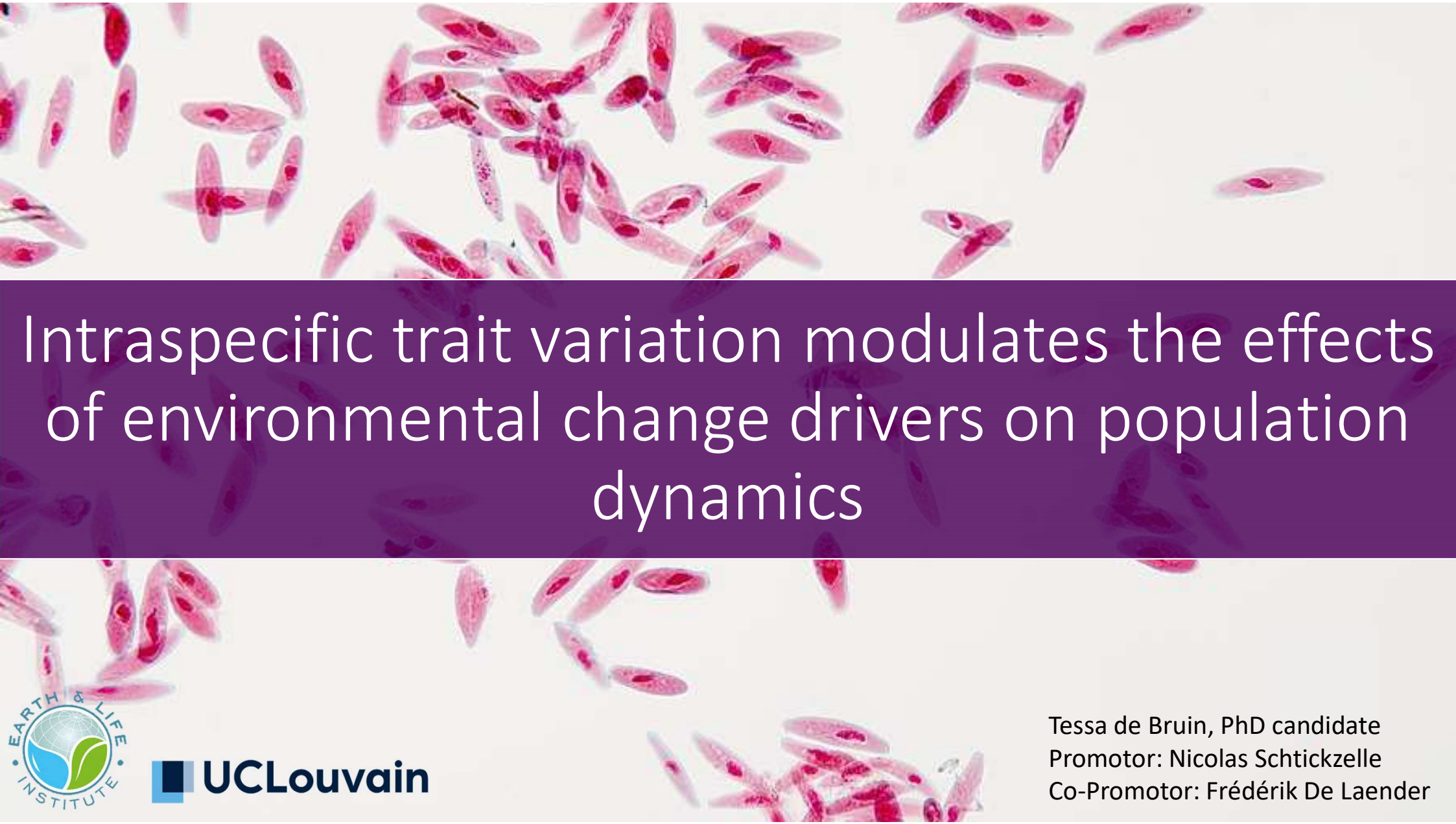

Intraspecific trait variation modulates the effects of environmental change drivers on population dynamics

Tessa de Bruin, PhD candidate
Promotor: Nicolas Schtickzelle
Co-Promotor: Frédérik De Laender

The main anthropogenic threat to biodiversity

Enhancement of Environmental Change Drivers (**ECDs**)

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Climate

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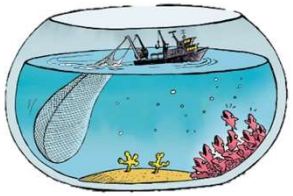

The main anthropogenic threat to biodiversity

Enhancement of Environmental Change Drivers (**ECDs**)

Climate
Pollution
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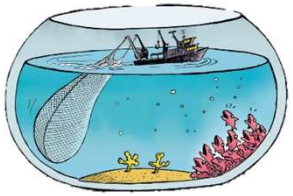
Foreign species invasion



Biodiversity *between* vs *within* species

Interspecific trait variation

Biodiversity *between* vs *within* species

Interspecific trait variation

Intraspecific trait variation (**ITV**)

IF variation in phenotypical traits modulates the effects of ECDs on population demography:

1) The demographic response of a species to environmental change drivers is population-specific

2) Population-specific demographic response to ECDs can be explained by population-specific changes in relevant trait values

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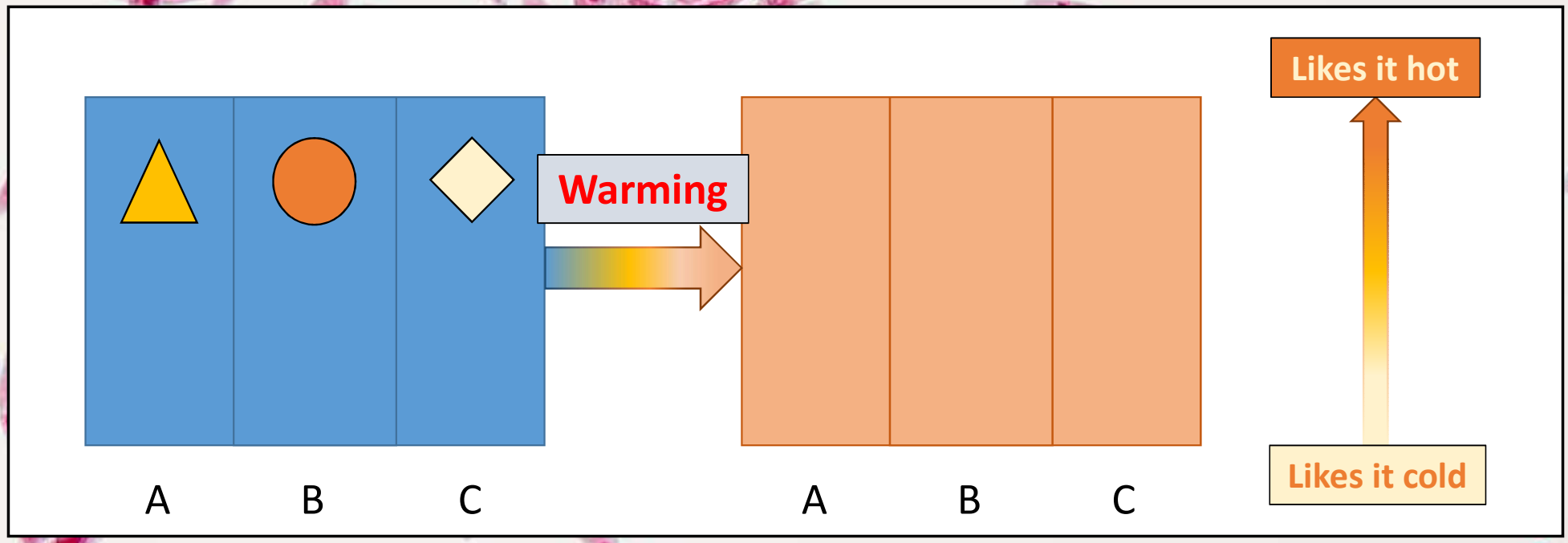
We need a fast growing model system that can be highly controlled

Intraspecific Trait Variation enables a species to handle change?



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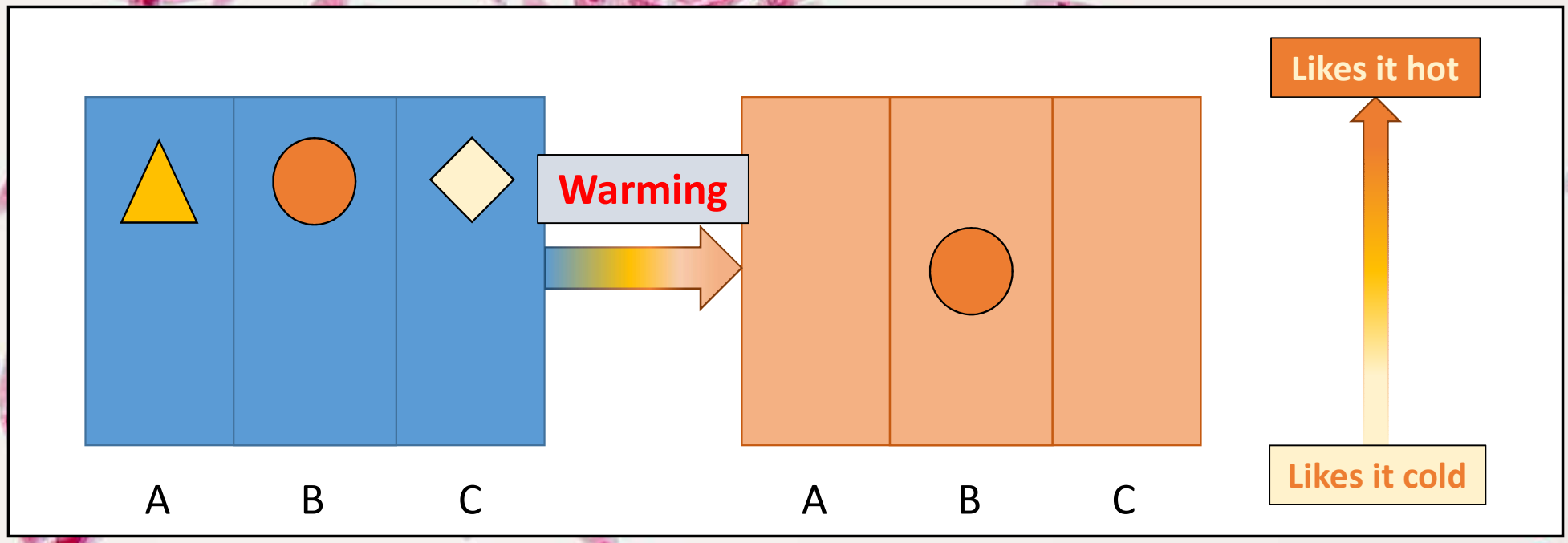

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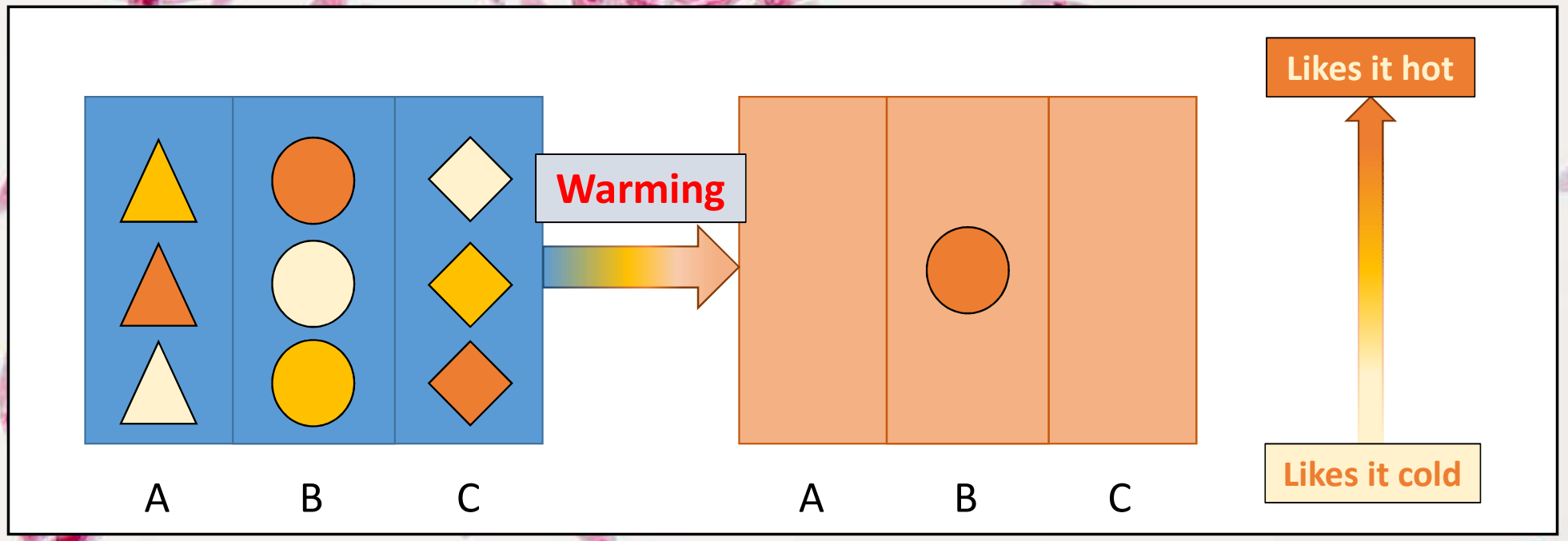

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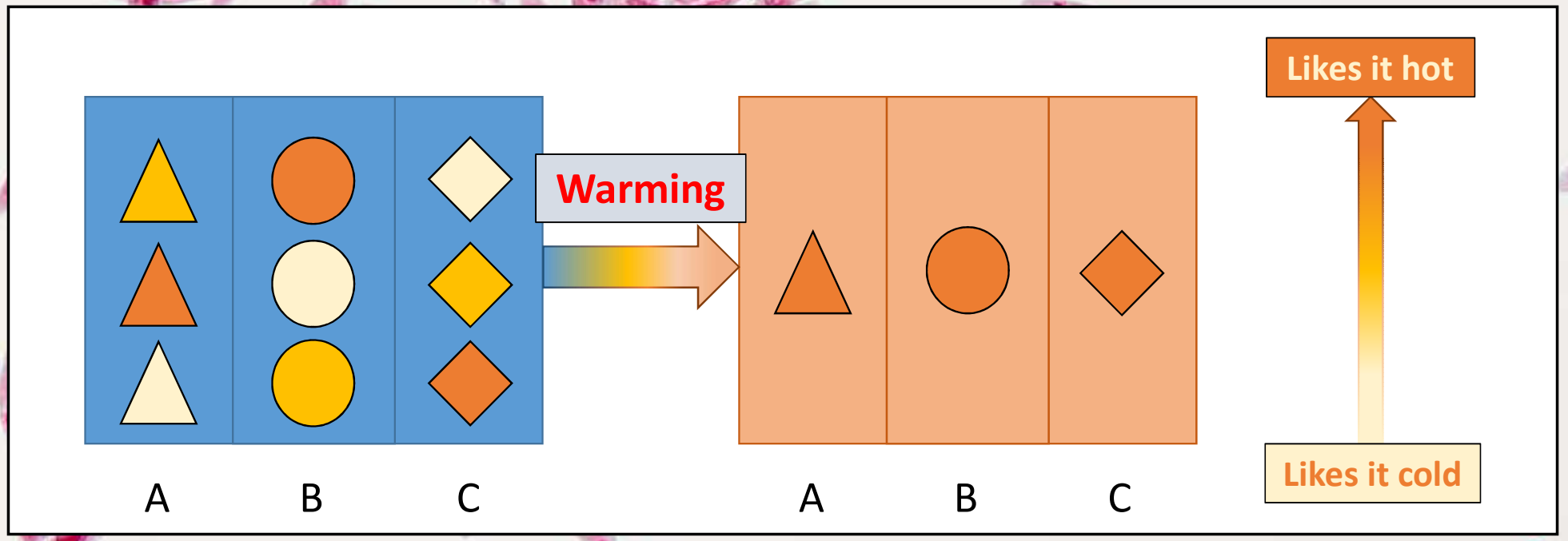
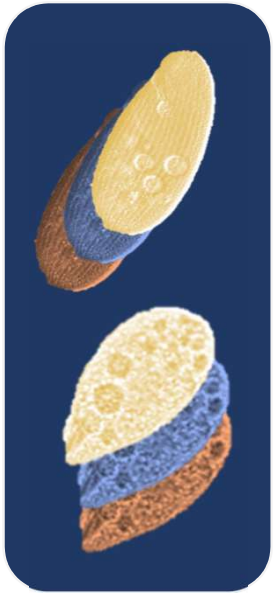
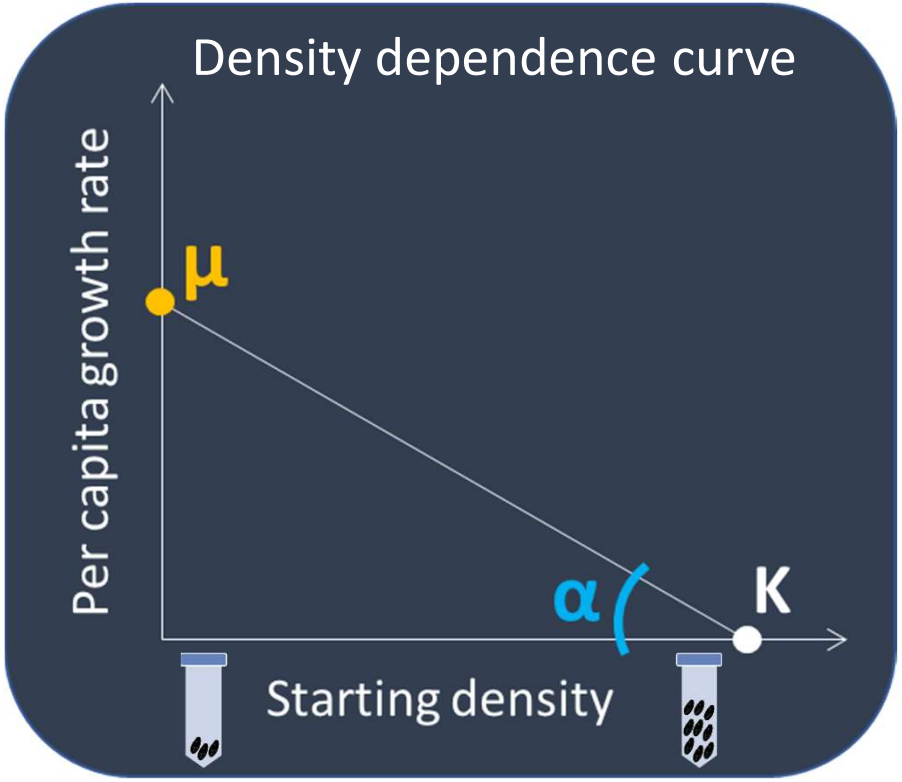


Demography: Growth & Interaction



Colpidium striatum
Strains:
Colp 1, Colp 3, Colp 5

Tetrahymena thermophila
Strains:
Tetra 2, Tetra 3, Tetra 7



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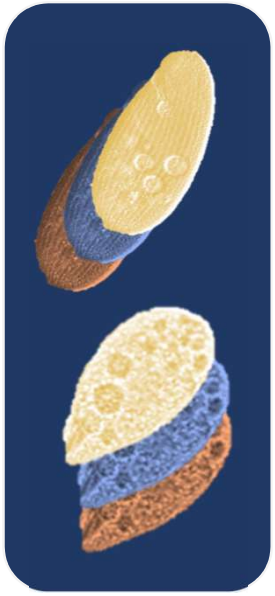

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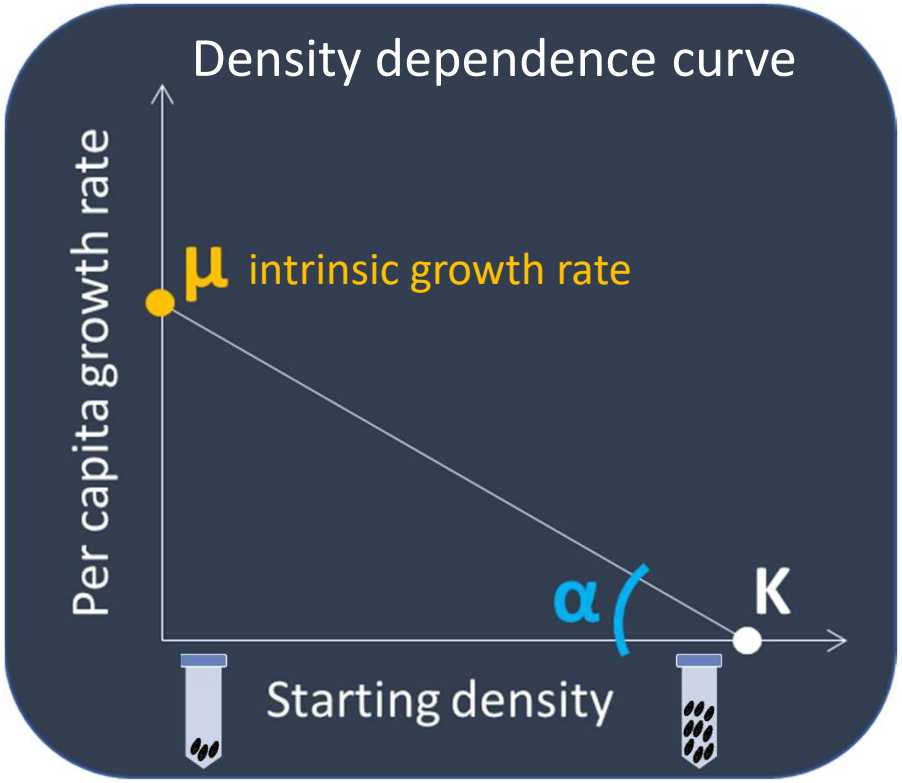

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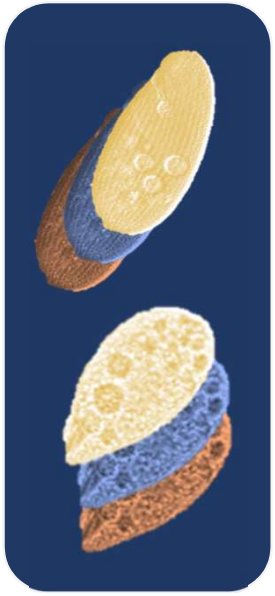

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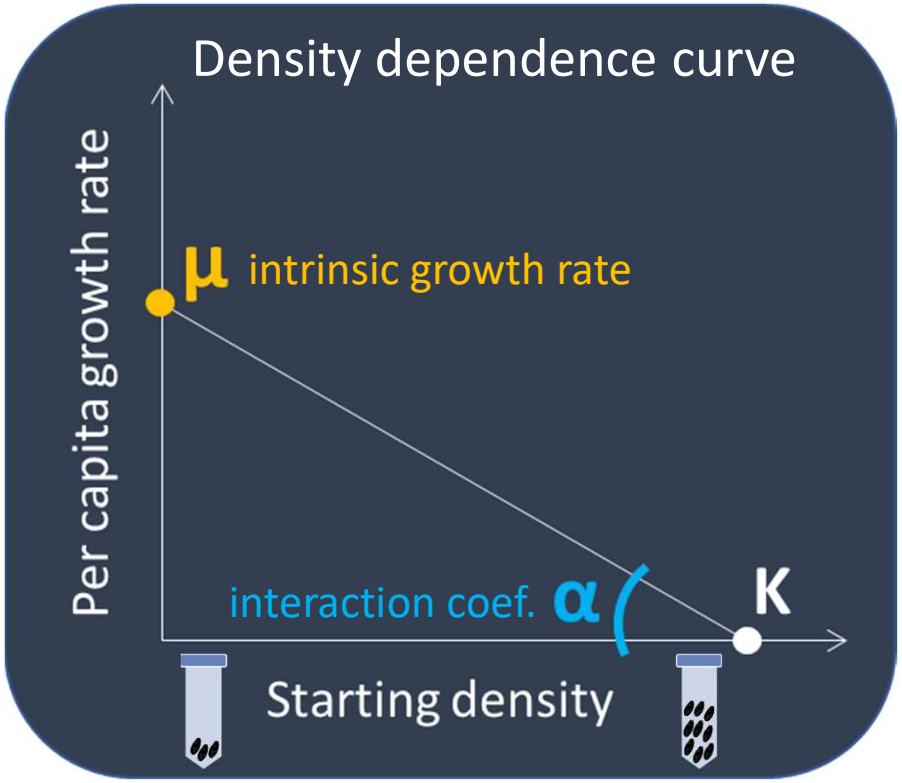

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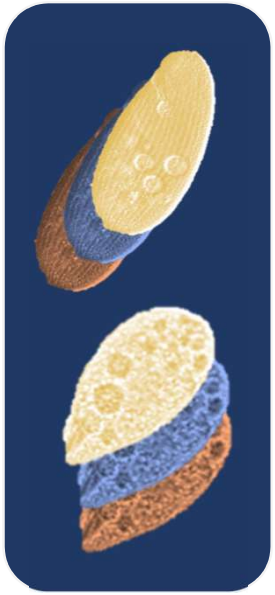

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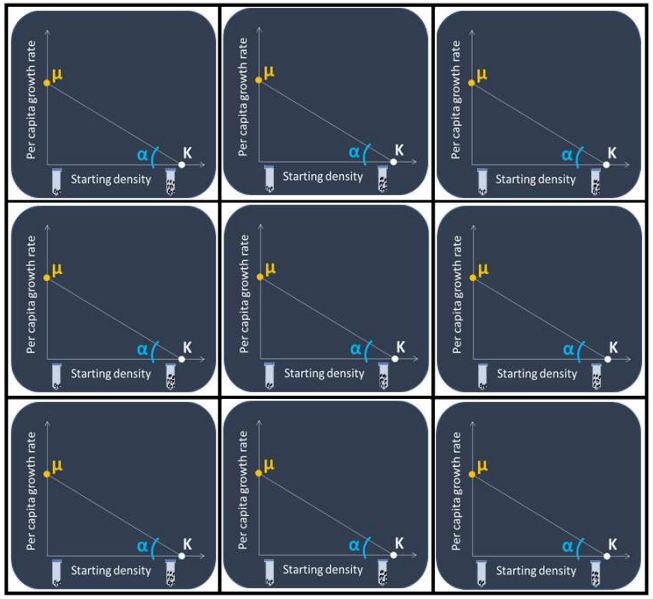
Temperature

20°C 22°C 24°C

Atrazine pollution

0mg/L 10mg/L 20mg/L



Automated image analysis

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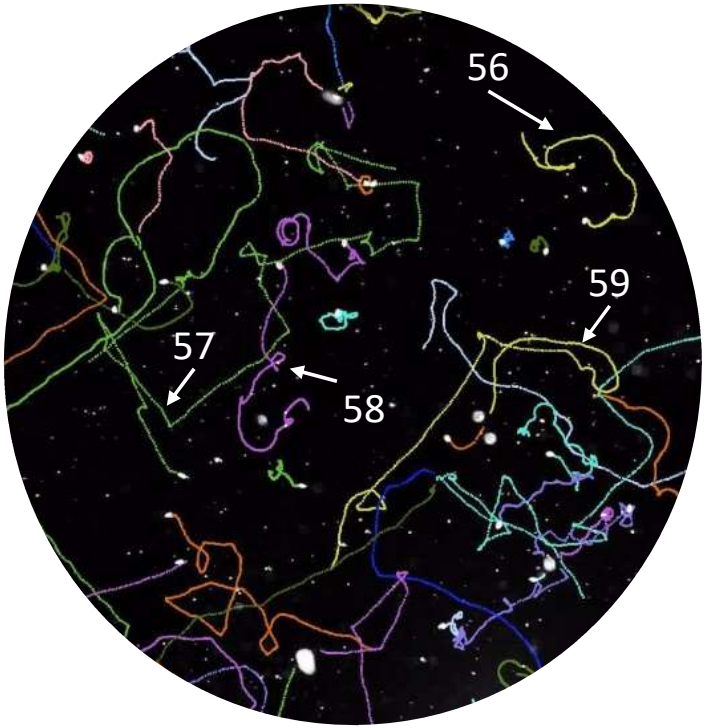
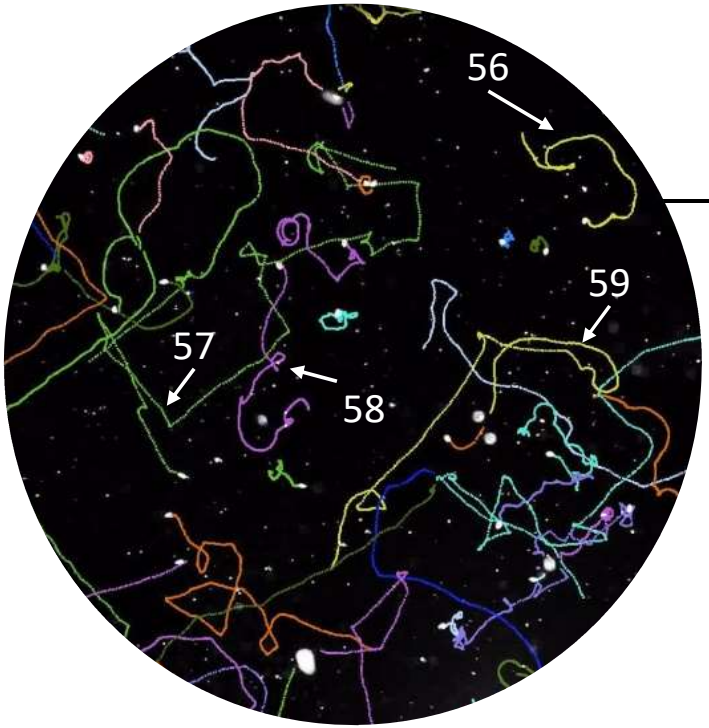


Grey scale videos measuring abundance & phenotypical traits

Start: T0 | End: T1 | 3 replicates

Automated image analysis



Grey scale videos measuring abundance & phenotypical traits

Start: T0 | End: T1 | 3 replicates

Individual	Shape	Size	Speed	Linearity
56	1.55	30	19.20	0.34
57	1.60	33	22.05	0.45
58	1.53	28	15.33	0.31
59	1.55	30	17.00	0.44

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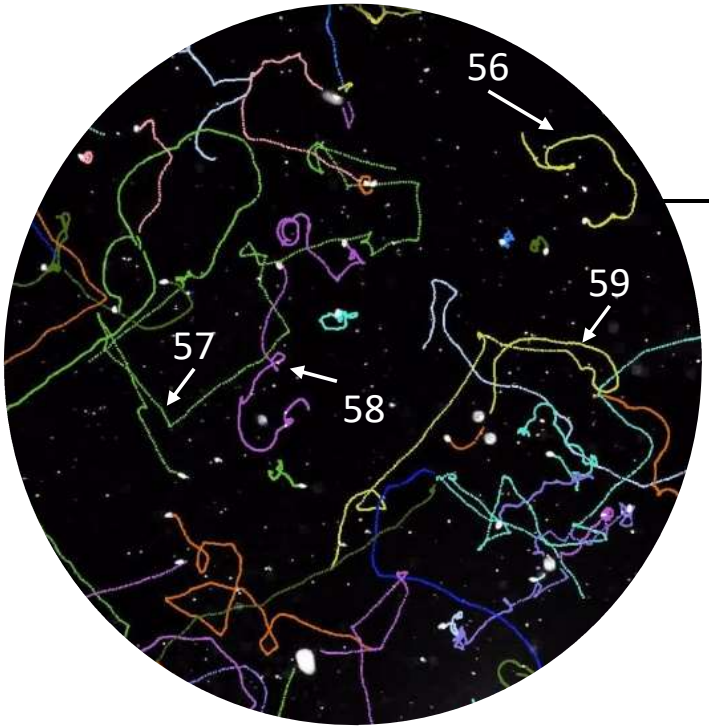

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Average values ± SD for each individual per sample

Calculation carrying capacity

Mean of K: μ/-α

Variance of K: Taylor approximation

$$s^2\left(\frac{\mu}{\alpha}\right) \approx \frac{(\bar{x}_\mu)^2}{(\bar{x}_\alpha)^2}\left(\frac{s_\mu^2}{(\bar{x}_\mu)^2} - 2\frac{cov(\mu,\alpha)}{\bar{x}_\mu \bar{x}_\alpha} + \frac{s_\alpha^2}{(\bar{x}_\alpha)^2}\right)$$

Variation in phenotypical traits: Strategy index

	 Sit-and-wait	Disperse 
Shape		
Size		
Speed		
Linearity		

Variation in phenotypical traits: Strategy index

	Sit-and-wait		Disperse
Shape		<	
Size			
Speed			
Linearity			

Variation in phenotypical traits: Strategy index

	Sit-and-wait		Disperse
Shape		<	
Size		>	
Speed			
Linearity			

Variation in phenotypical traits: Strategy index

	Sit-and-wait		Disperse
Shape		<	
Size		>	
Speed		<	
Linearity			

Variation in phenotypical traits: Strategy index

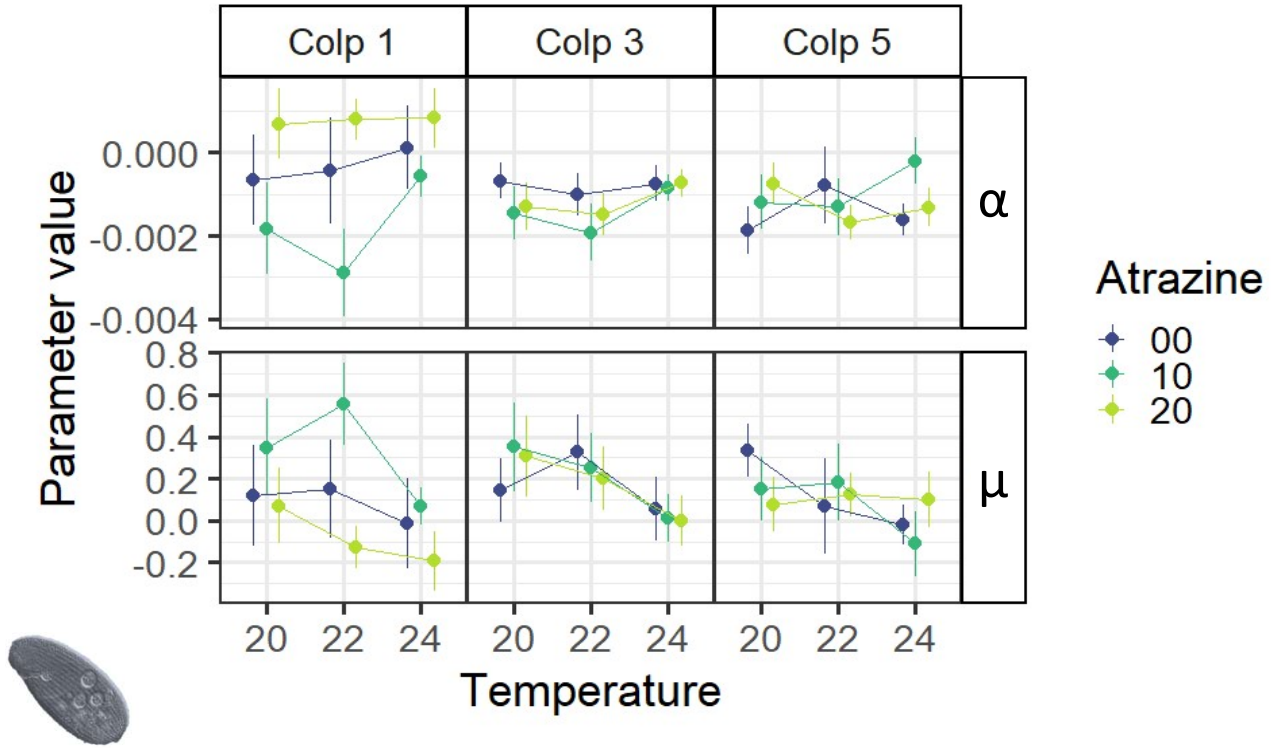
	Sit-and-wait		Disperse
Shape		<	
Size		>	
Speed		<	
Linearity		<	

Variation in phenotypical traits: Strategy index

	Sit-and-wait		Disperse
Shape		<	
Size		>	
Speed		<	
Linearity		<	

Strategy index = Shape − Size + Speed + Linearity

The demographic response of a species to ECDs is population-specific



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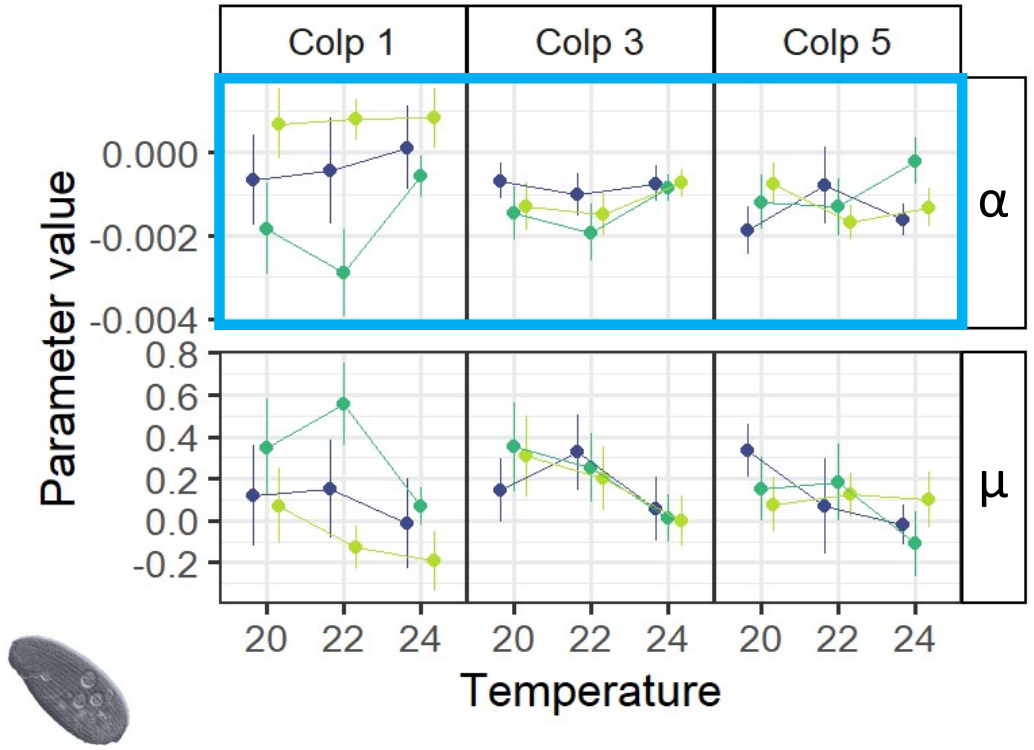
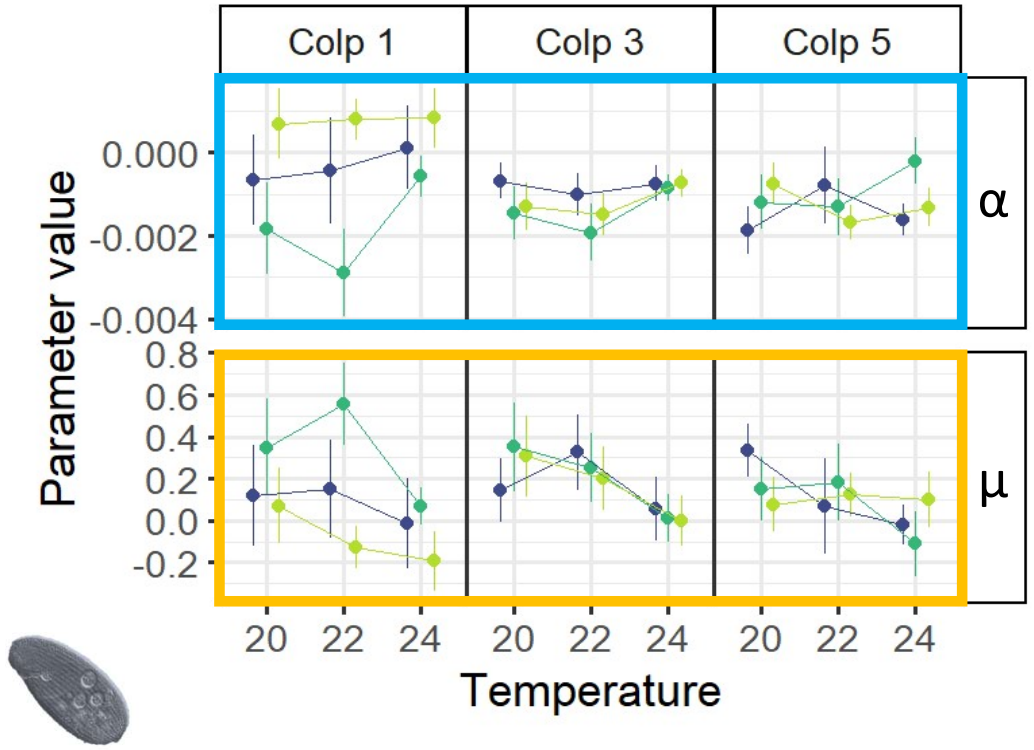


No main effects;
Non-linear effect of atrazine on Colp 1

Atrazine
00
10
20

The demographic response of a species to ECDs is population-specific



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Strain-specific mean value;
Decreases with temperature

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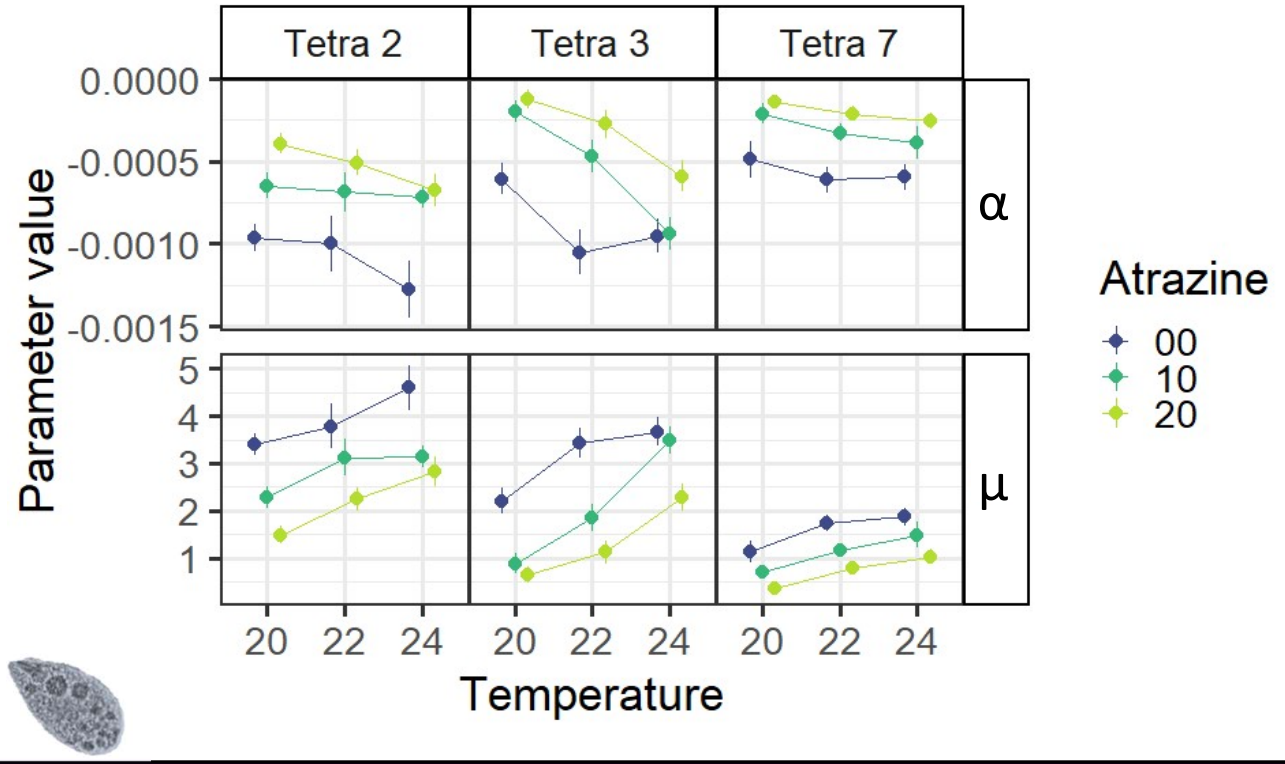

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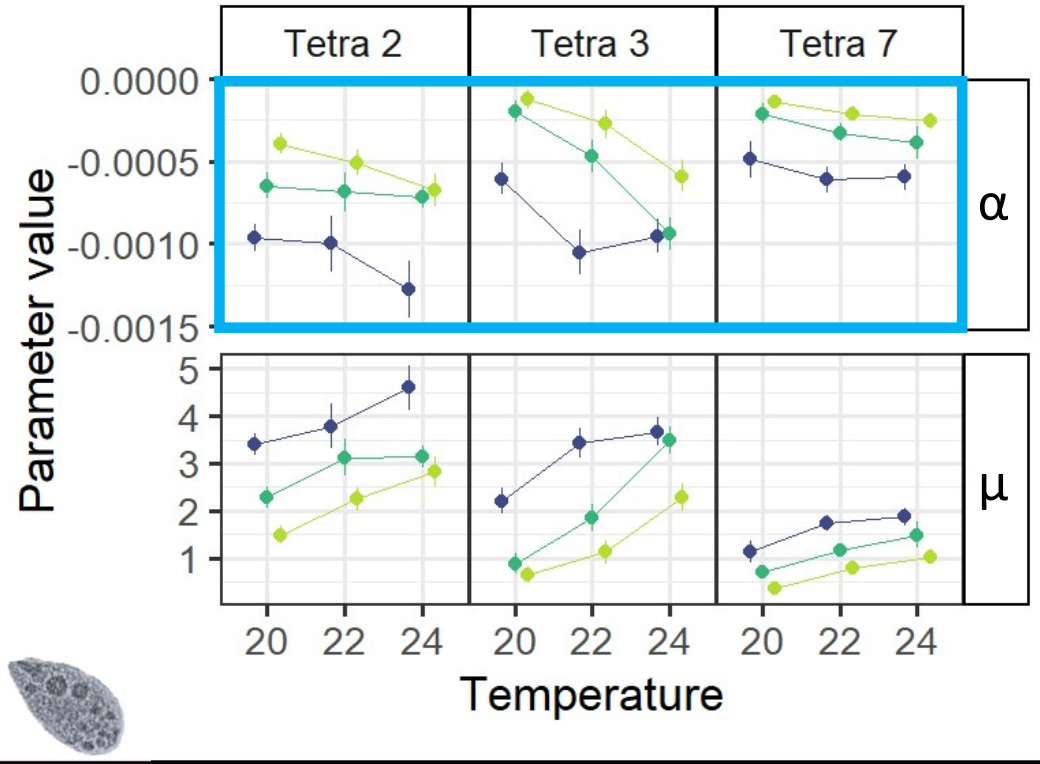
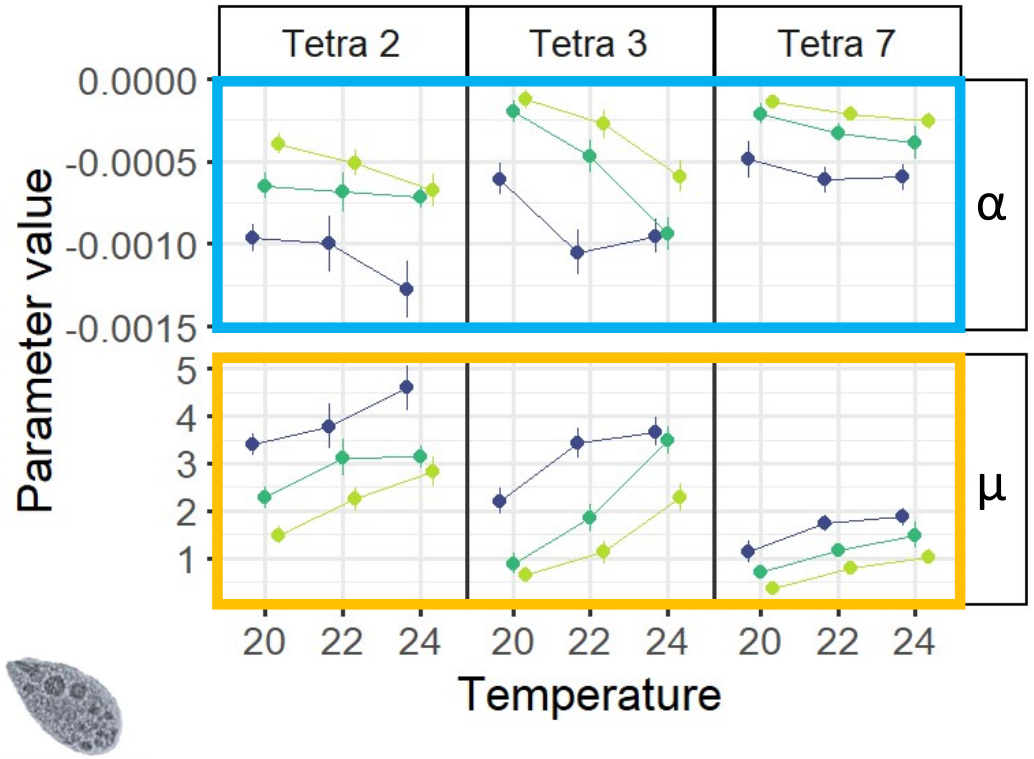


Strain-specific mean value;
Intensifies with temperature in a strain-specific way;
Relaxes with atrazine

Atrazine
00
10
20

The demographic response of a species to ECDs is population-specific



Strain-specific mean value;
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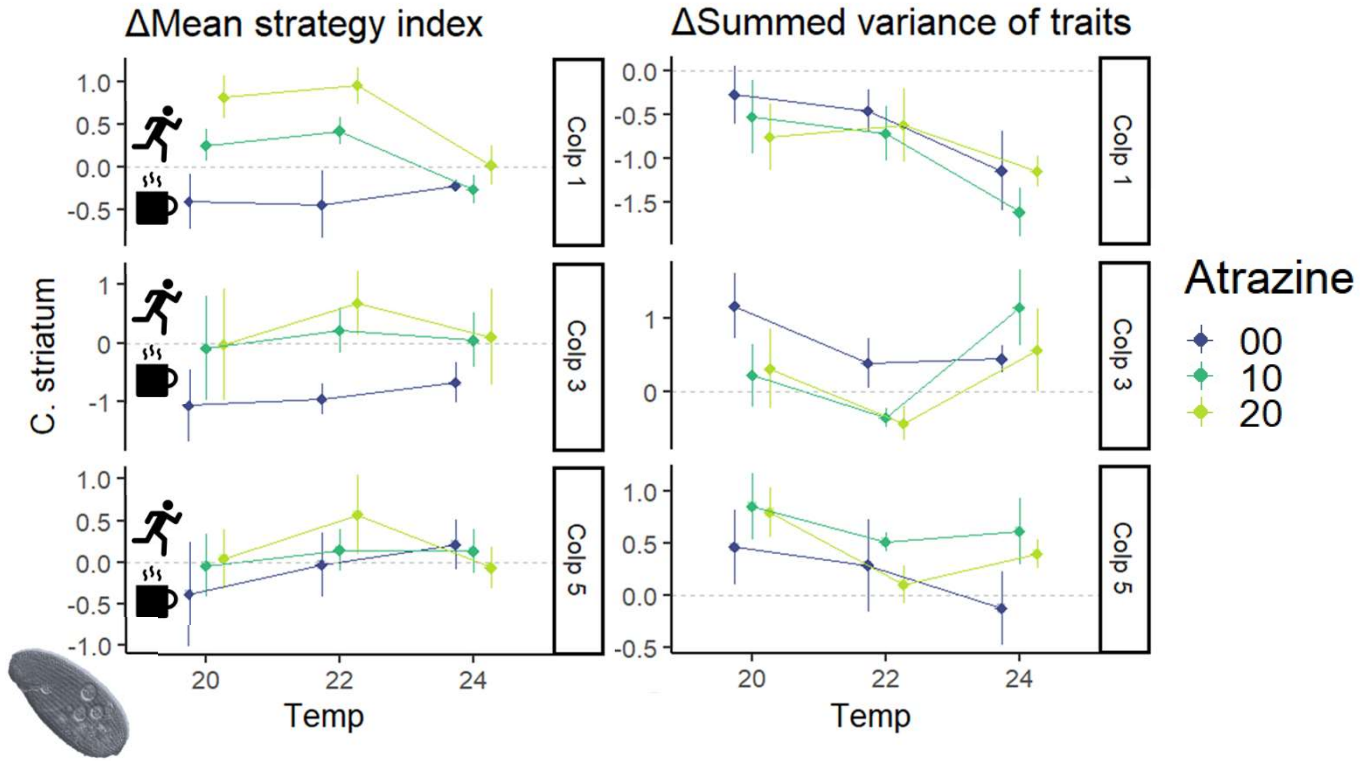
Atrazine
00
10
20

Strain-specific mean value;
Increases with temperature;
Decreases with atrazine;
Magnitude of both temperature and atrazine effects are strain-specific

The response of relevant trait values to ECDs is population-specific



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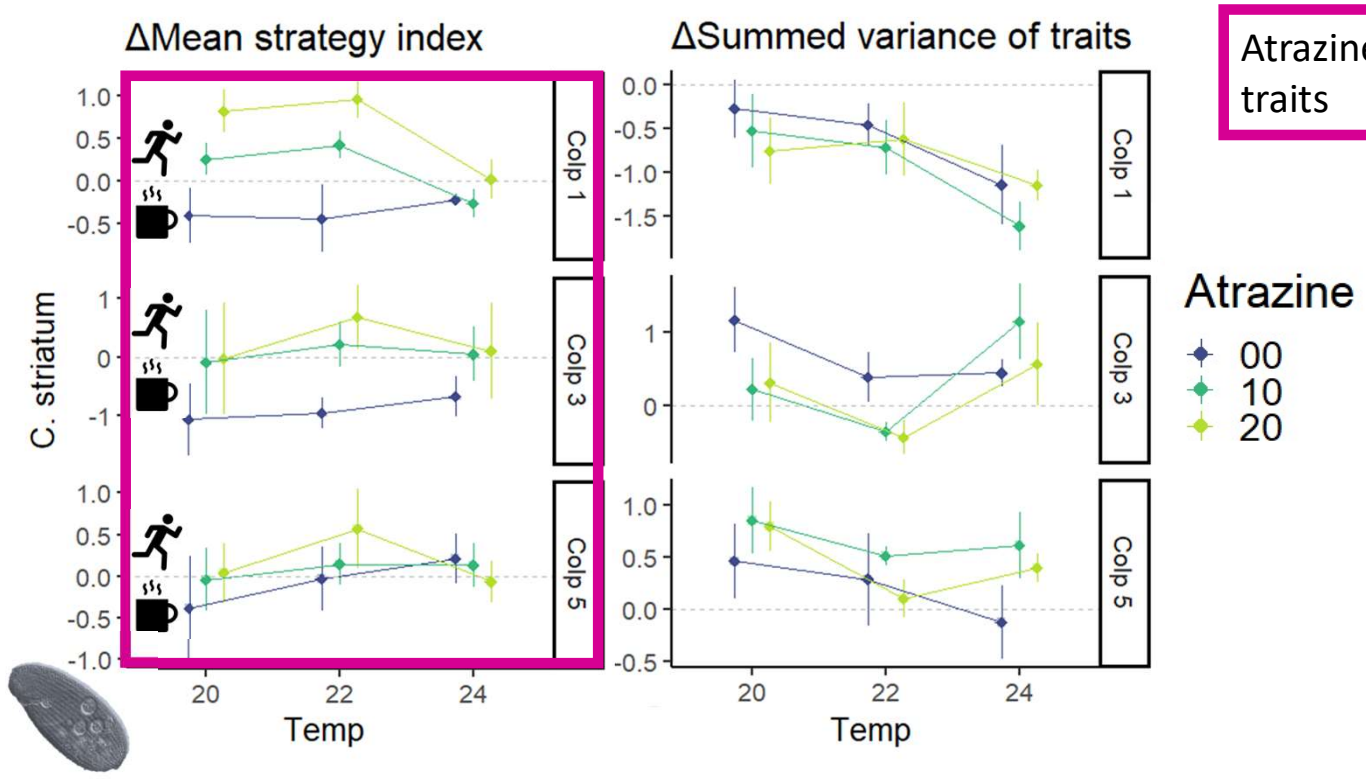
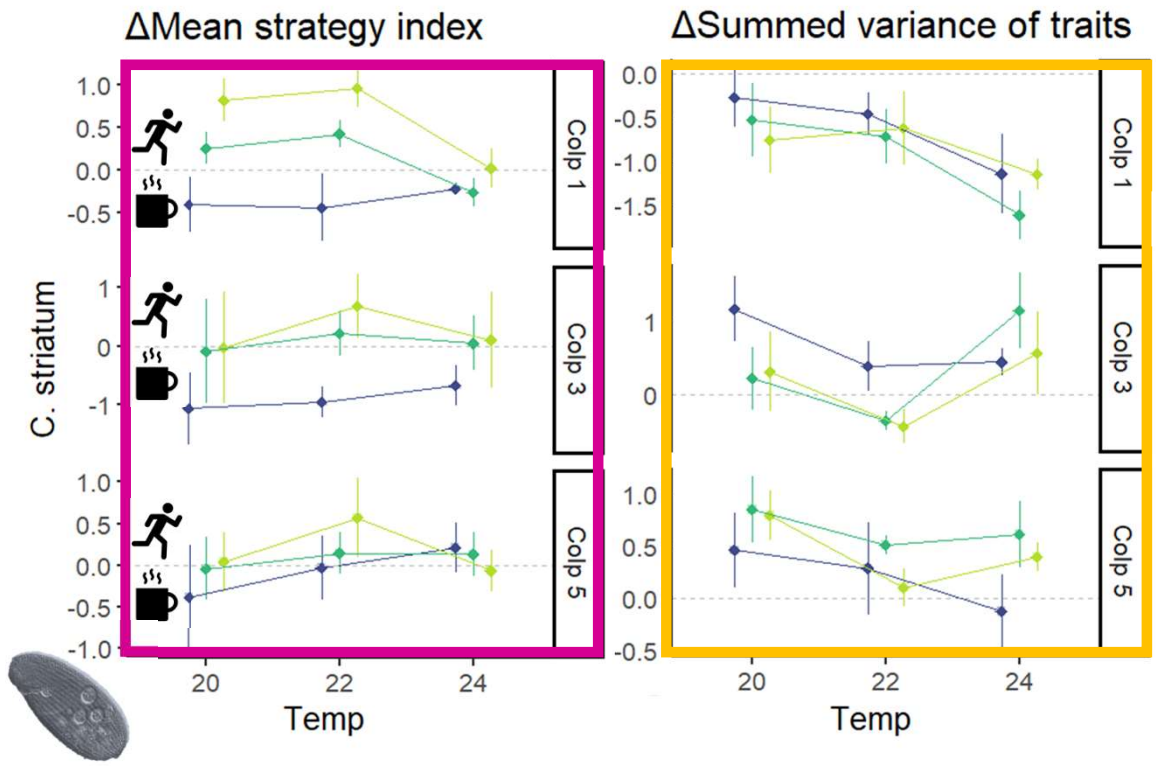


Atrazine increases dispersal-related traits

The response of relevant trait values to ECDs is population-specific

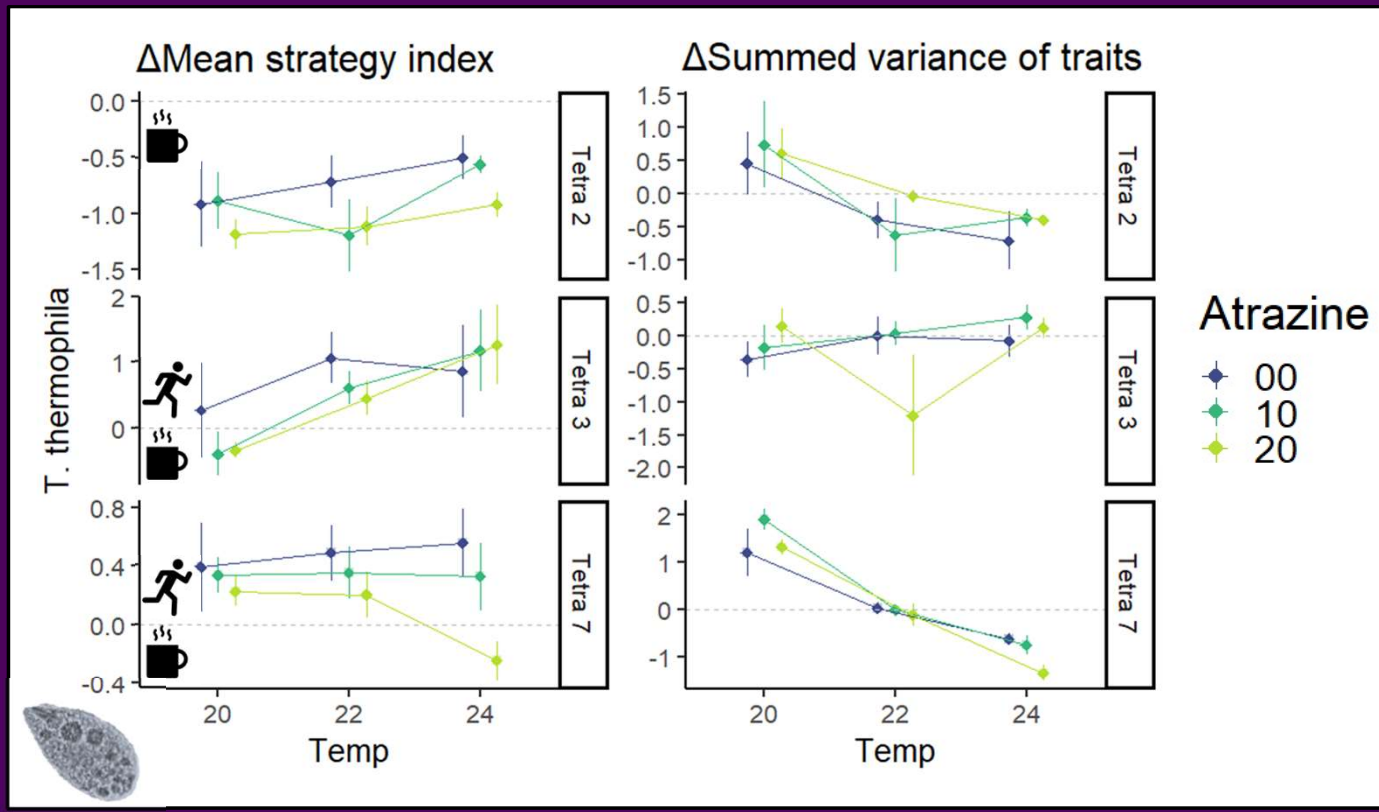


Atrazine increases dispersal-related traits

Atrazine
00
10
20

Summed trait variance is strain-specific;
Warming has a negative, strain-specific effect on summed trait variance

The response of relevant trait values to ECDs is population-specific



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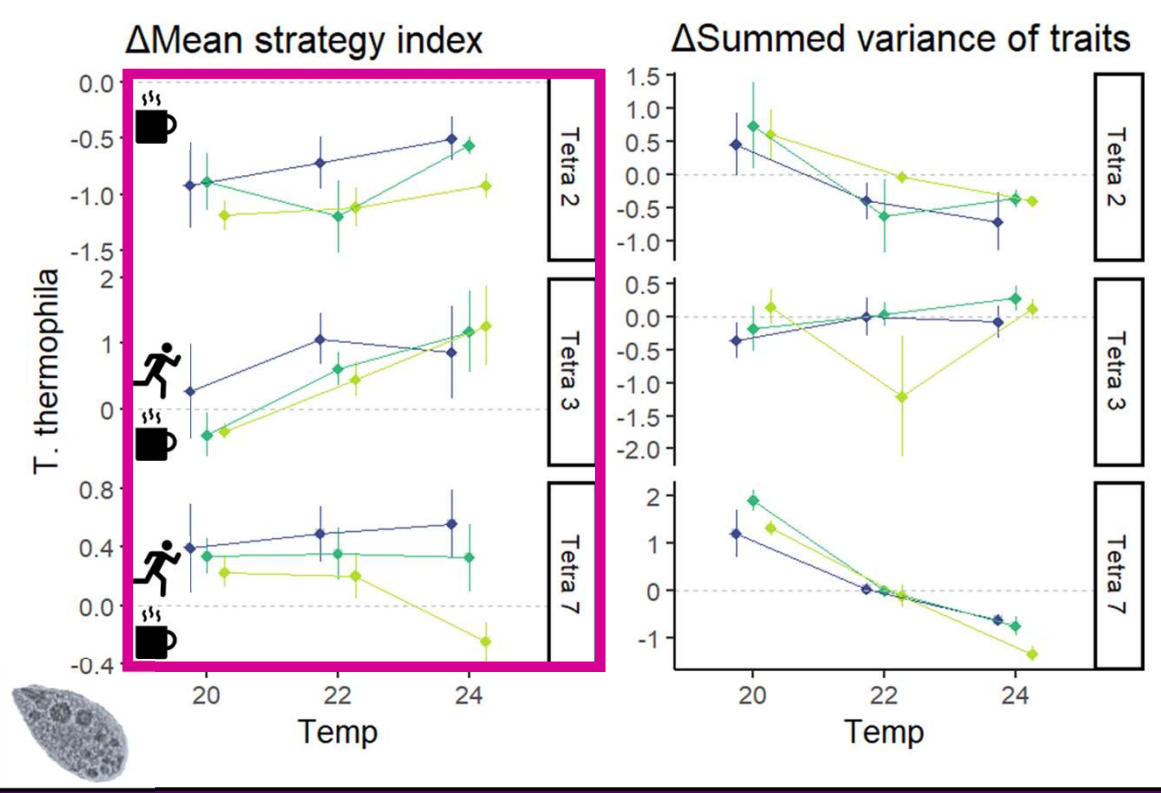
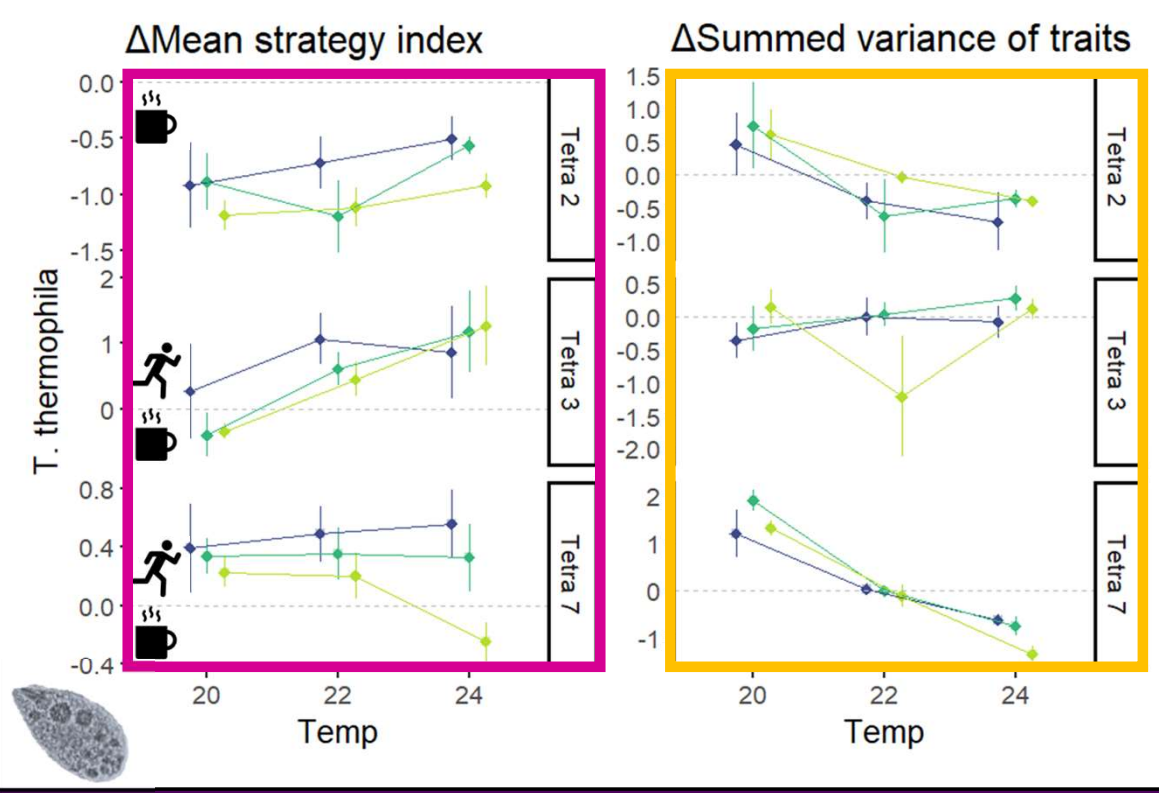


Warming increases dispersal-related traits in a strain-specific way; Individuals of Tetra 2 seem more sedentary than the others

The response of relevant trait values to ECDs is population-specific

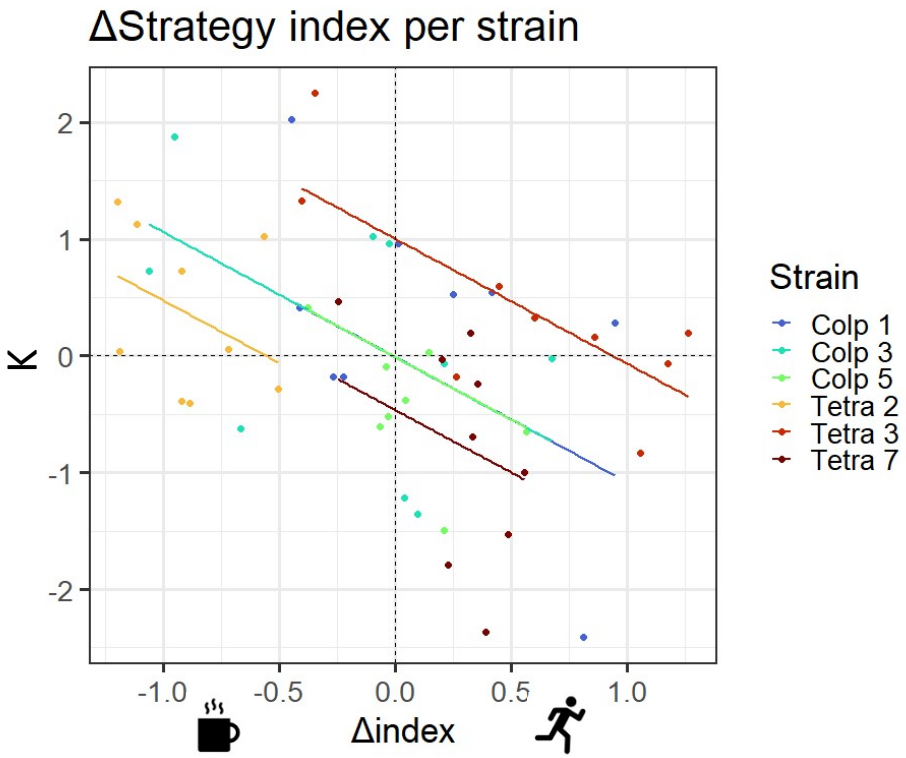


Warming increases dispersal-related traits in a strain-specific way;
Individuals of Tetra 2 seem more sedentary than the others

Atrazine
- 00
- 10
- 20

Summed trait variance is similar among strains;
Warming decreases summed trait variance in Tetra 2 and Tetra 7, but Tetra 3 is unaffected

Finding the best model describing K versus strategy index and summed trait variance



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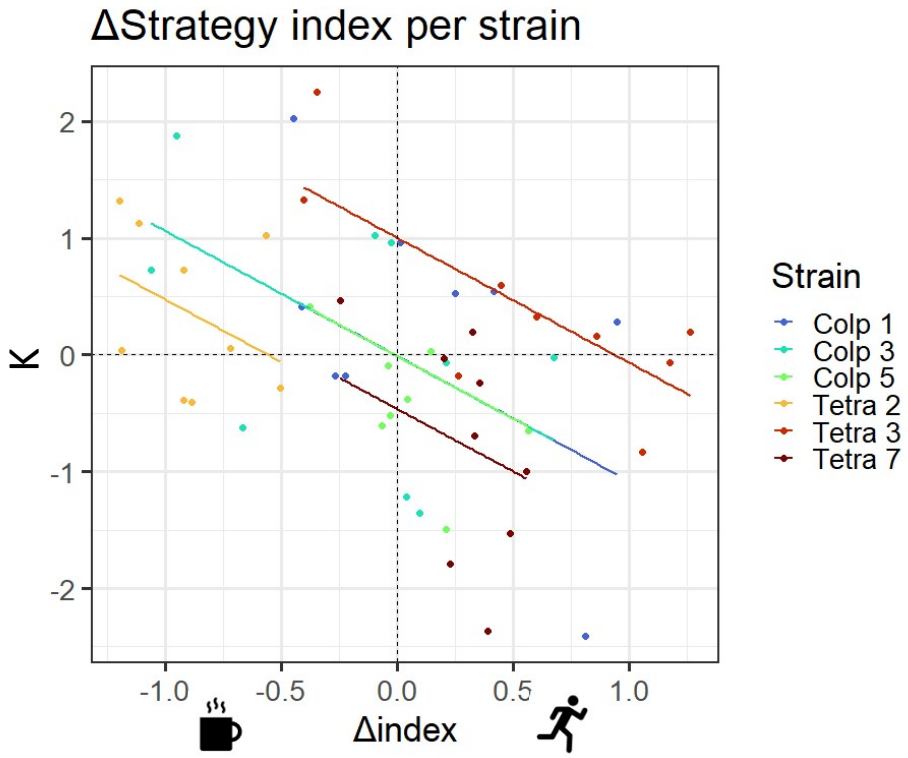
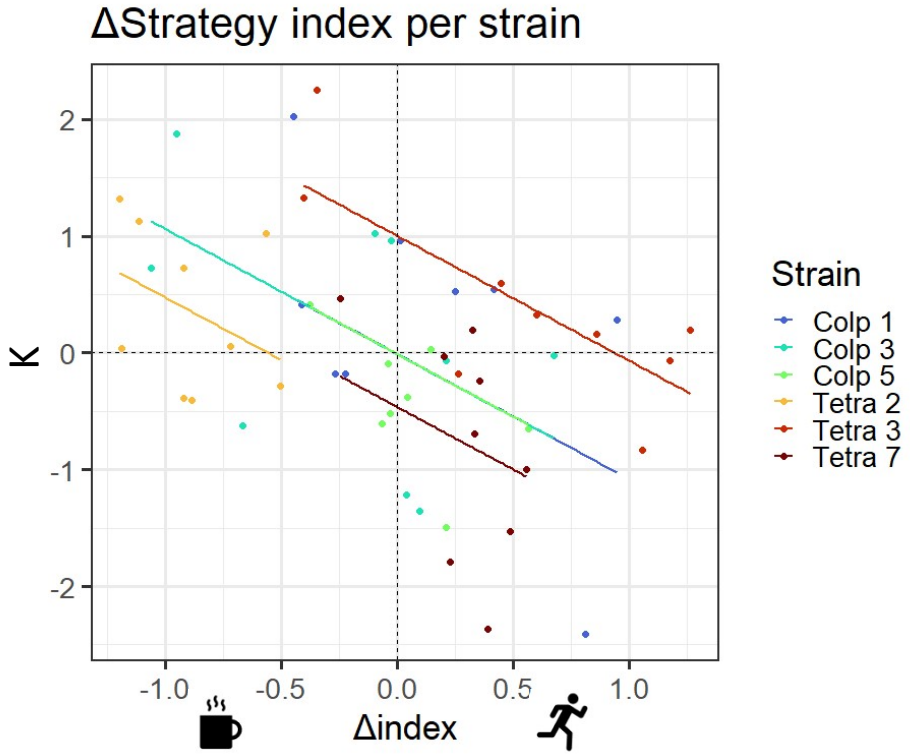


All strains share the same slope → **strength** of effect

Strains of *T. thermophila* are allowed separate y-intercepts → **scale** of effect

Finding the best model describing K versus strategy index and summed trait variance

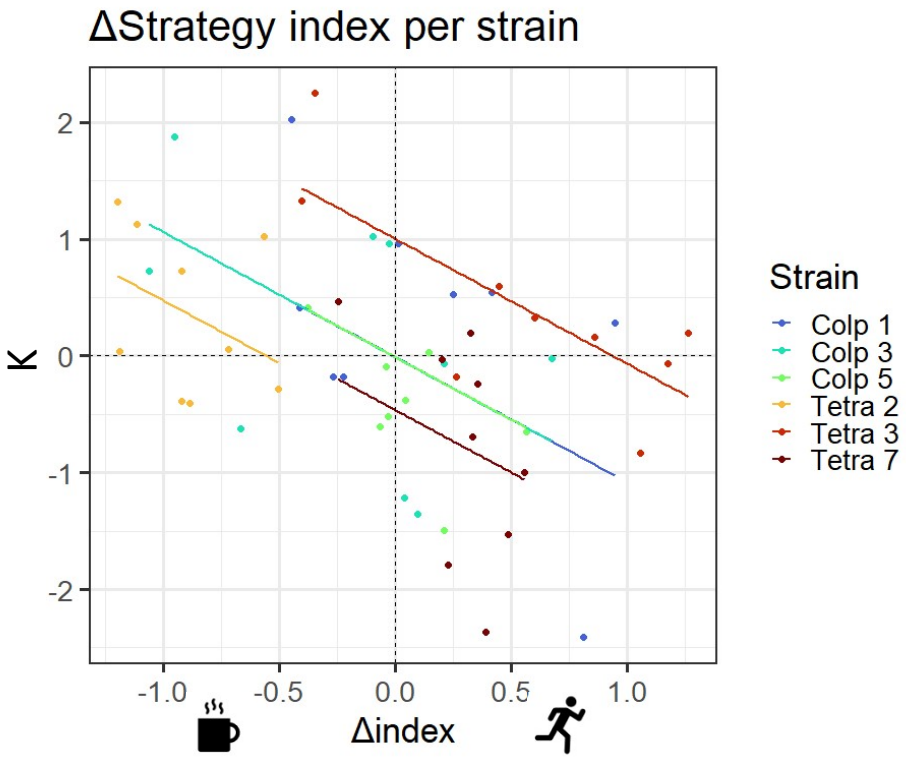


All strains share the same slope → **strength** of effect

Strains of *T. thermophila* are allowed separate y-intercepts → **scale** of effect

All summed trait variance explaining K is due to one strain → Tetra 7

Carrying capacity explains 33% of dispersal related traits across species



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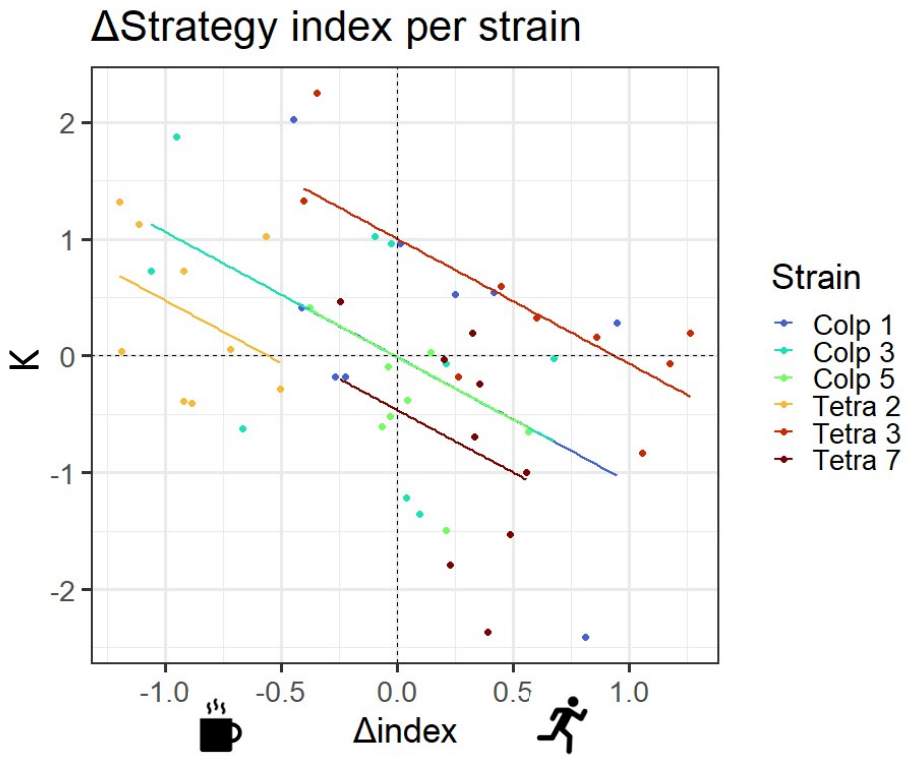

K below a certain threshold value is associated with an increase in dispersal

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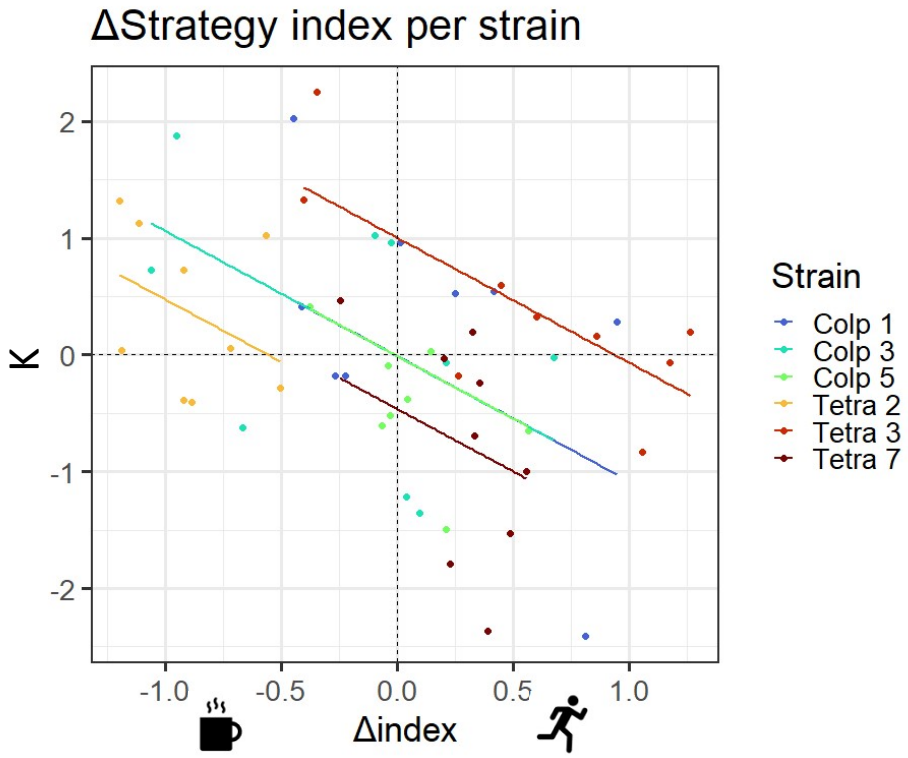

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This threshold value of K is relatively similar within species for all strains used in this experiment except for Tetra 3

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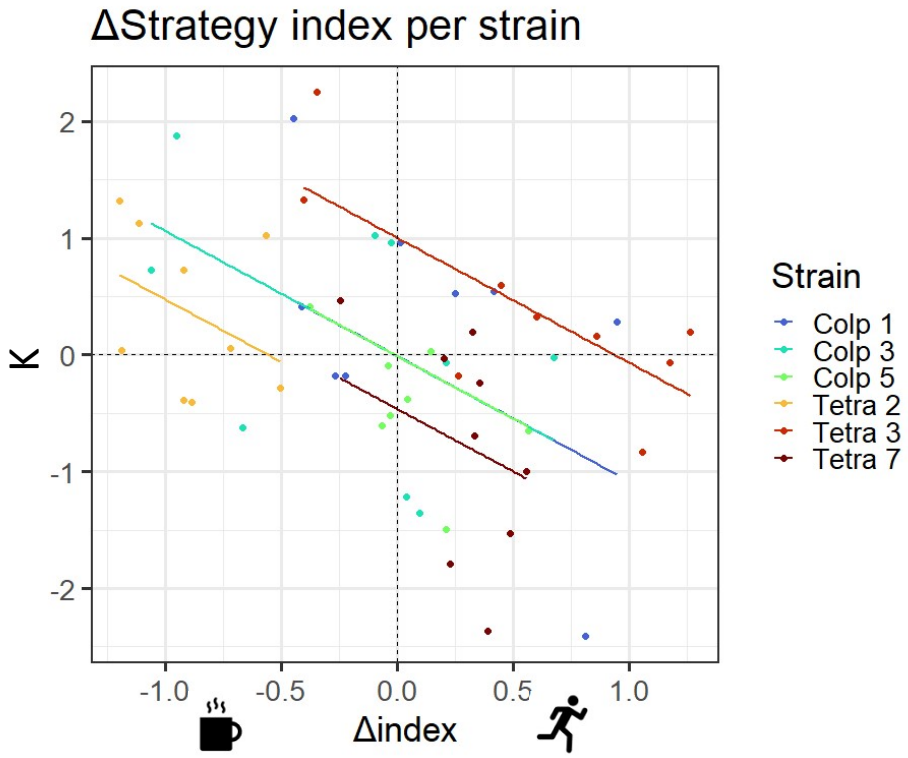

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Strains used in this study differ more strongly **intraspecifically** for *T. thermophila* than for *C. striatum* concerning the relation between K and Δindex


Thank you for listening!
Any Questions?