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Can the brood rearing temperature affect adult bee fitness?

*A hypothesis explaining the time interval between bee loss
and its primary causal factor.*

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Well populated hives at the end of the season. 4 supers of honey produced.



all photos – 3rd September !!!

Poorly populated hives along the whole season after a spring intoxication occurred during sowing of Poncho and Cruiser dressed corn seeds. Only 1 super of honey produced.

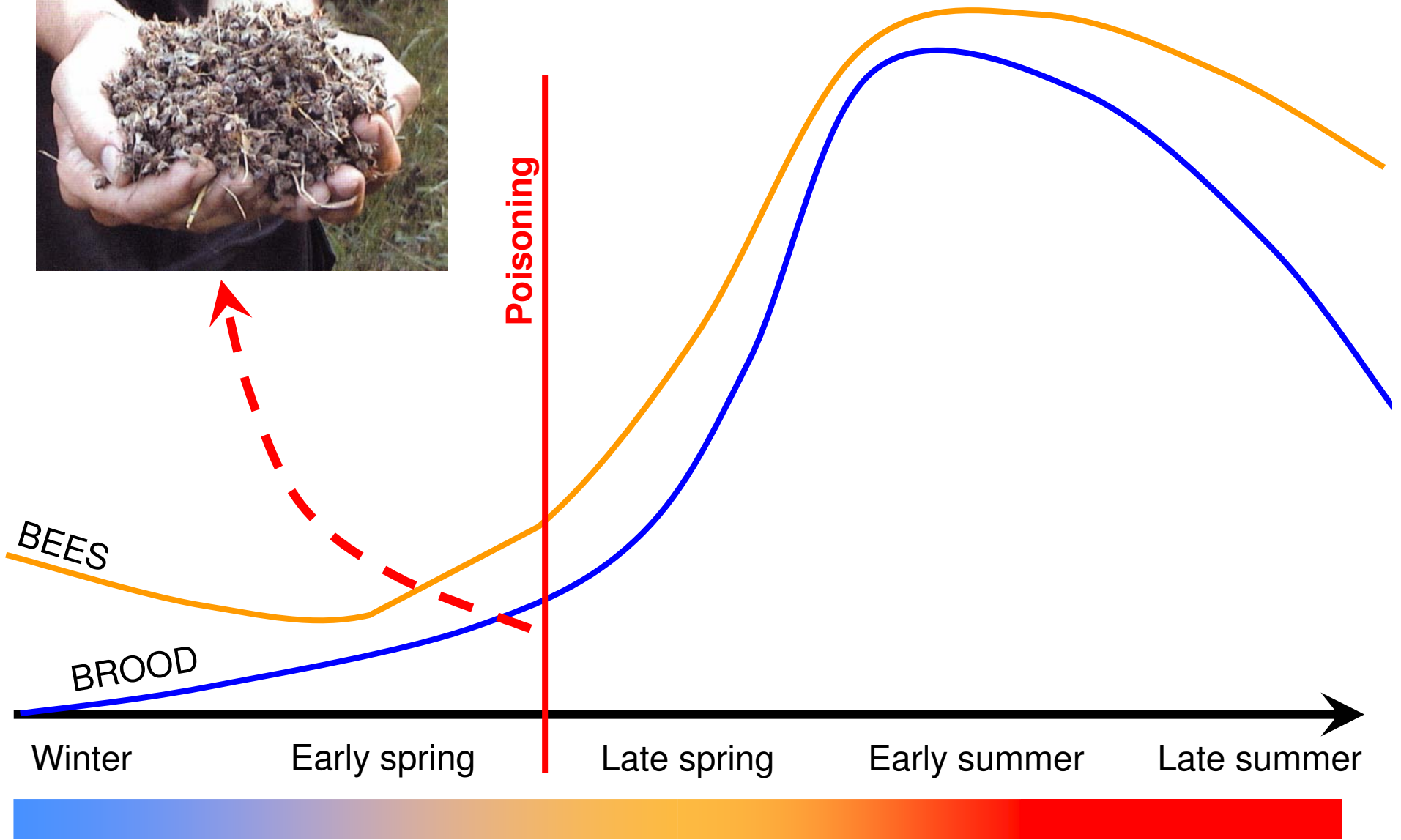


Fot. Zacchetti

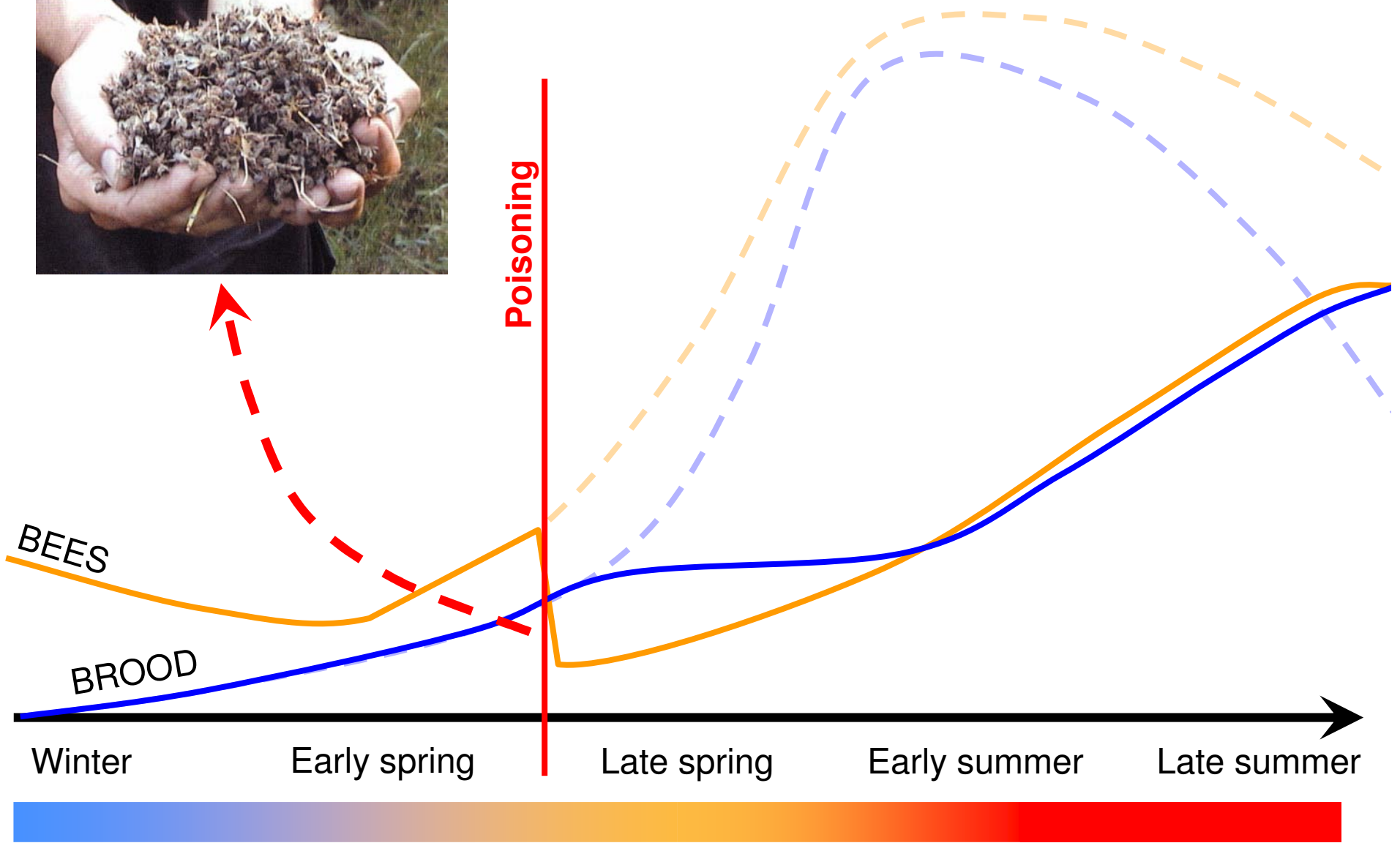
- No evident high bee mortality
- Nevertheless the colony remains weak during the season
- Low honey production

- **Effects of the bee loss delayed in time ?...**
- **What is the mechanism ?**

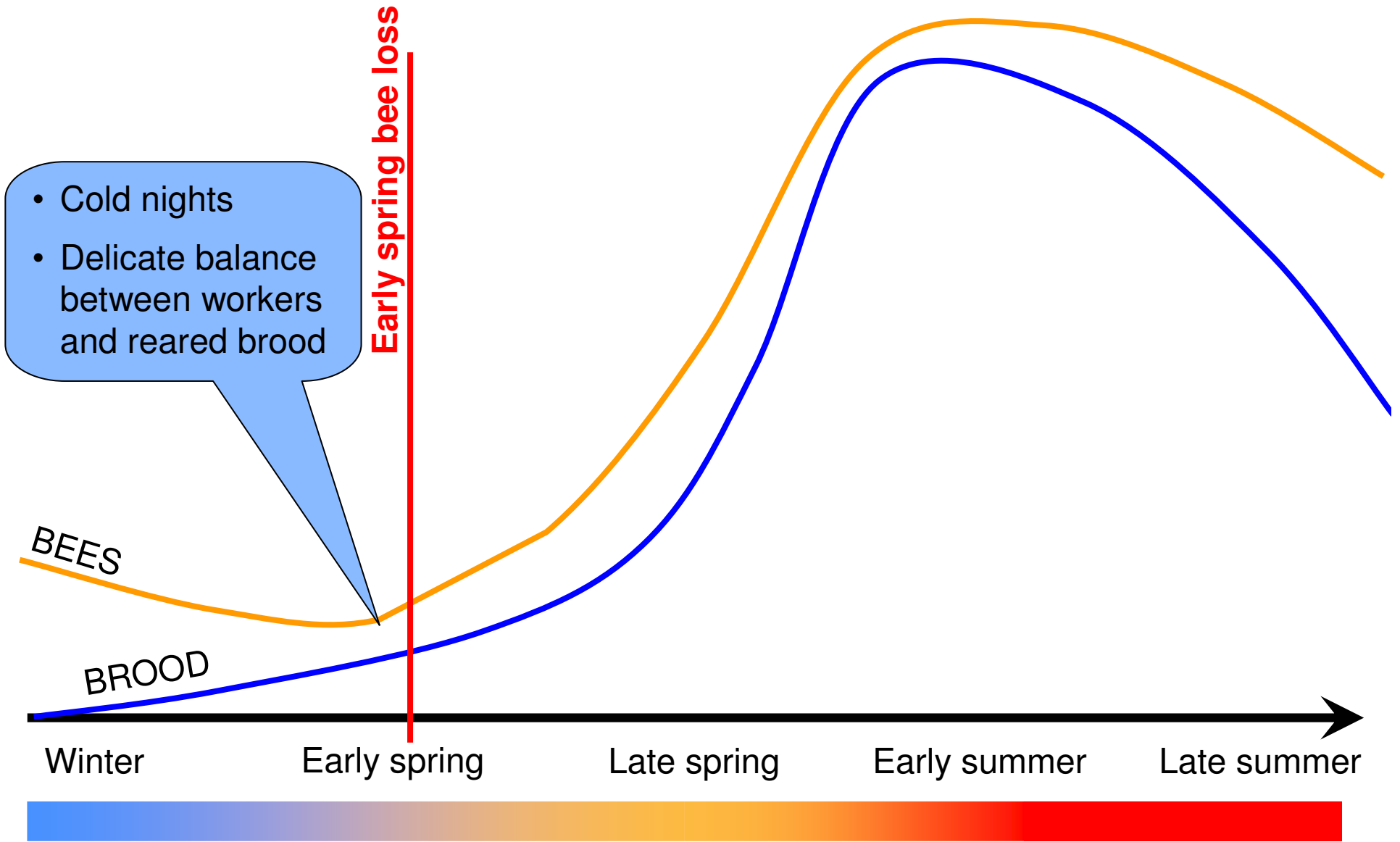
Colony dynamics



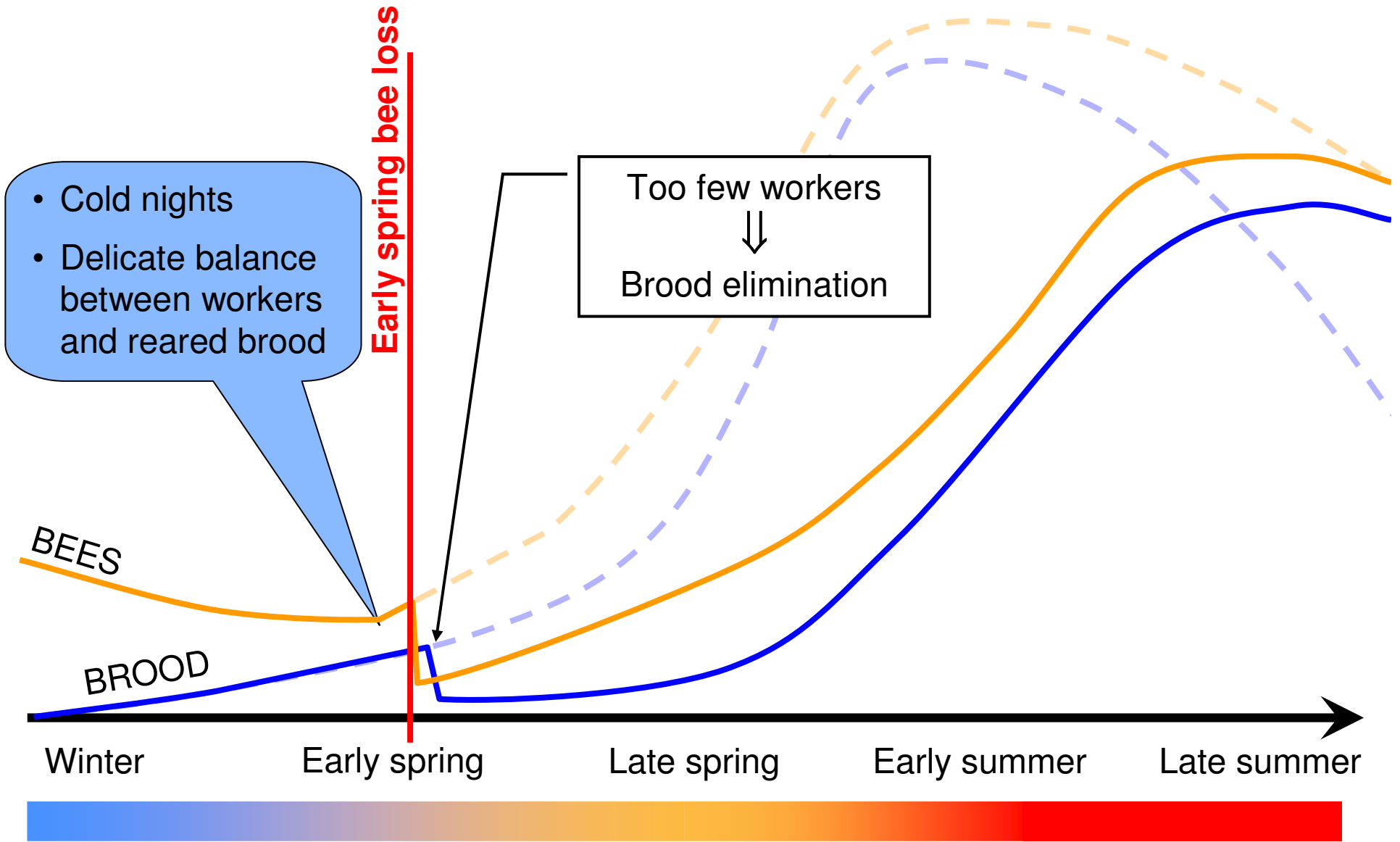
Colony dynamics



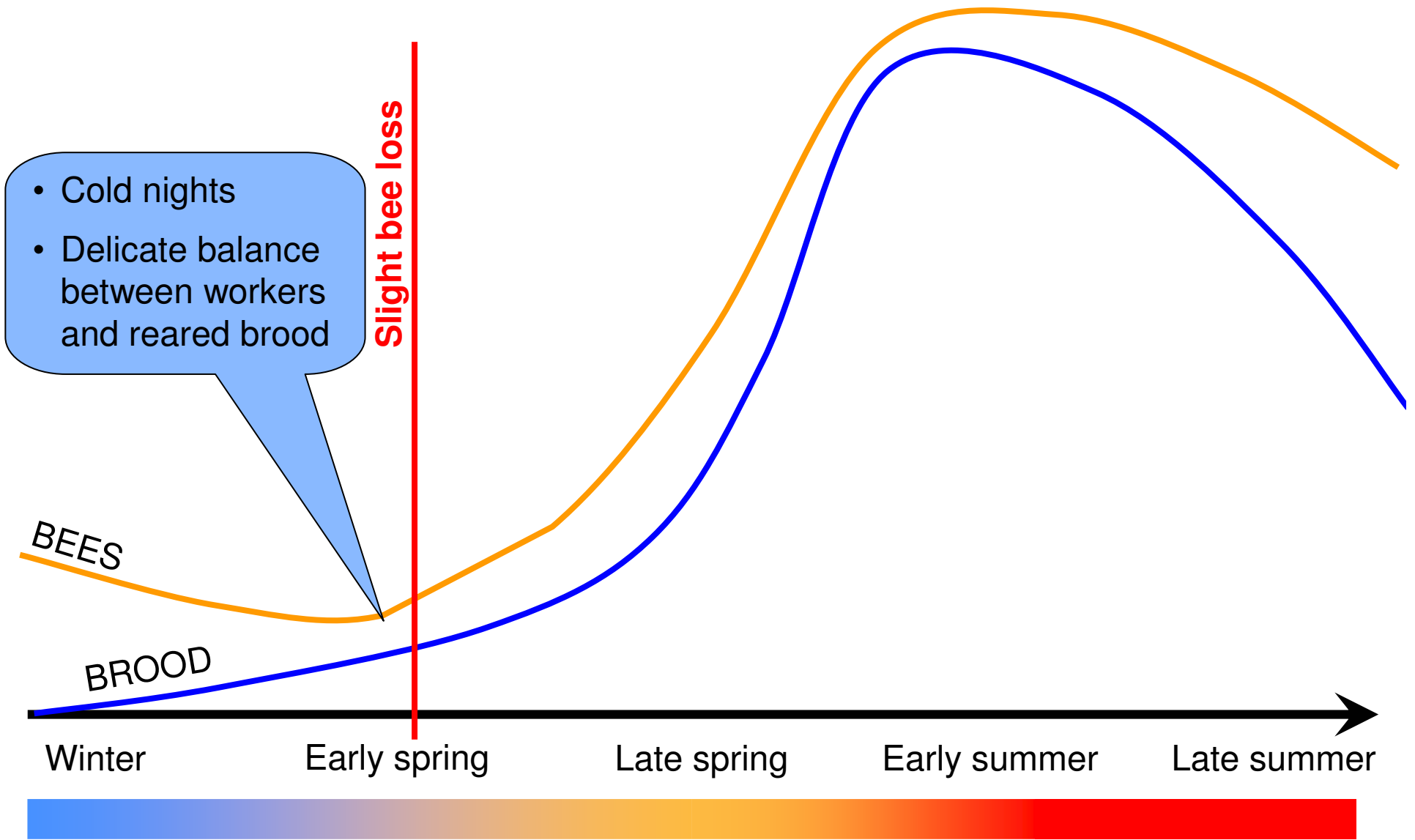
Colony dynamics



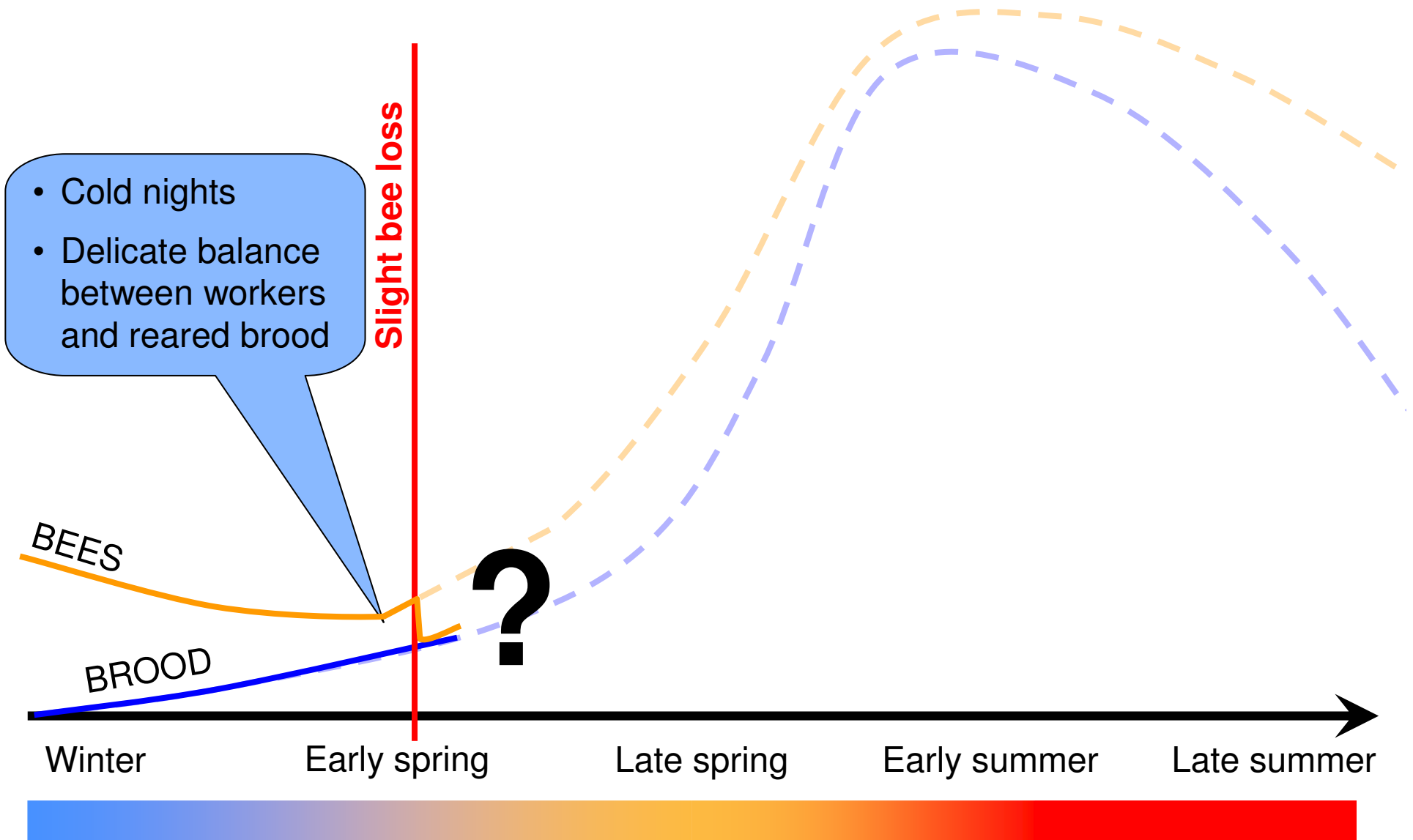
Colony dynamics



Colony dynamics



Colony dynamics



Aim of the study

Does the brood rearing temperature influence the brood
and the emerged adult bees ?

Experimental method

- Aupinel's protocol for *in vitro* rearing of honey bee larvae
- Larvae reared since 12-hours age till pupation at two constant temperatures:
 - optimal $\approx 35^{\circ}\text{C}$
 - suboptimal $\approx 33^{\circ}\text{C}$
- In each experiment, all the larvae came from the same hive



Analysed data

effects of brood rearing temperature

- **Effects on development:**

- Development mortality
- Adult bee emergence
- Adult bee longevity

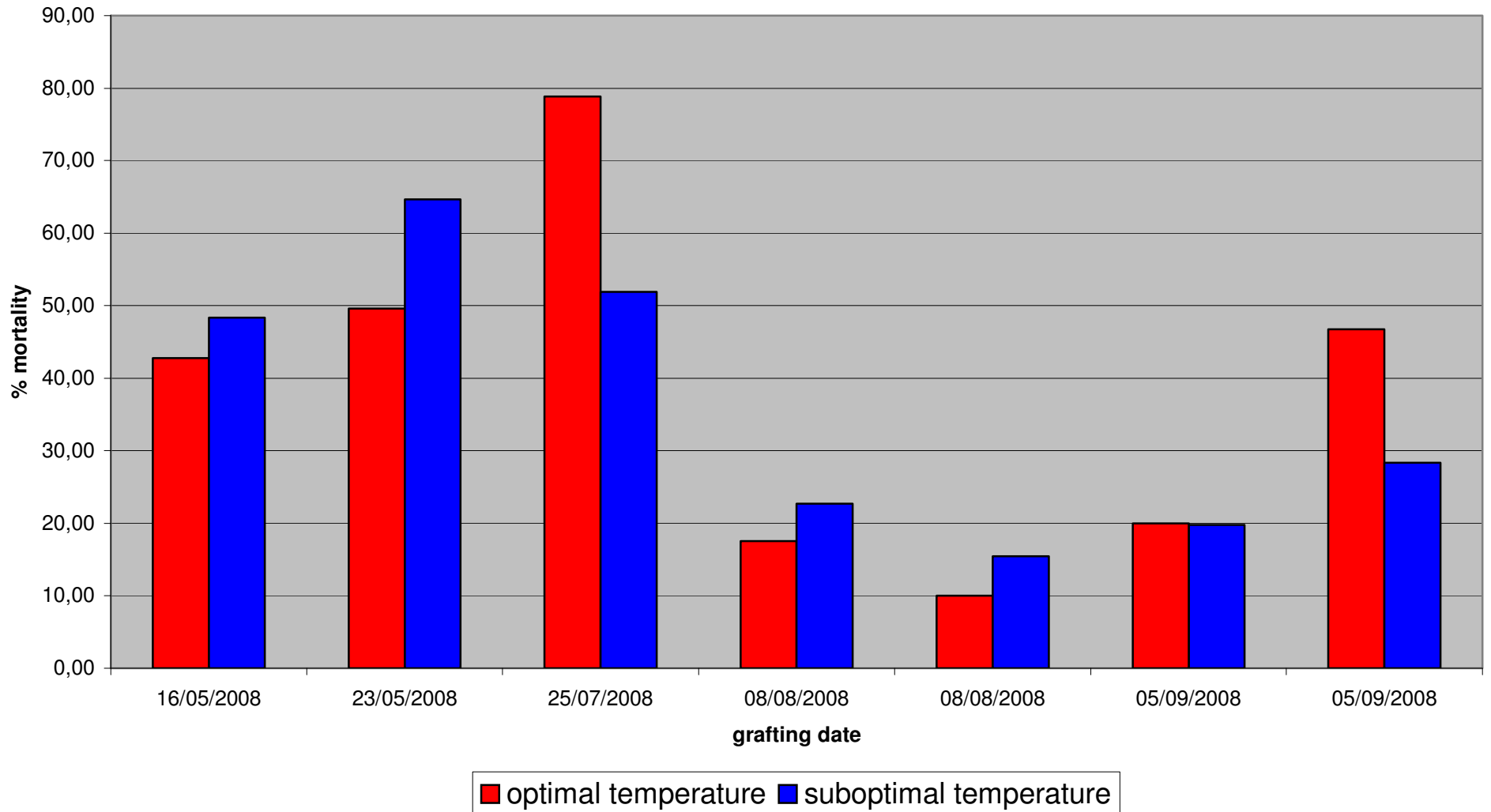
- **Effects on susceptibility to pesticide intoxication:**

- Larval LD50 of Dimethoate
- Adult bee response to administration of LD50 Dimethoate

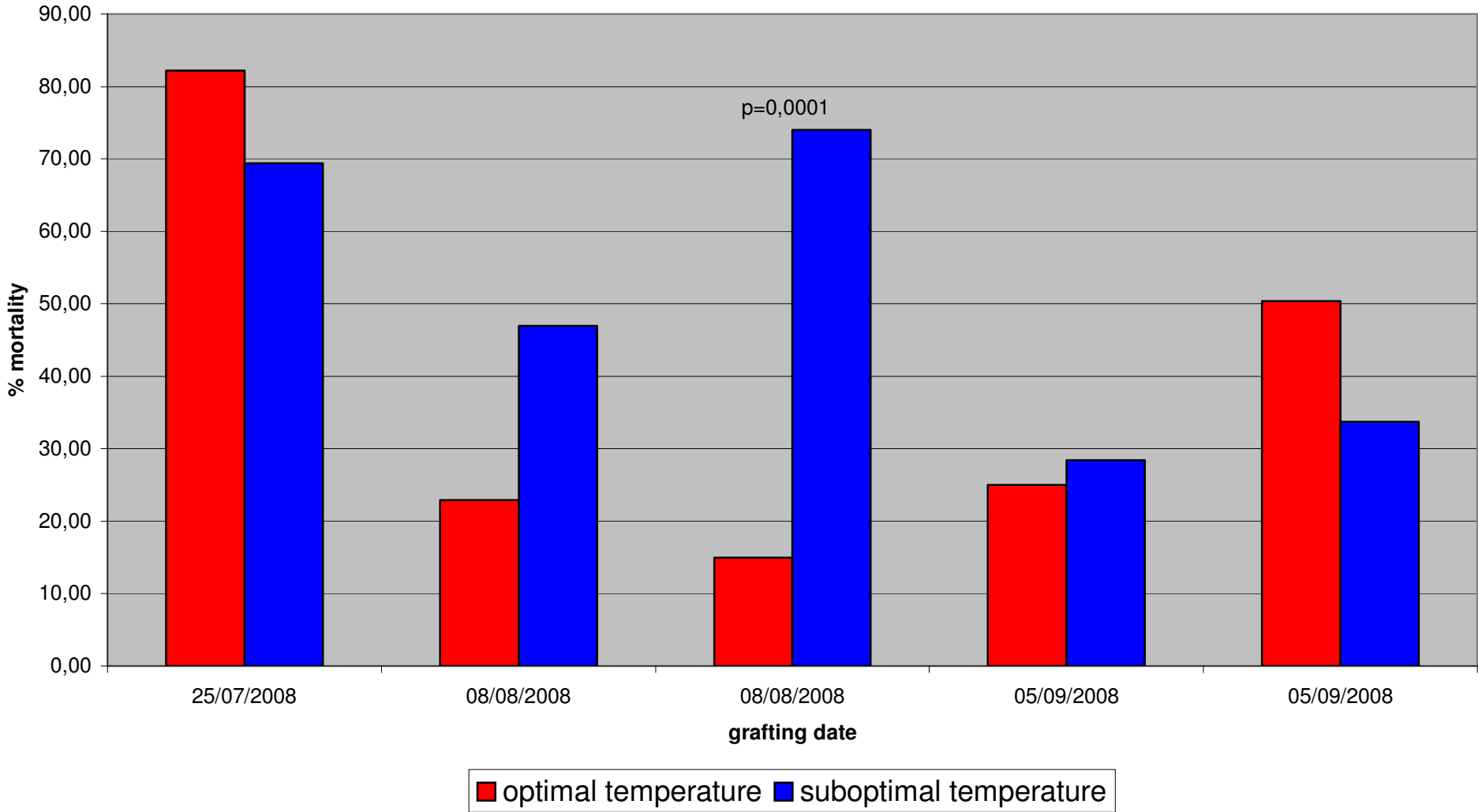
Results

Effects on development

Larval and prepupal mortality at D15



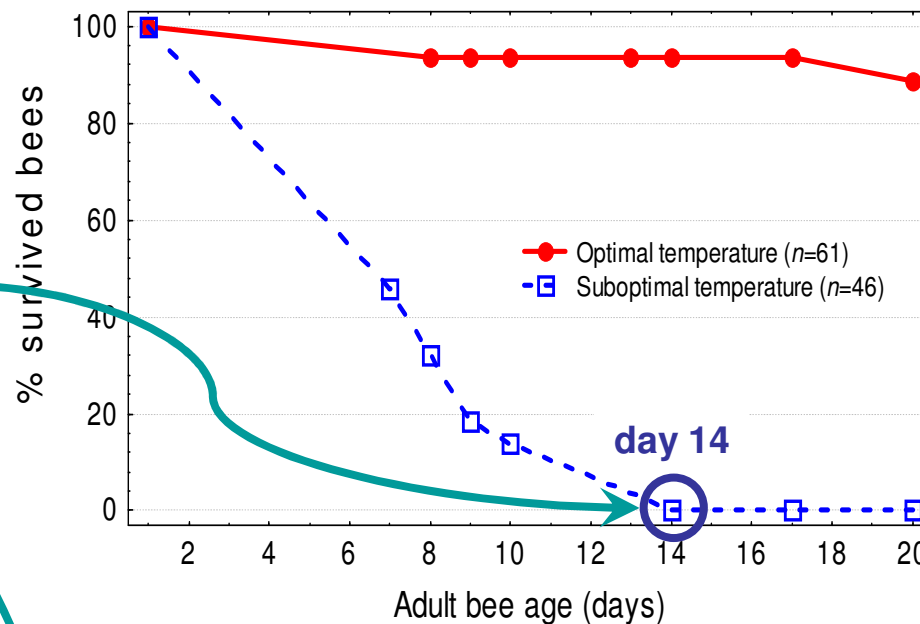
Development mortality at adult emergence



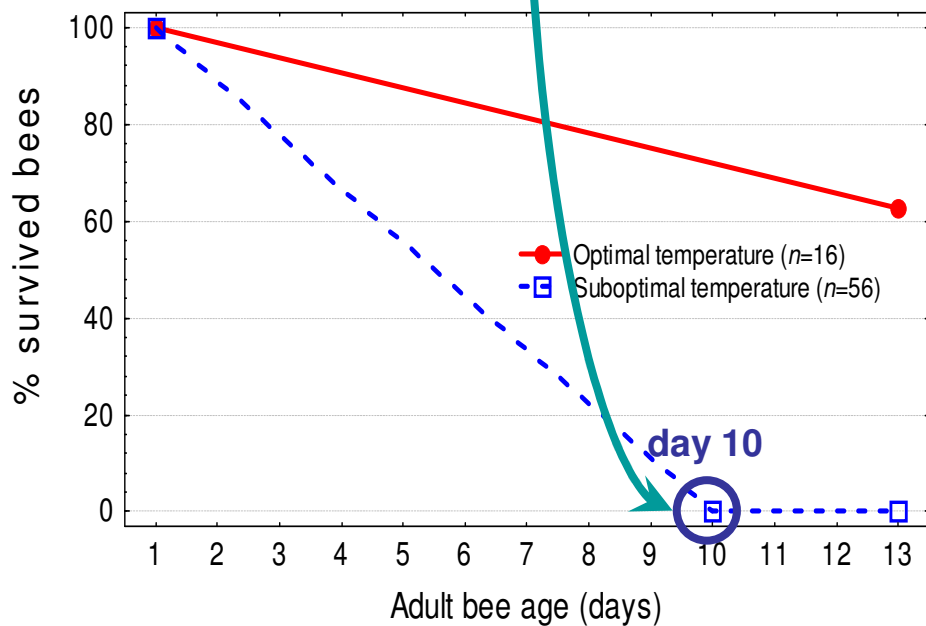
Adult bee longevity

survival = 0

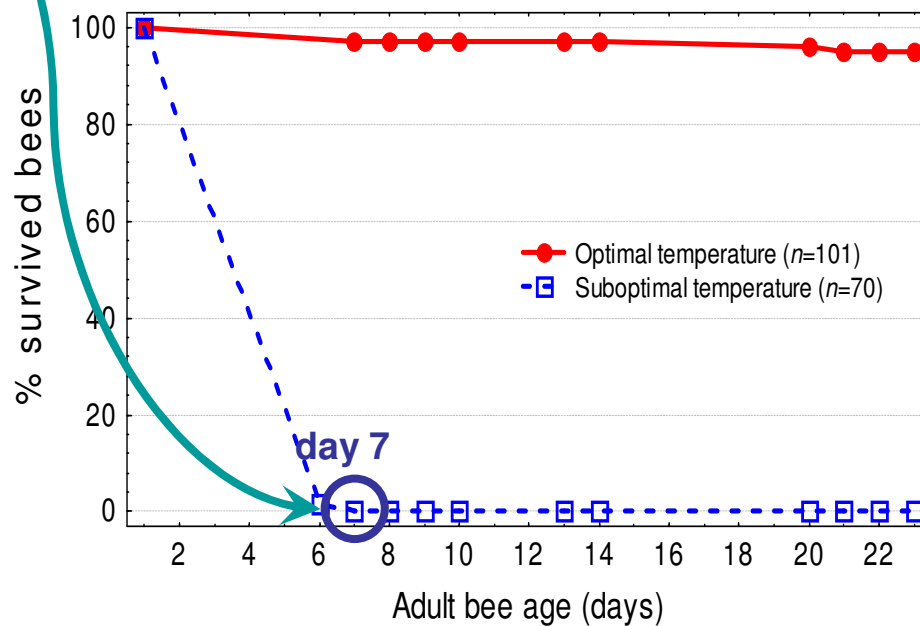
Grafting date: 16/05/08



Grafting date: 25/07/08



Grafting date: 08/08/08



Results

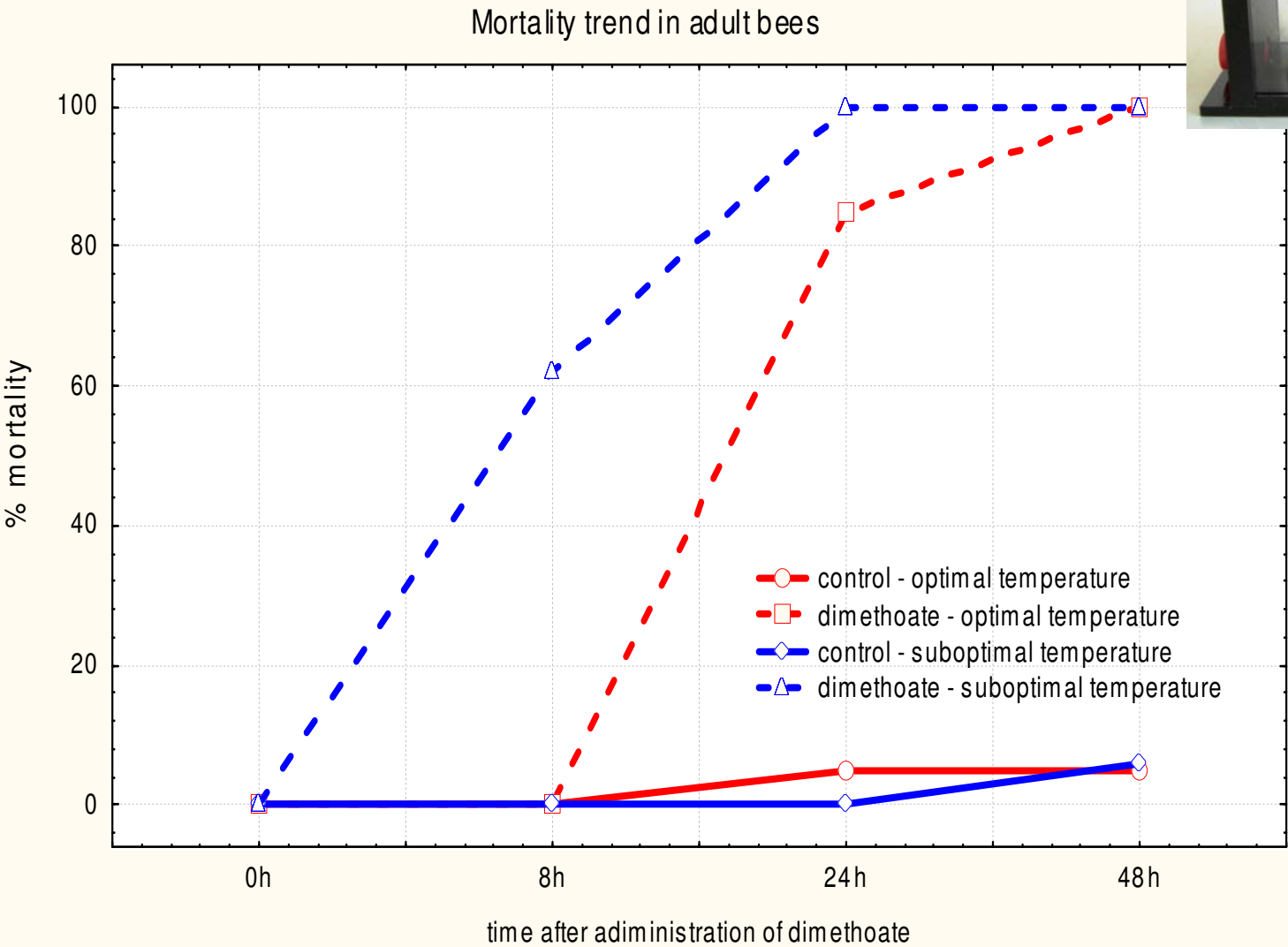
Effects on susceptibility to pesticide intoxication

Larval toxicity



Brood rearing temperature	LD50 Dimethoate ($\mu\text{g}/\text{larva}$)	
	48h	72h
optimal	0,67	0,43
suboptimal	18,64	2,00

Adult bee toxicity

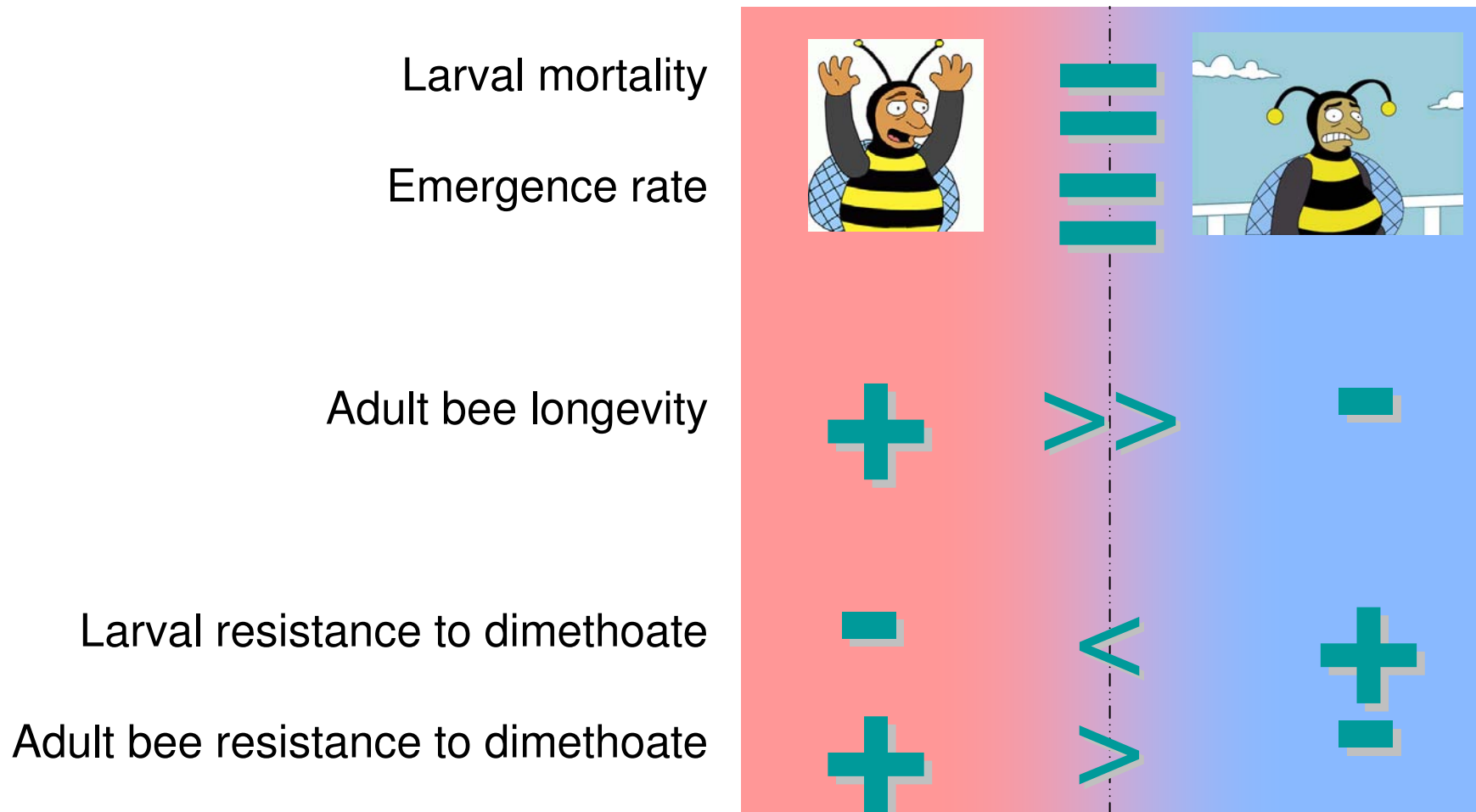


Summary

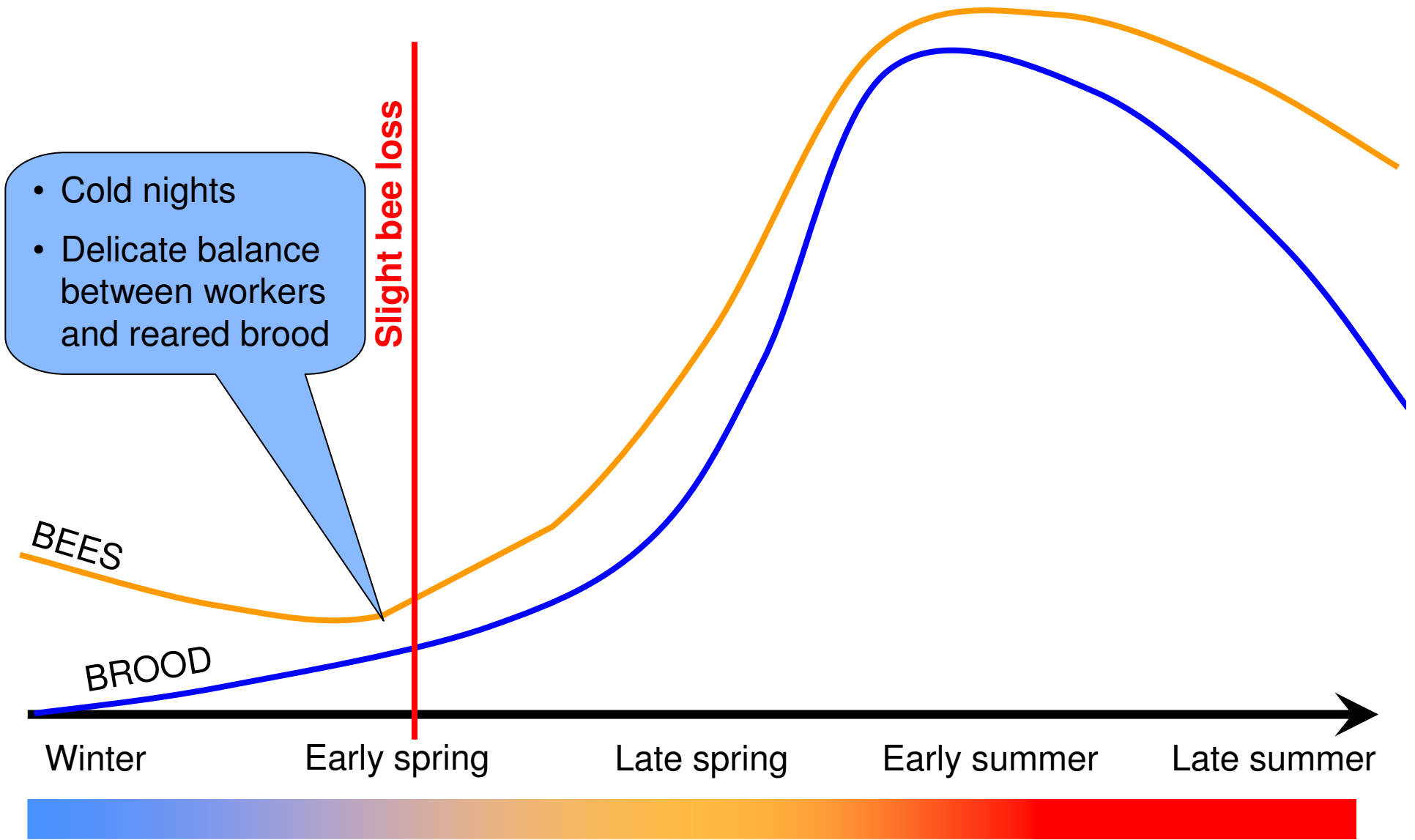
Brood temperature

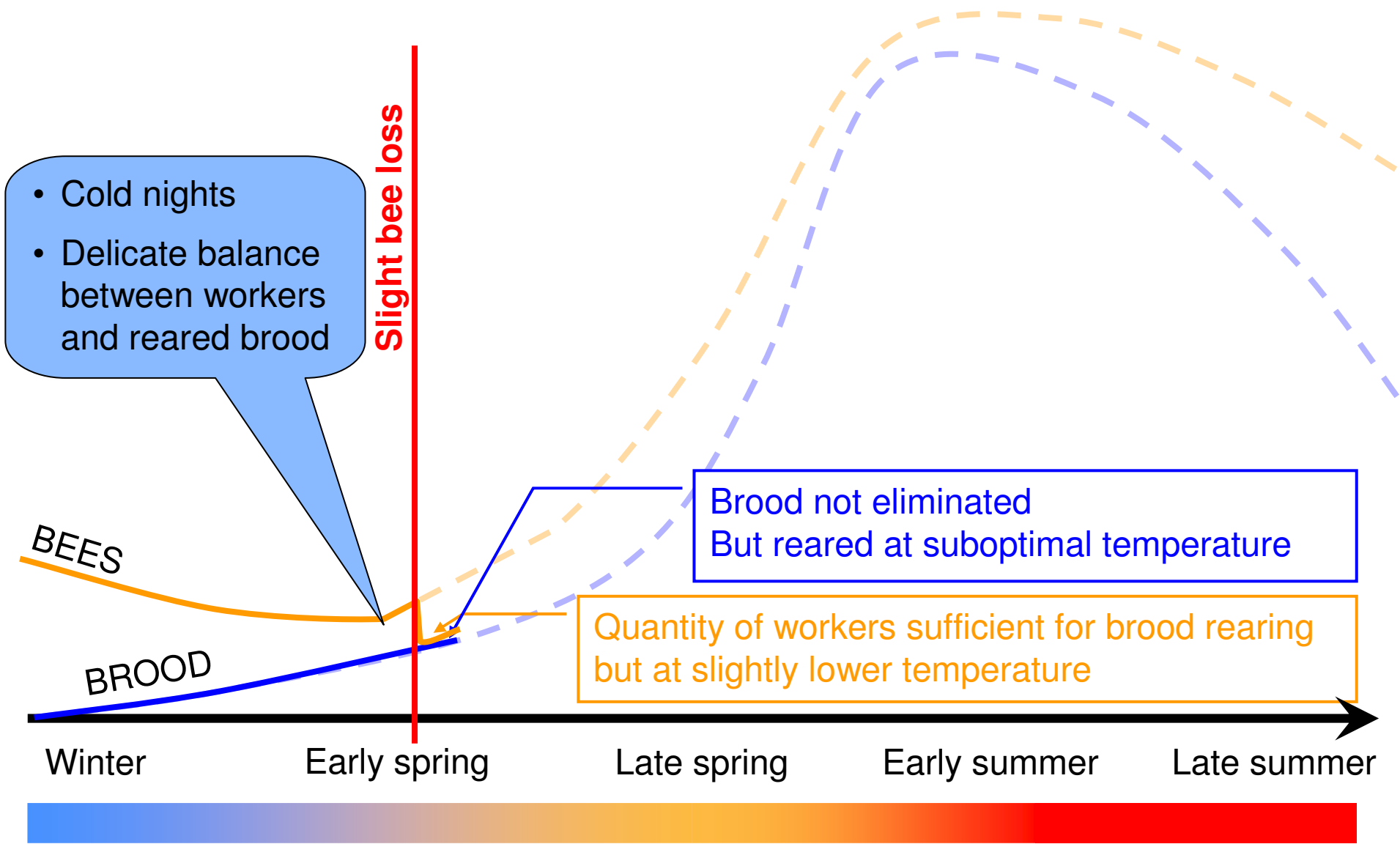
Optimal (35°C)

Suboptimal (33°C)



Damage hypothesis





- Cold nights
- Delicate balance between workers and reared brood

Slight bee loss

Brood not eliminated
But reared at suboptimal temperature

Quantity of workers sufficient for brood rearing
but at slightly lower temperature

BEES

BROOD

Winter

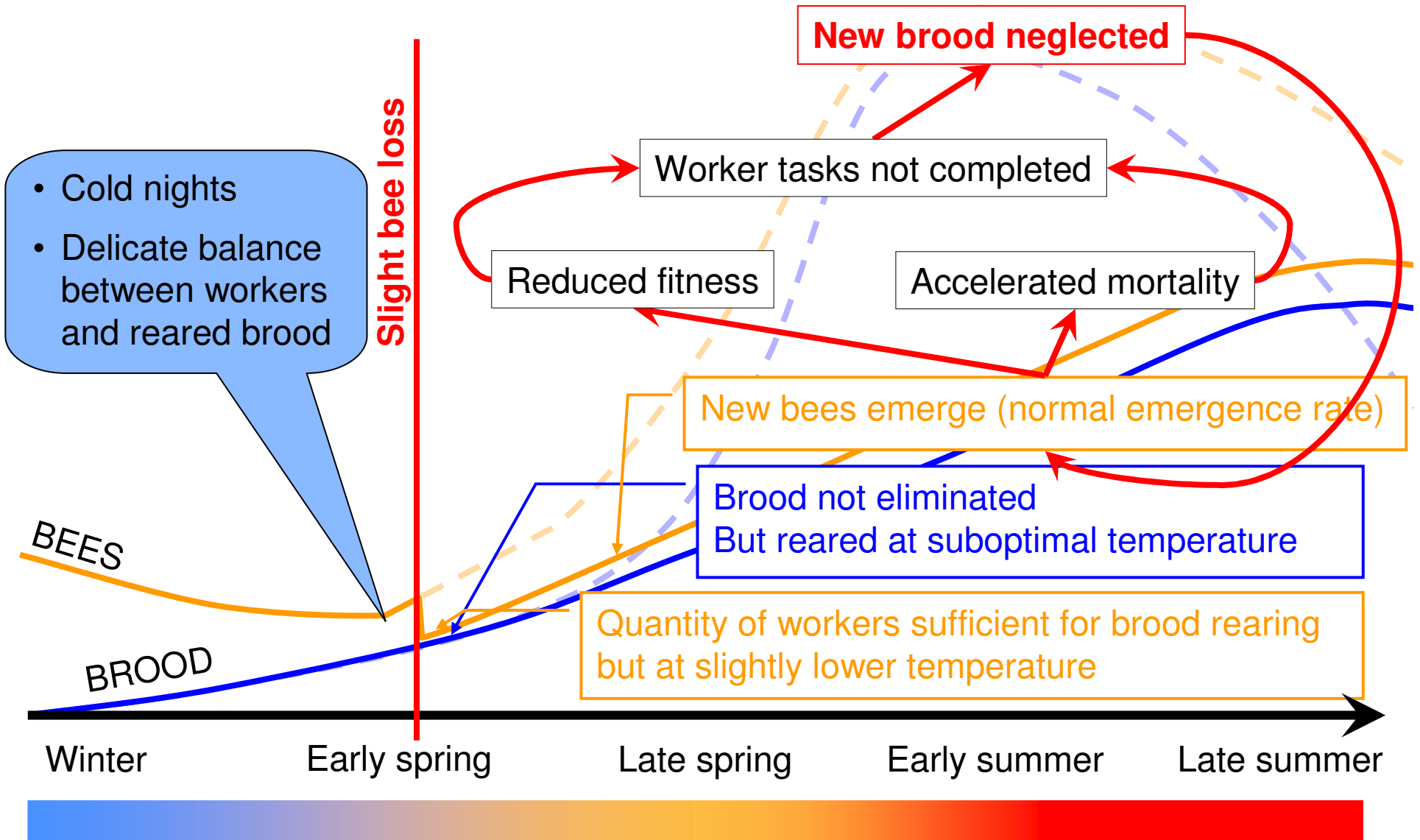
Early spring

Late spring

Early summer

Late summer

The colony remains weak for long time



Time interval: cause - effect

Causal factor

pesticide poisoning in early spring

Invisible damage

slightly lower brood rearing temperature

no effects on adult emergence

apparently normal colony development

worker fitness highly reduced

**Visible effects
delayed in time**

important negative effects on the colony
(colony remains weak)



**The effects of the lower brood rearing temperature
seem to be influenced by some other factor
(colony, season ?)**