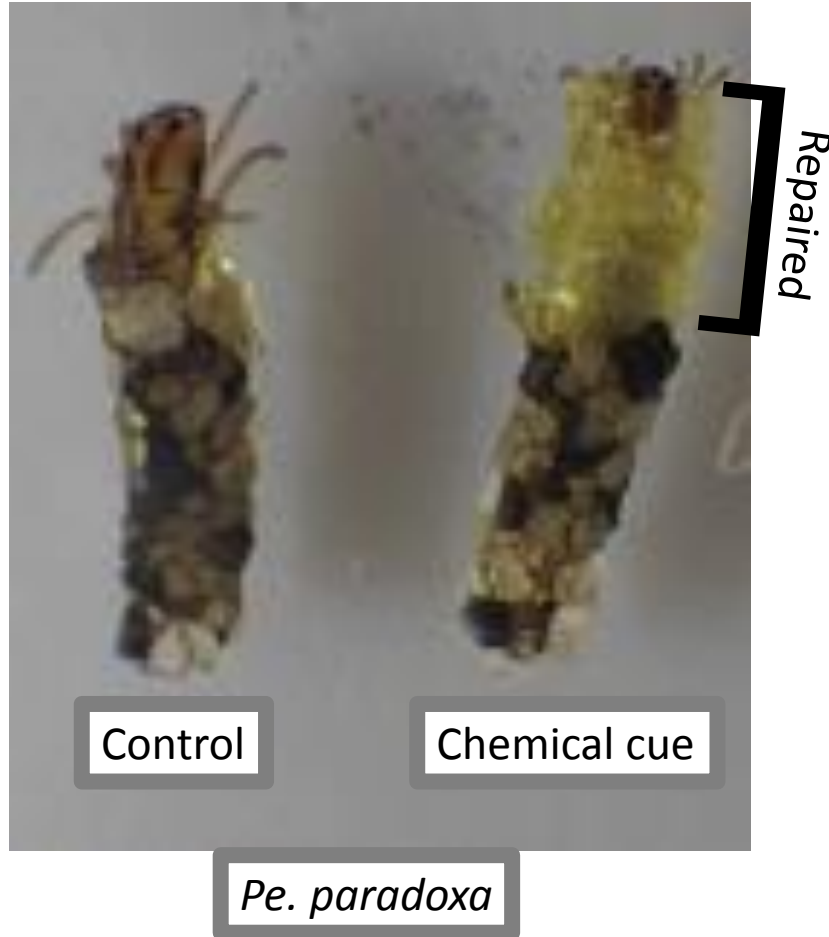
## Material number used for case repair



*Pe. paradoxa* add materials quickly in response to predator chemical cue  
(Responses were stronger in Larger species)

# Main Result

Material number used for case repair



# Discussion

Larvae immediately repair their cases in response to predators

Larvae detect the presence of predators



They expedite their case repair because of emergency

Hypothesis

Under presence of predators,  
larvae extend their cases quickly when larval case is damaged

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*Marginally proved*

1. Caddis larvae can alter their case making behaviour in response to predators  
(Not limited to material change as previous study showed)
2. Trophic interactions with fish is different between two species  
Bigger body size can be easily recognized by fish?

# Interspecific interaction

this June

*Pe. Paradoxa* : *Ps. Kisoensis* = 55:55  
Incubated in a same aquarium tank.



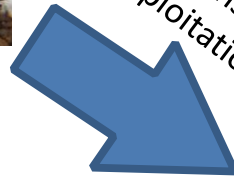
this July

*Pe. Paradoxa* : *Ps. Kisoensis* = more than 40 : less than 5  
(But growth rates were clearly higher in both)



*Pe. paradoxa*

Intense  
Exploitation



*Ps. kisoensis*

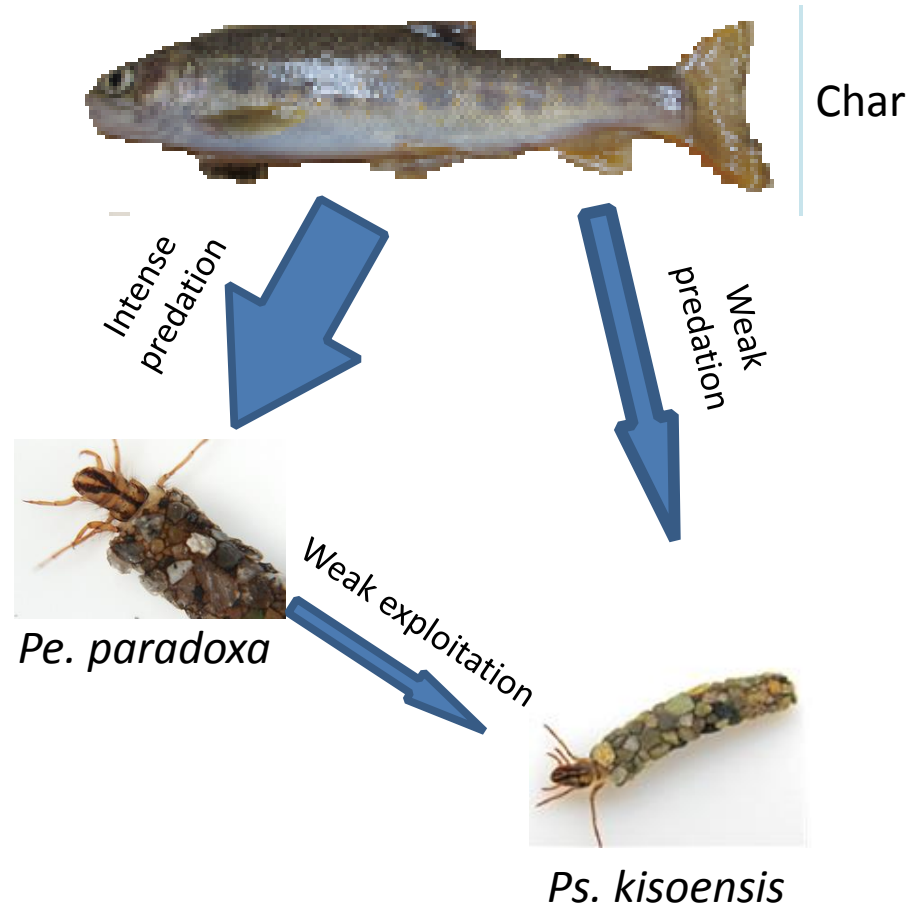
Instead that they can co-exist in Akashio....




: Trophic interaction



# Interspecific interaction



Interspecific interaction may change between with/without predator

 : Trophic interaction

# Implication

Responses to predators are different among species



By evaluating larval responses, trophic interaction may be presumed.

# Acknowledgements

I thank Professor Tayasu for providing me chemical cue of fish.

I also thank Mr. Fujinaga for taking picture.