

Consecutive mating of black soldier fly males to produce full- and half-sibling offspring

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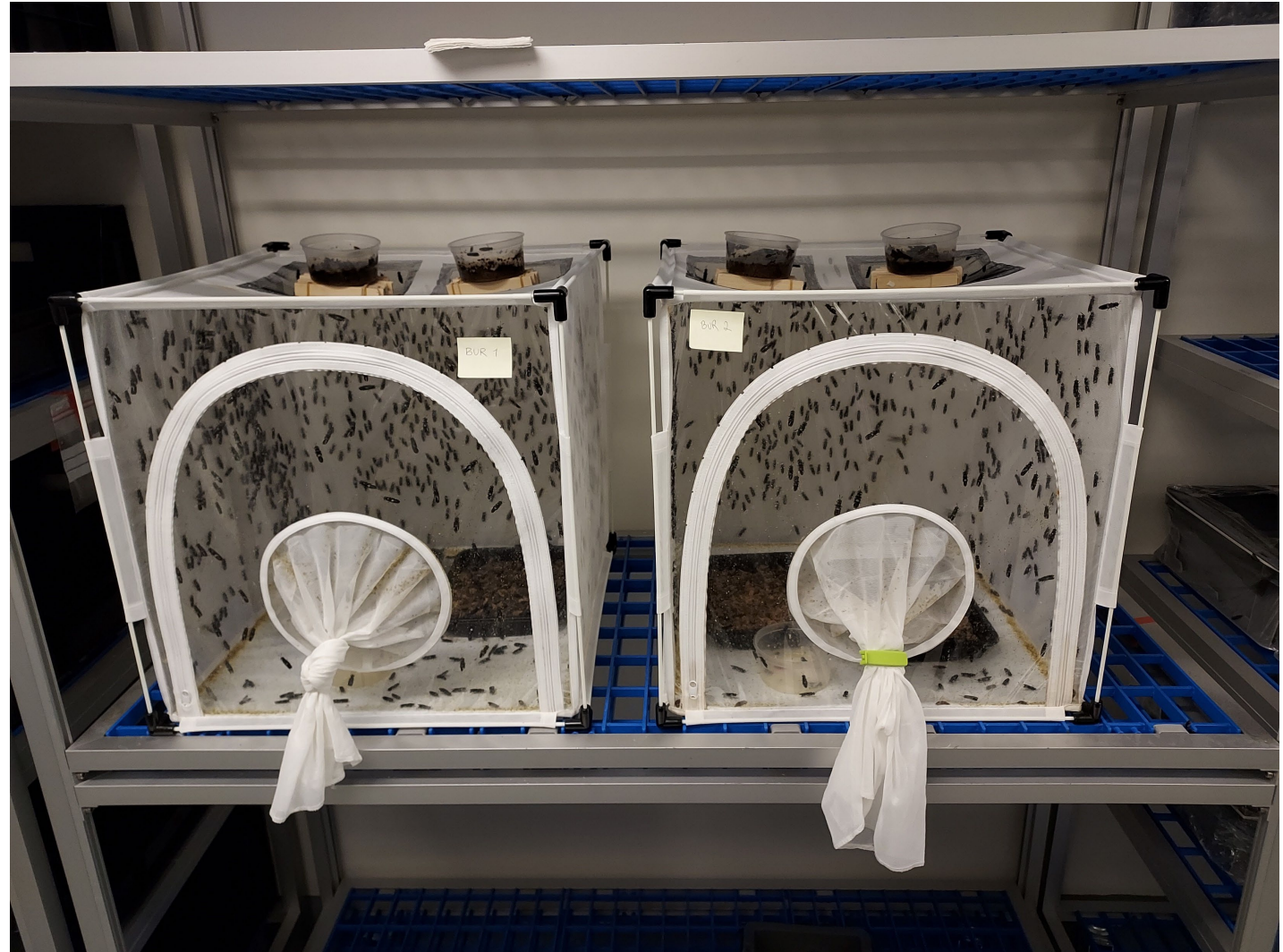
Animal breeding programs

- Controlled mating
- Pedigree tracking
- Full-/half-sibling breeding design



Need to mate under lekking conditions

- Mass rearing
- Multiple pairs
- Population level selection



First round

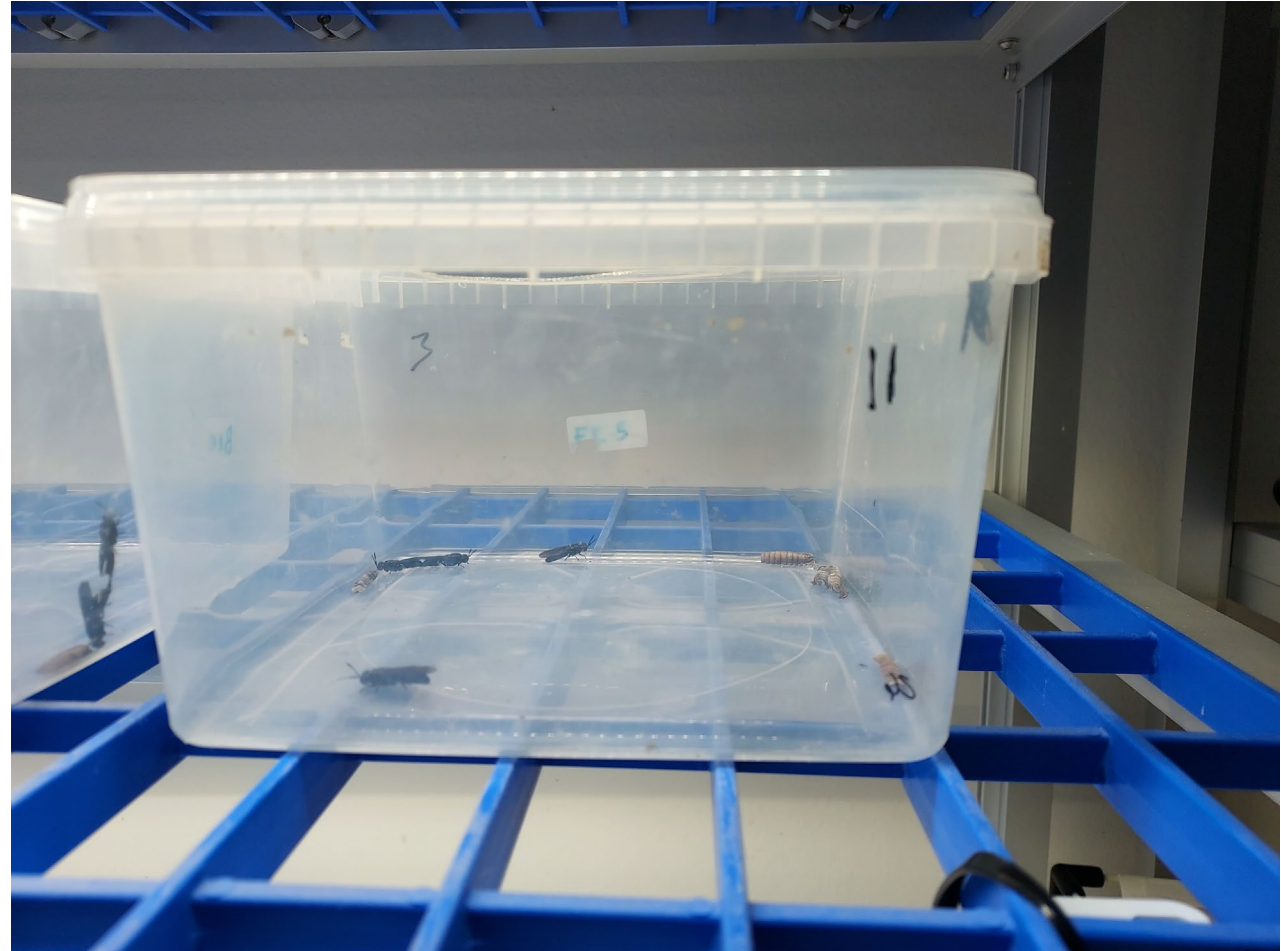
- Can a selected male mate a selected female?
- Can a selected male mate multiple females?



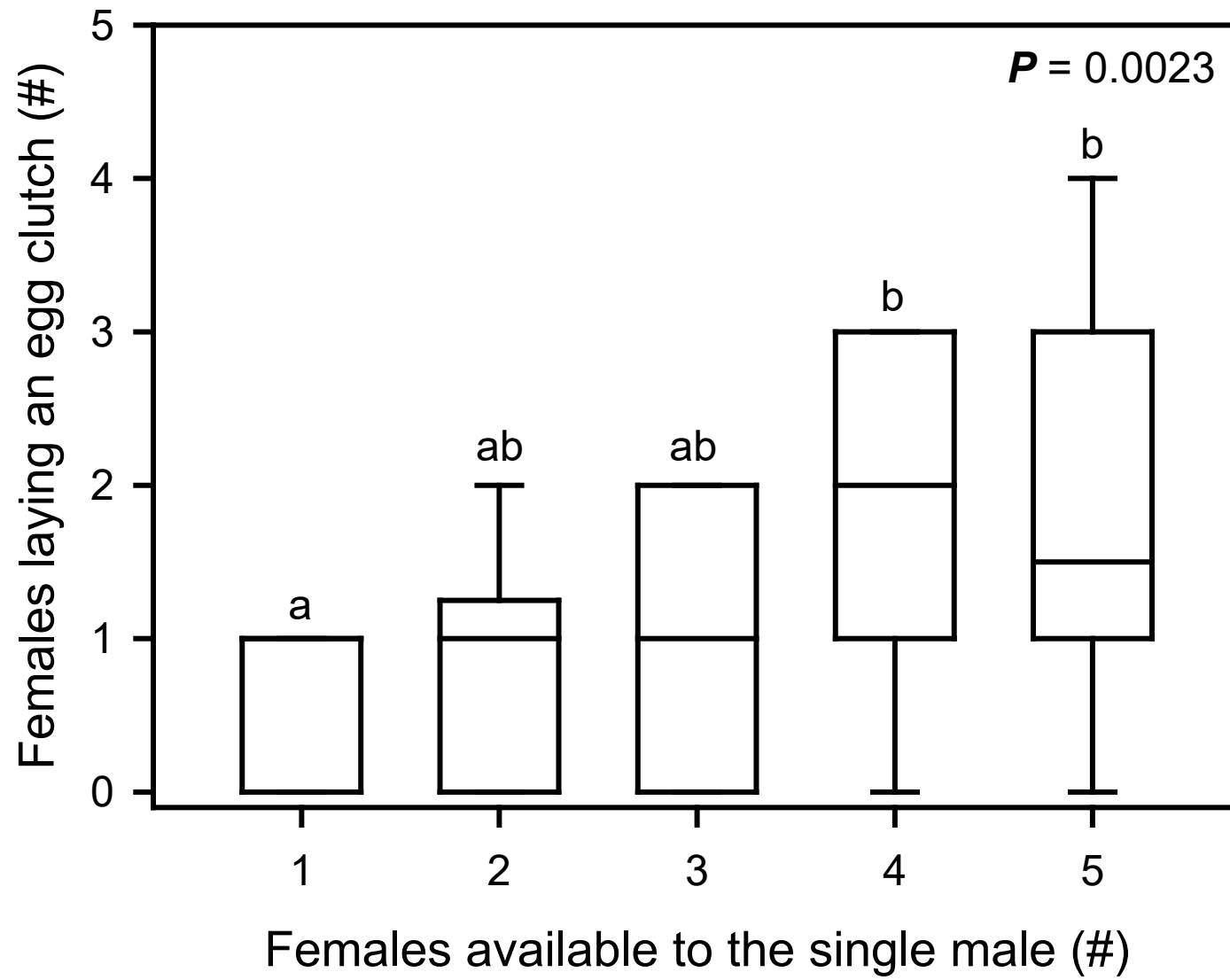
- Pupae in individual drosophila vials

First round

- 1 male + 1 female
- 1 male + 2 females
- 1 male + 3 females
- 1 male + 4 females
- 1 male + 5 females
- N = 18
- 48 h since emergence
- 48 h to mate
- 27°C
- 70% RH
- Fluorescent tubes







2nd round



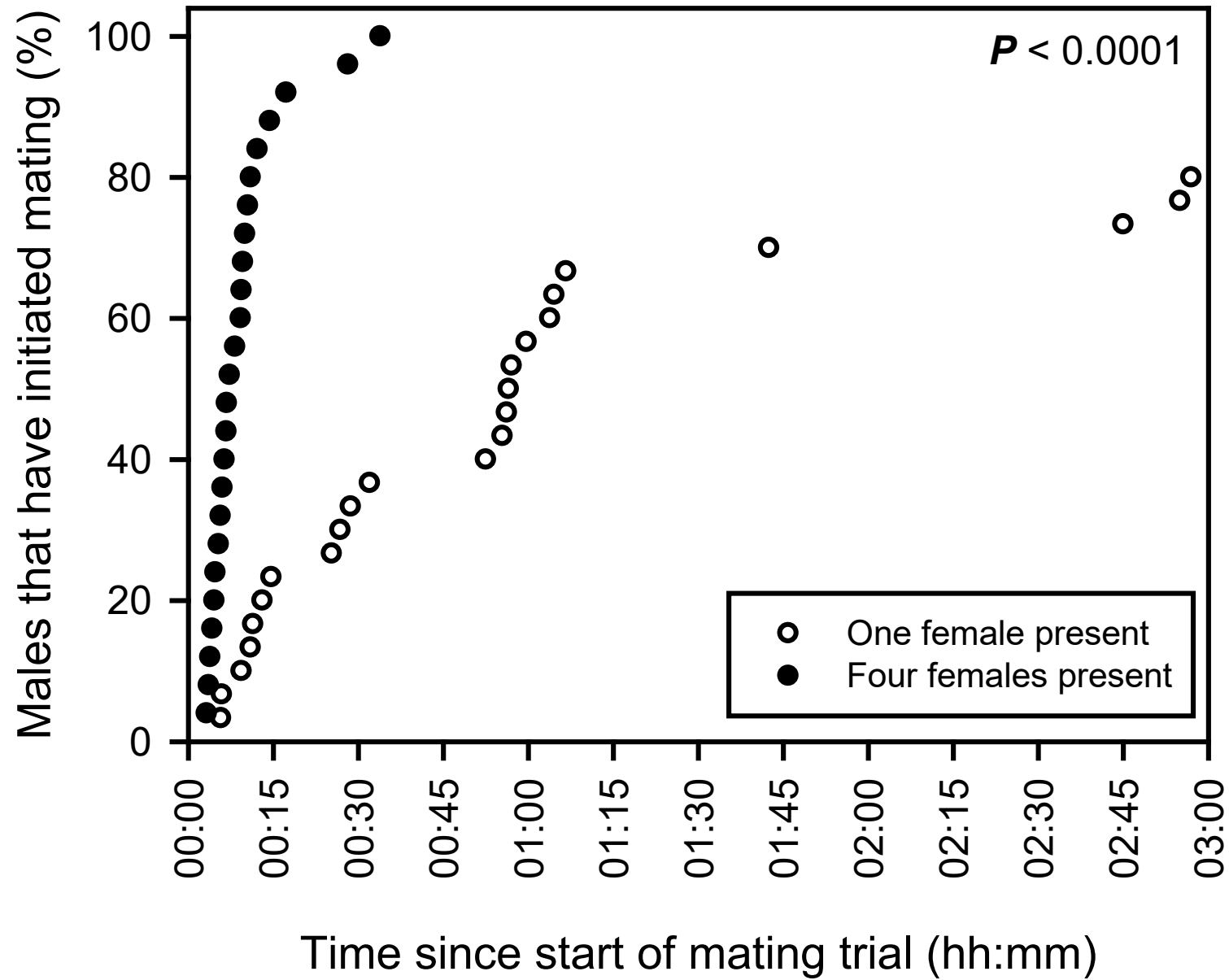
Round 2

- 1 male + 1 female
- N = 30
- 1 male + 4 females
- N = 25
- 50W LED lights
- Observation for 4 hours
- 48 h since emergence
- 27°C
- 70% RH



Round 2 – 1 male + 1 or 4 females

- How quickly will pairs mate?
- Does the number of females influence time until first mating?
- How soon will males mate again?
- How many females will be mated in this short time frame?



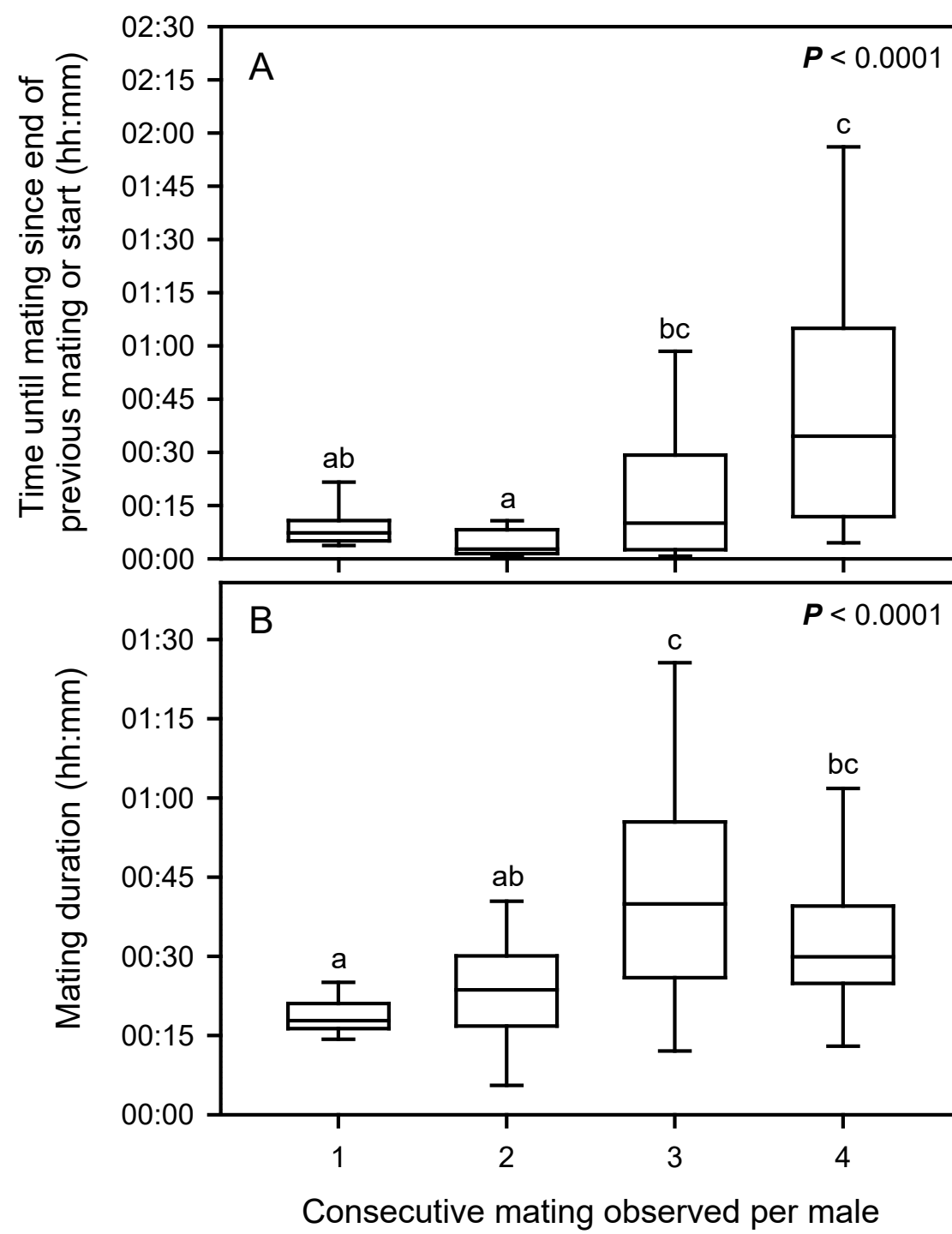
1 male + 1 or 4 females, 4 hours of observation

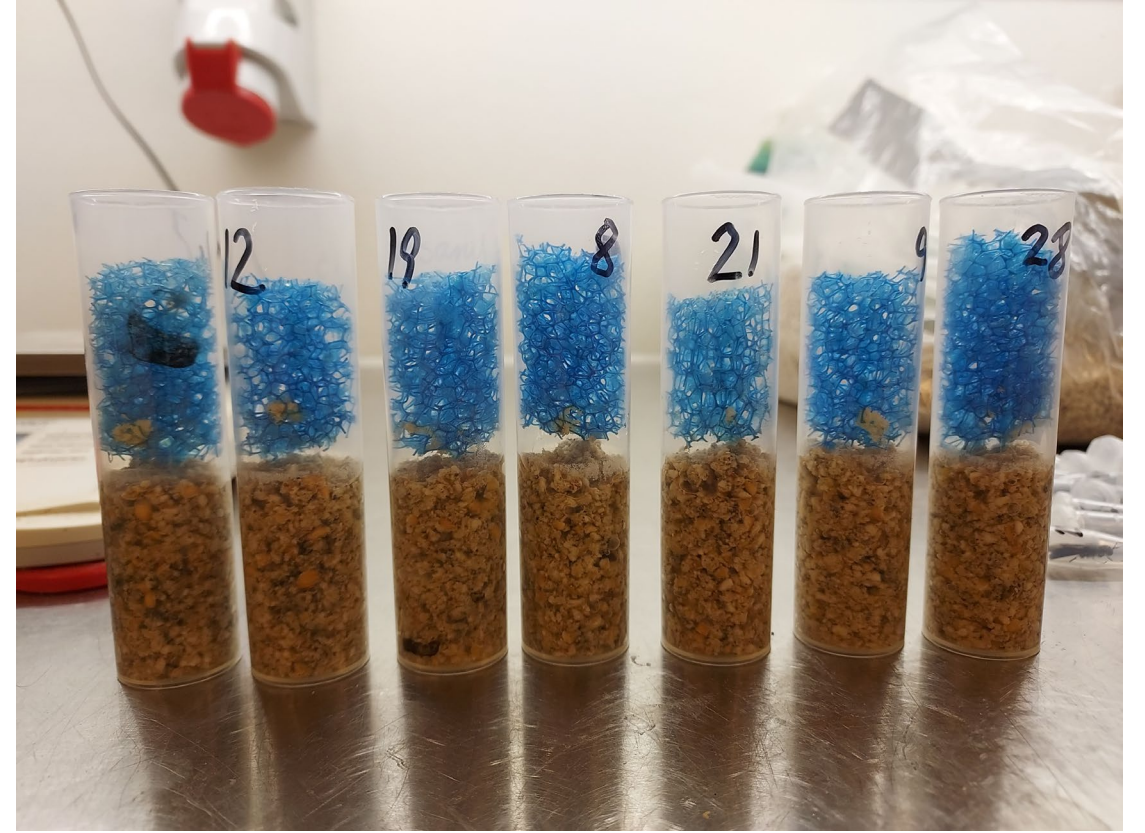
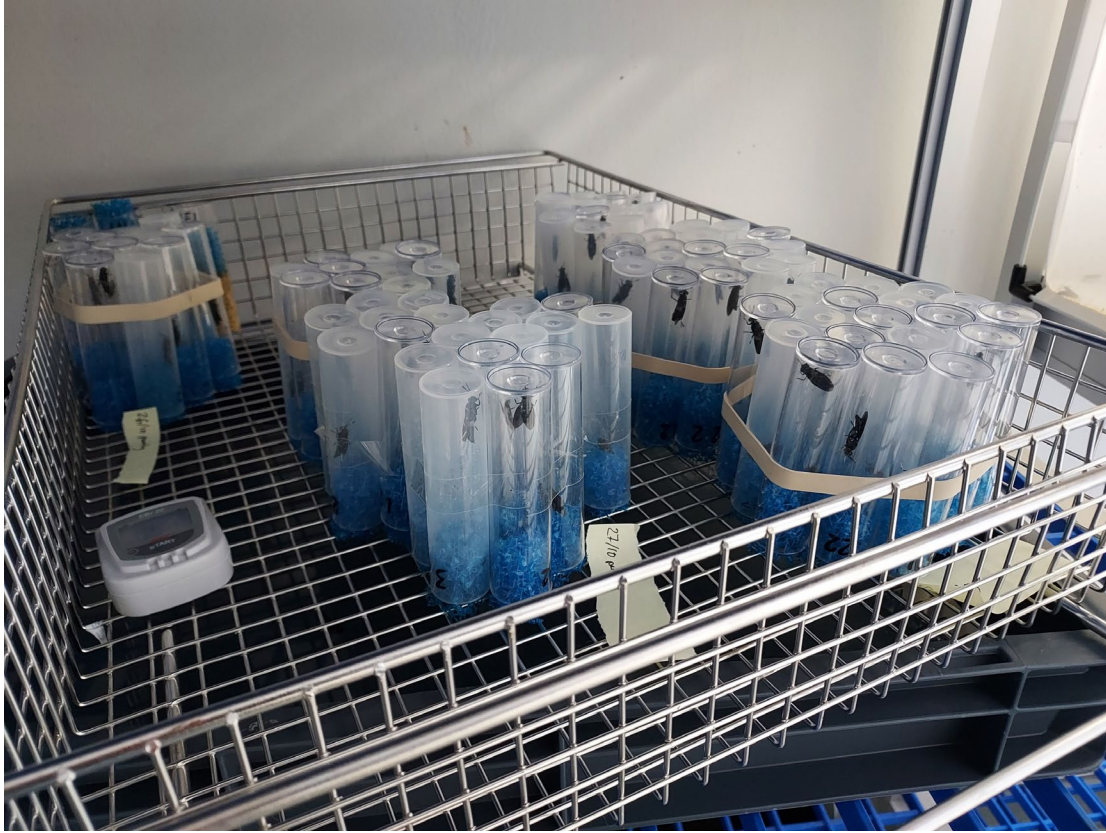
1 female present

- 80% mated within 3 hours

4 females present

- 100% mated within 35 minutes
- 96% mated a 2nd time
- 88% mated 3 times
- 52% mated 4 times





1 male + 1 female

- All but 1 mated females (N = 24) laid an egg clutch
- All egg clutches hatched to larvae (median 149)

1 male + 4 females

- 1 female laid an egg clutch (8%)
 - 2 females laid an egg clutch (44%)
 - 3 females laid an egg clutch (36%)
 - 4 females laid an egg clutch (12%)
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- Significant correlation between the number of times a male mated and the number of females producing an egg clutch (Pearson: $\chi^2_{9,25} = 18.32$, $P = 0.032$)
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- 92% (58 out of 63) egg clutches produced larvae (median 138)

Conclusions

- Individual fly pairs can be readily mated without lekking
- A male can successfully mate multiple females within a few hours

Implications

- Individual flies can be selected for breeding
- Pedigrees can be tracked
- Full-/half-sibling offspring can be readily attained

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