

Cold storage: a tool for delayed and stable black soldier fly (*Hermetia illucens*) pupae eclosion

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EAAP-Lyon, 2023

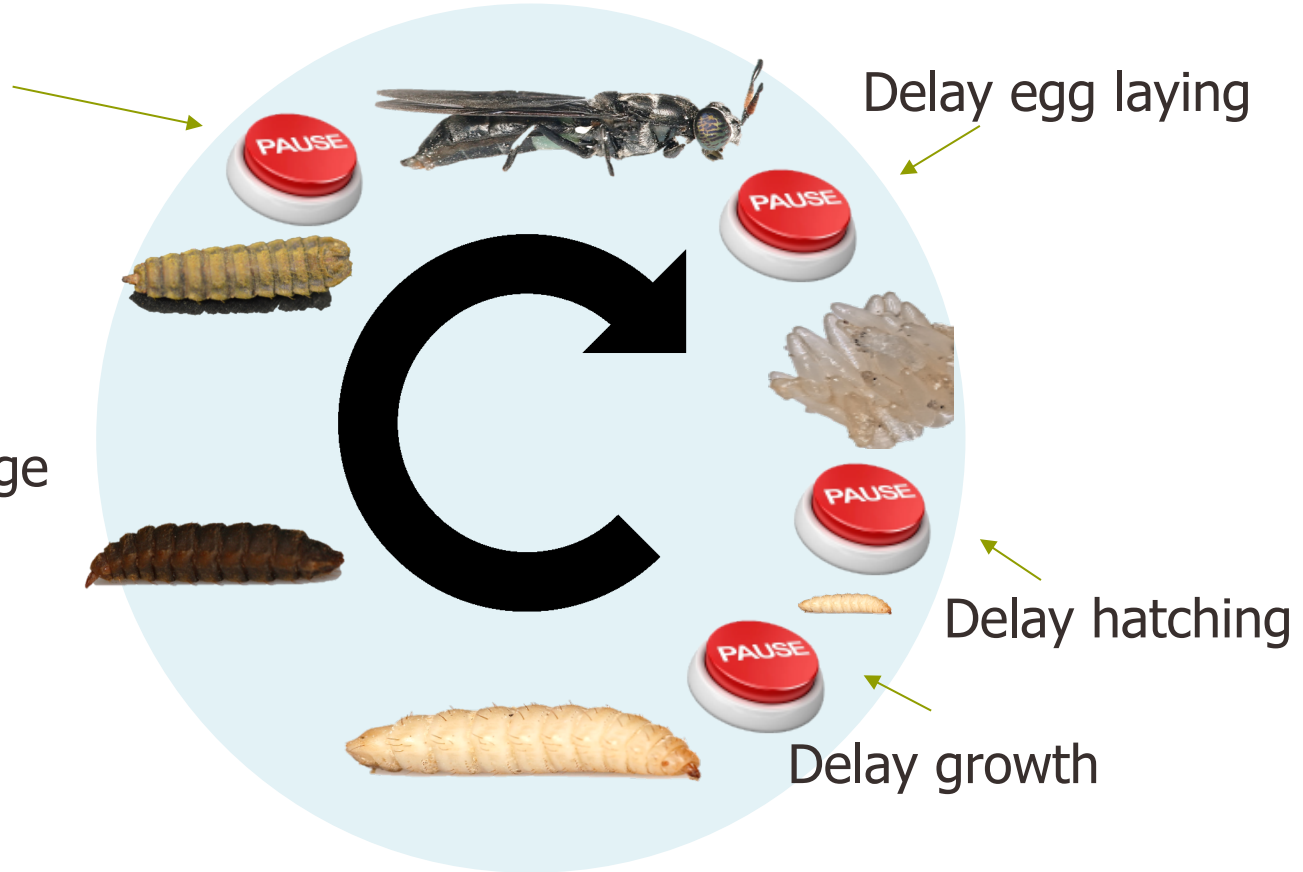


Why?

Explosive growth requires a pause button

Delay eclosion

-immobile
-non-feeding stage



It has nothing to do with
this...



Explosive growth requires a pause button

Delay
eclosion



Questions: Can we cool them down?

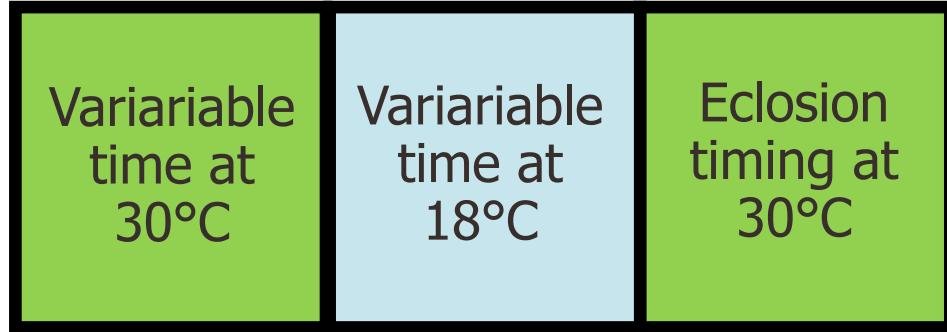
And if so:

-> does the age of the pupae matter?

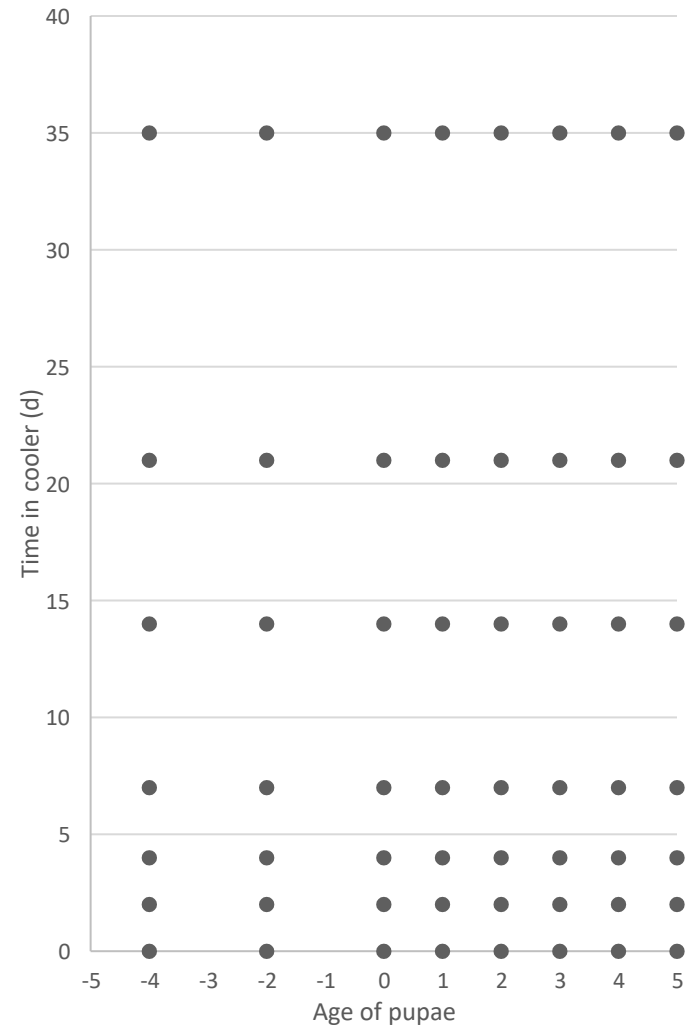
-> does the time in the cooler matter?

● How?

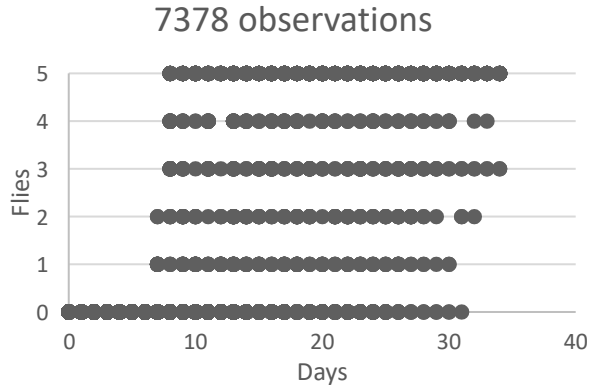
Experimental design 18°C



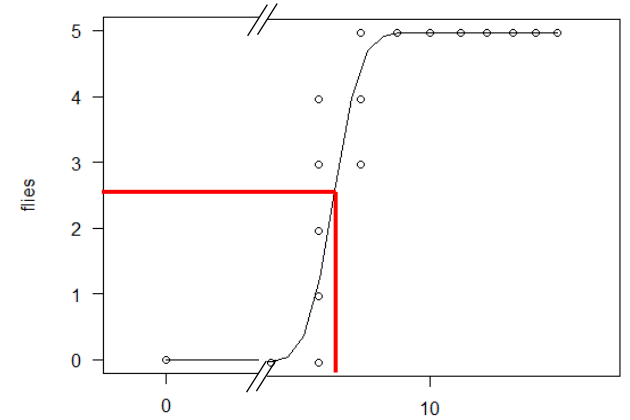
- 4 REPLICATES AND 5 PUPAE/REPLICATE
- DAILY CHECKS (PUPAE/FLIES)



Statistical analysis



- FOR EACH PUPAE AGE
- FOR EACH 'COOL' TIME

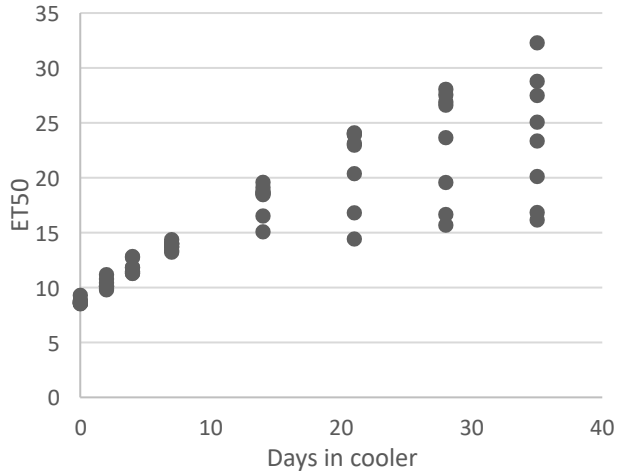


CALCULATE 50 % ECLOSION TIME (ET50)

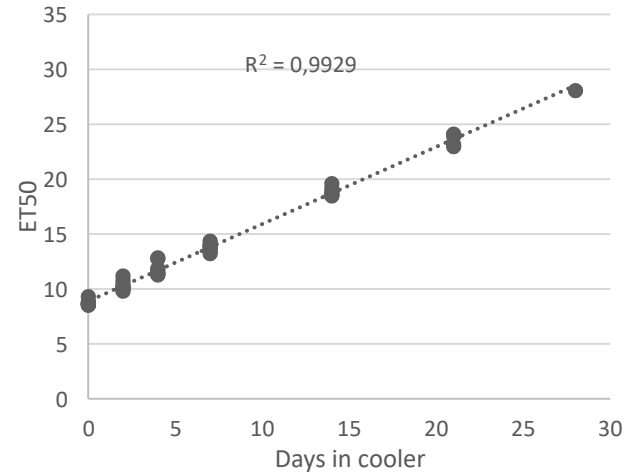
LOG-NORMAL DOSE RESPONSE CURVE WITH FIXED UPPER AND LOWER LIMIT (5-0) USING DRC PACKAGE IN R

RESULT-> 56 ET50'S

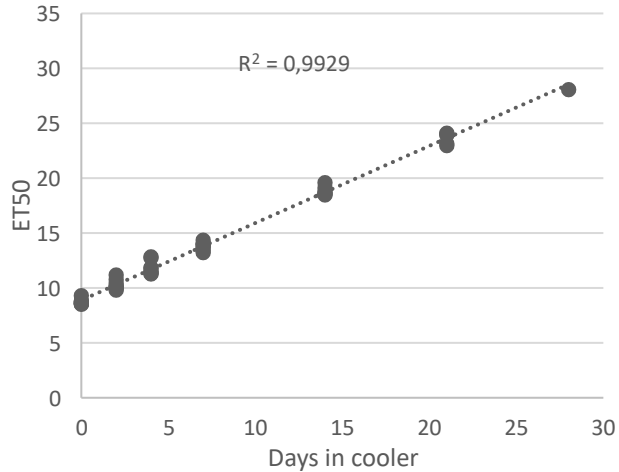
Result 18°C



REMOVE THE
COMBINATIONS
WHERE FLIES
EMERGED IN
COOLING
= NOT ACCURATE →



Result 18°C

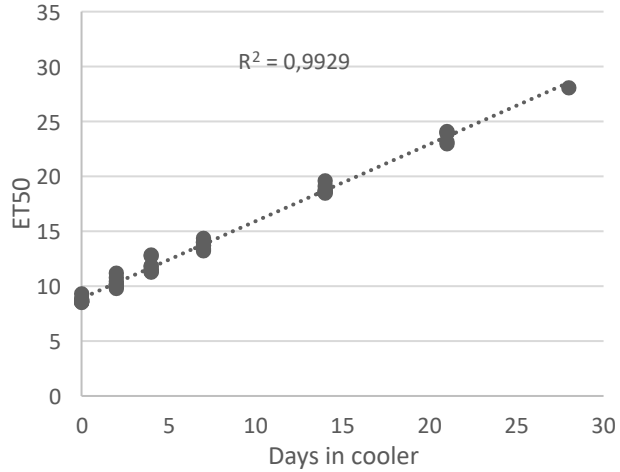


FOR EVERY DAY IN COOLING,
YOU 'WIN' 0.7 DAYS ON THE
PAUSE BUTTON OR 30 %
DEVELOPMENT RATE

ALSO:

- AGE OF PUPAE DOES NOT MATTER!
- TIME DOES NOT MATTER

Result 18°C



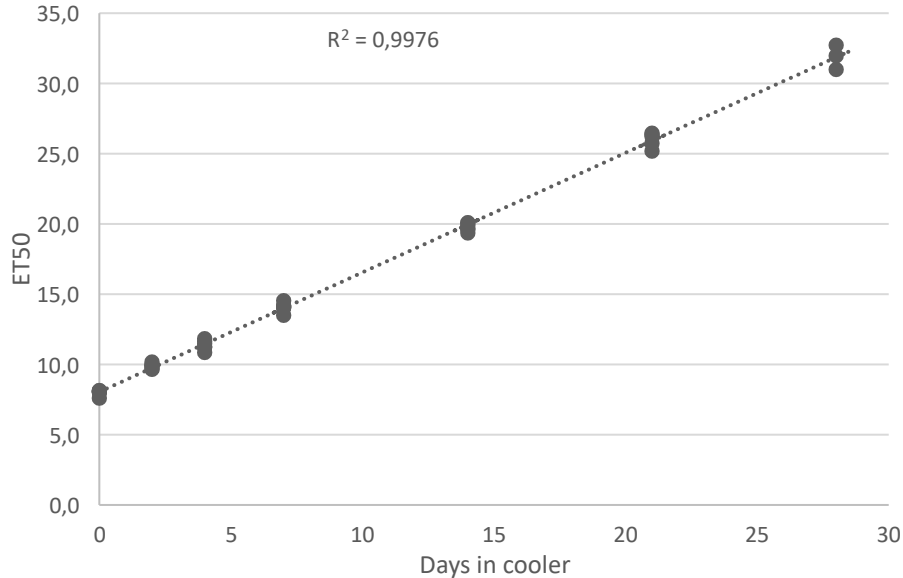
AT 30 % OF CONTROL DEVELOPMENT
99.6 % ECLOSION RATE

CAN WE PAUSE A BIT MORE?

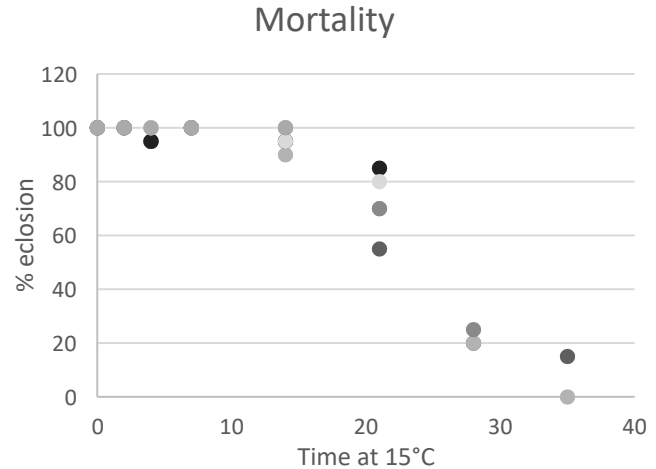


NEW TRIAL AT 15 °C

Result 15°C

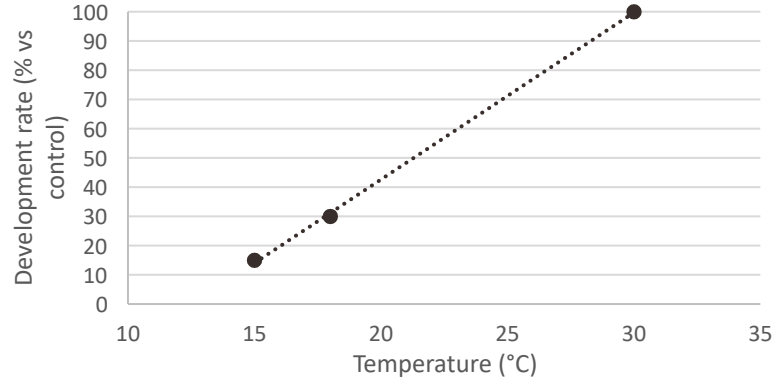


15 % OF CONTROL DEVELOPMENT
84 % ECLOSION RATE



Can we make any predictions

- AGE OF THE PUPAE DOES NOT MATTER
- DIRECT AND STABLE EFFECT OF COOLING
 - 30 % development at 18°C
 - 15 % development at 15°C

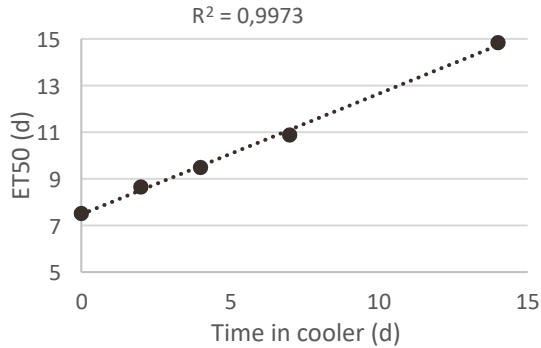


COULD IT BE THAT EASY?

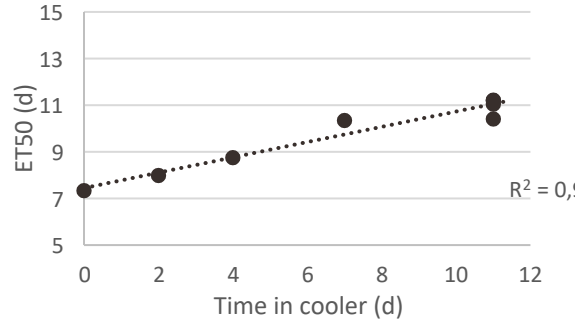


TEST AT 21, 24, 27°C

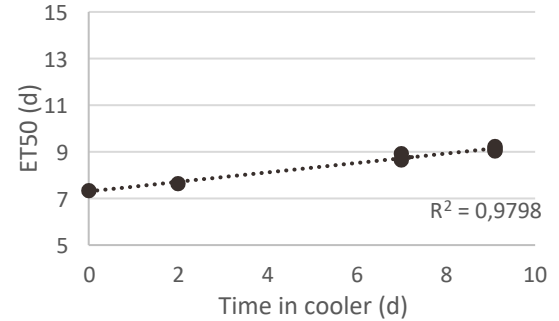
Results 21, 24, 27 °C



21°C
= 48 % CDR

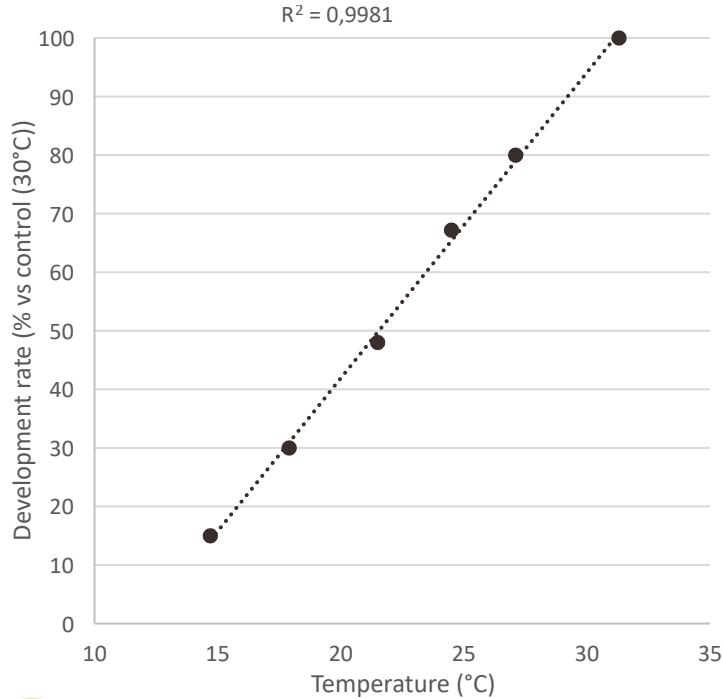


24°C
= 67 % CDR



27°C
= 80 % CDR

Results ALL temperatures



$$DR = 5.2 * C^{\circ} - 62.6$$

(COMPARED TO CONTROL)

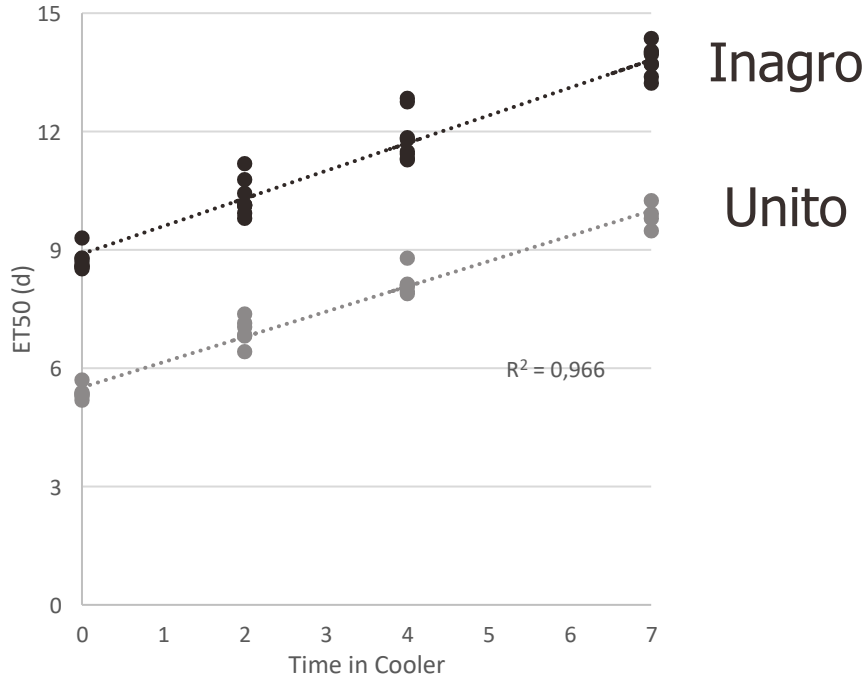


VARIABLE PAUSE BUTTON!

UP TO 3 WEEKS!

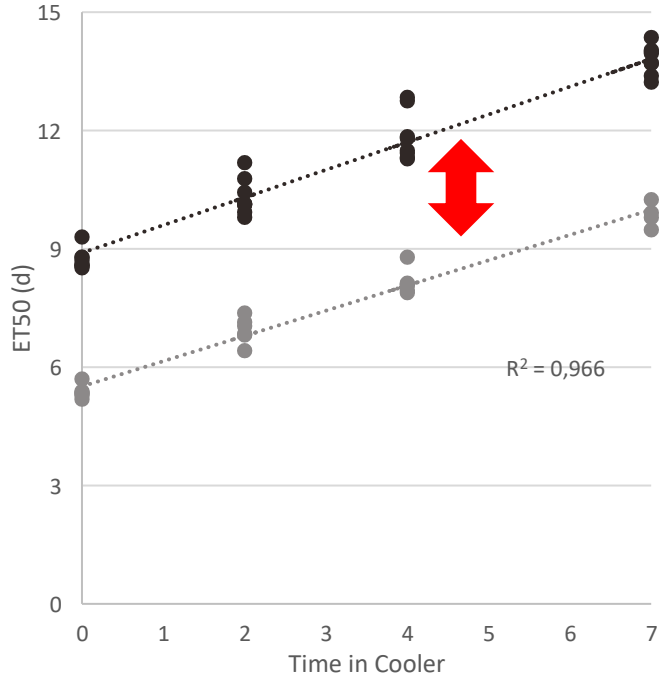
● However...

Second population at 17-18 °C...

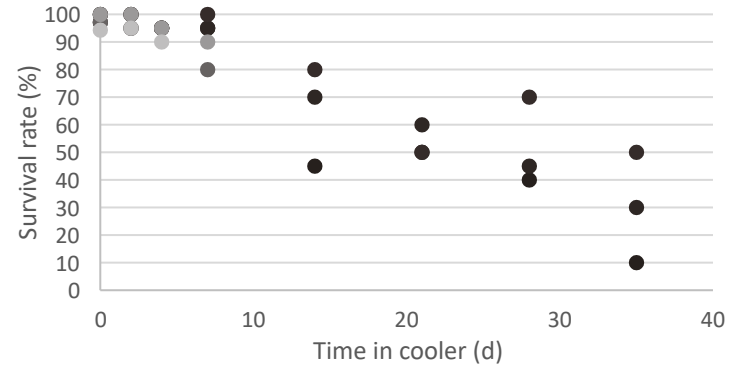


NO SIGNIFICANT DIFFERENCE IN
DEVELOPMENT RATE

Second population at 17 °C...



CONTROL ET50 = 5.3 DAYS = FAST
AND A HIGH MORTALITY
≈ 1 WEEK STORAGE...



Conclusion

Conclusion



- IS POSSIBLE TO SLOW DOWN DEVELOPMENT
- INDEPENDENT OF PUPAE AGE
- INDEPENDENT OF TIME IN COOLER
- (SEMI-INDEPENDENT OF POPULATION)

- MAY NOT BE USEFUL POPULATIONS WITH FAST CONTROL DEVELOPMENT AND/OR A LOWER COLD TOLERANCE