Expected response to selection on larval size and development time in the housefly (*Musca domestica)*

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Introduction

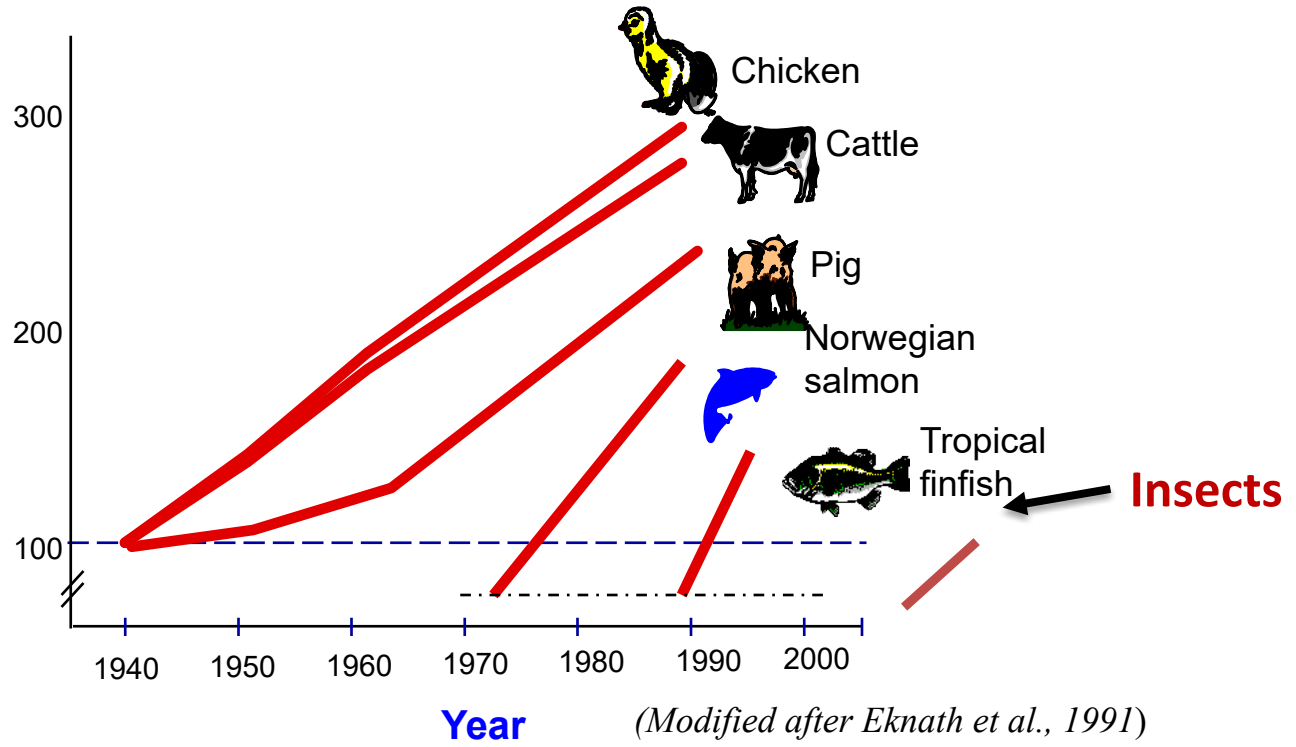
- The demand for protein will increase dramatically in the future

- Interest in insect production because:
  proteins from insects can be produced more sustainable compared to other animal protein sources

- Selective breeding could be a way to increase efficiency in insect production

Selective breeding improves efficiency of production

Productivity % rel. to 1940



(Modified after Eknath et al., 1991)

Large unutilised potential for selective breeding:

- High fecundity
- Short life cycle

Benefits of selective breeding in insects

- Increased resource efficiency:

  - feed, land, water, labour per unit of product

- Tailor made products

- Highly favourable Benefit/Cost ratios:

  sheep, cattle, pigs, salmon: 5-50

Selective breeding in insects

- In early phase
- Mainly based on phenotypic/mass selection
- Easy method but..
- Difficult to select for more traits
- Difficult to control inbreeding

<u>Other breeding methods requires:</u>

- Need to be able to master reproduction
- Phenotyping of animals
- Keep track of relationships

Aim

How large genetic improvement to expect if we select for larval size and development time using a family design in insects using the house fly as an example?

Traits and parameters

Larval size at day 7 (mm^2)

Development time (from egg to adult, hours)

Trait	h^2	σ_p^2
Larval size	0.1	81
Development time	0.3	2100

Genetic and phenotypic parameters (Hansen et al., 2023)

Traits and parameters

Larval size at day 7 (mm^2)

Development time (from egg to adult, hours)

Genetic correlation = 0.0, ……, 0.60

unfavorable, larval size ⇧ = Devel. Time ⇧

Phenotypic correlation = 0.60

Economic values:

$EV_{LSIZE} = EV_{DTIME}$ Standardized per genetic standard dev.

Mating design and information

- 1 male mated with 2 females

- 80 females * 40 males
- 10 offspring per female = 400 males and 400 females

<u>Information in index:</u>

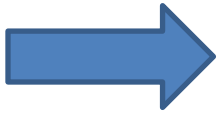
Larval size: 9 fullsibs and 10 halfsibs

Development time

<u>Prop. Selected:</u>

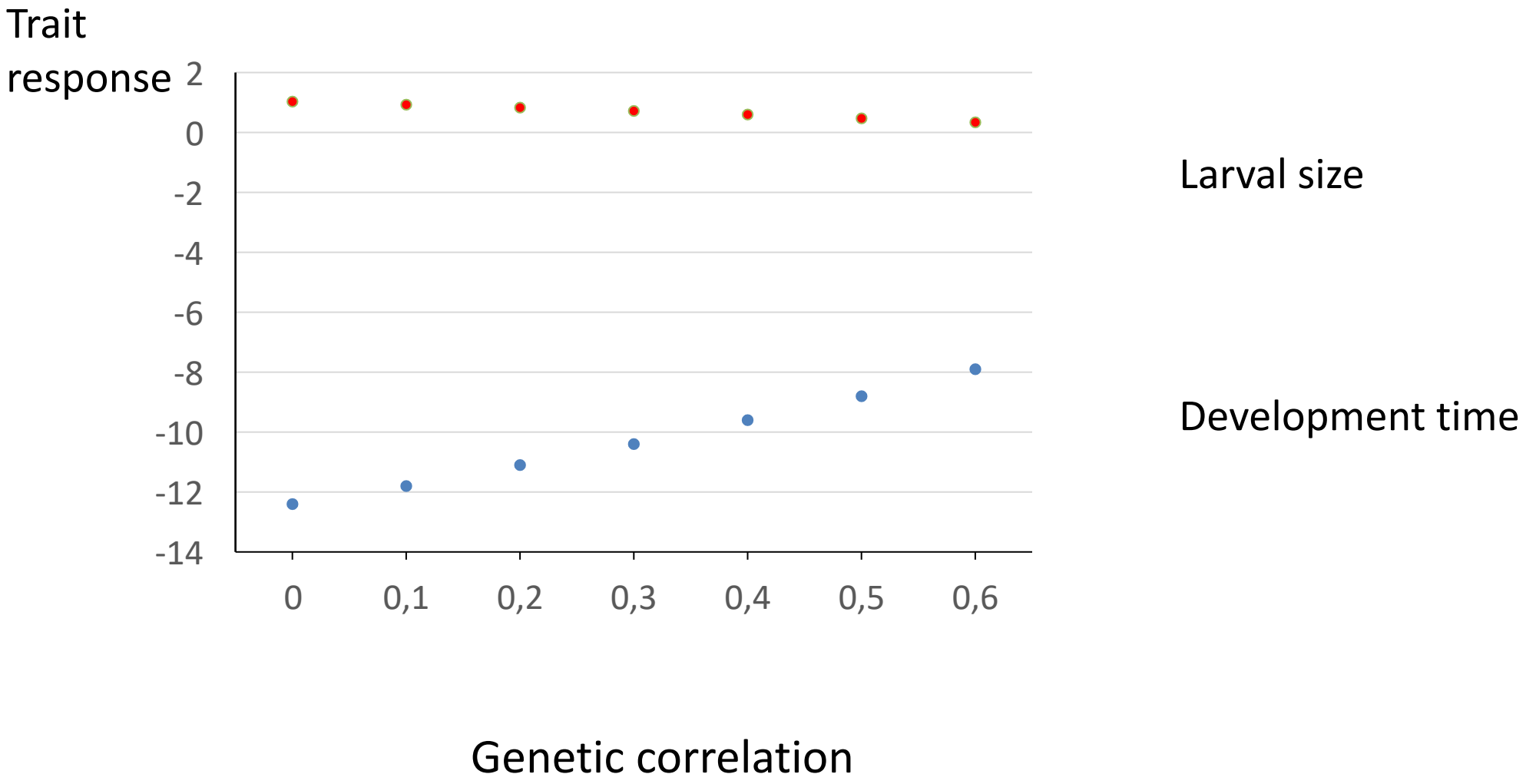
Males = 0.1

Females = 0.2



SelAction

Expected response



Results

Rate of inbreeding:

2.5 - 2.6% Inbreeding per selection round

Due to co-selection of sibs

Common environmental effect not included = lower response

Conclusion

With equal economic values it is possible to improve larval size and development time simultaneously

There is a large potential for selecting for important production traits in insects such as the housefly