
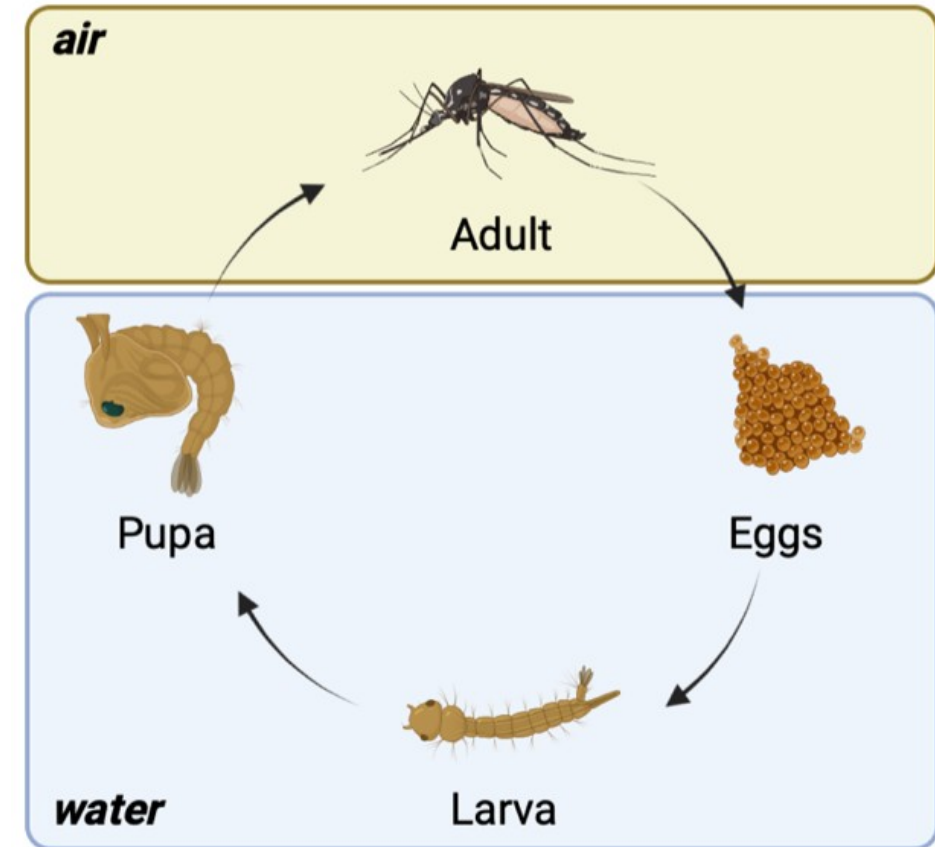


IMPERIAL

A review on the effect of
precipitation and water
availability on *Aedes*
mosquitoes life history
traits

Importance of precipitation and Aedes life history traits relationship

- Need rainfall for creation and maintenance of breeding sites
 - Amount of rainfall affects life history traits (survival, etc.)
- 
- Rainfall used in models to predict Aedes population dynamics
 - Second most important climatic variable in both correlative and mechanistic models

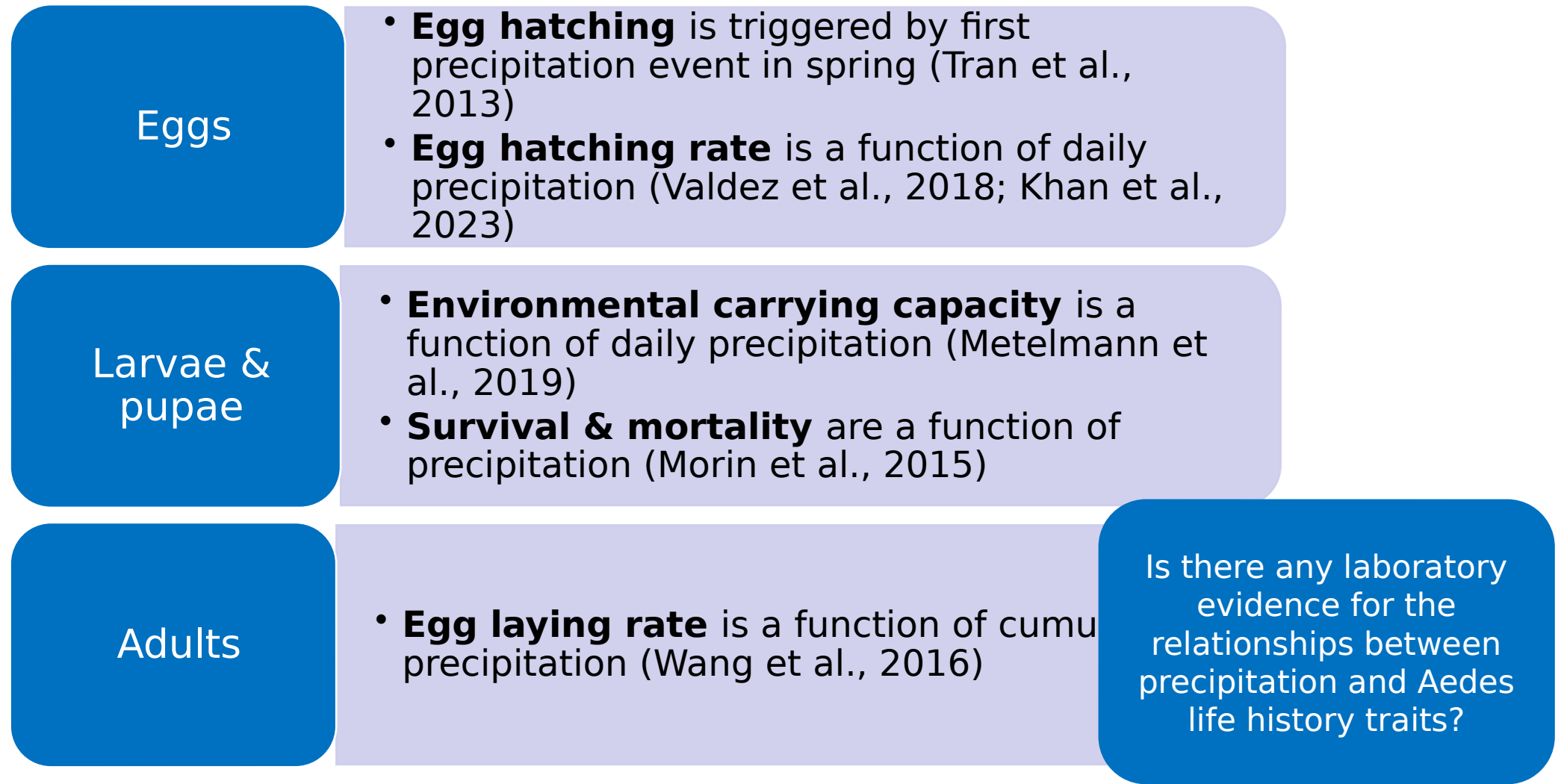


General lifecycle of Aedes species
(made with www.Biorender.com)

Why is the effect of rainfall important in mechanistic models?

- Require knowledge on the causal relationships in

How are mechanistic models incorporating precipitation to date?



Search strategy: laboratory evidence on rainfall-Aedes traits relationship

Search date: 12/02/2024

Number of reviewers: 4

Databases:

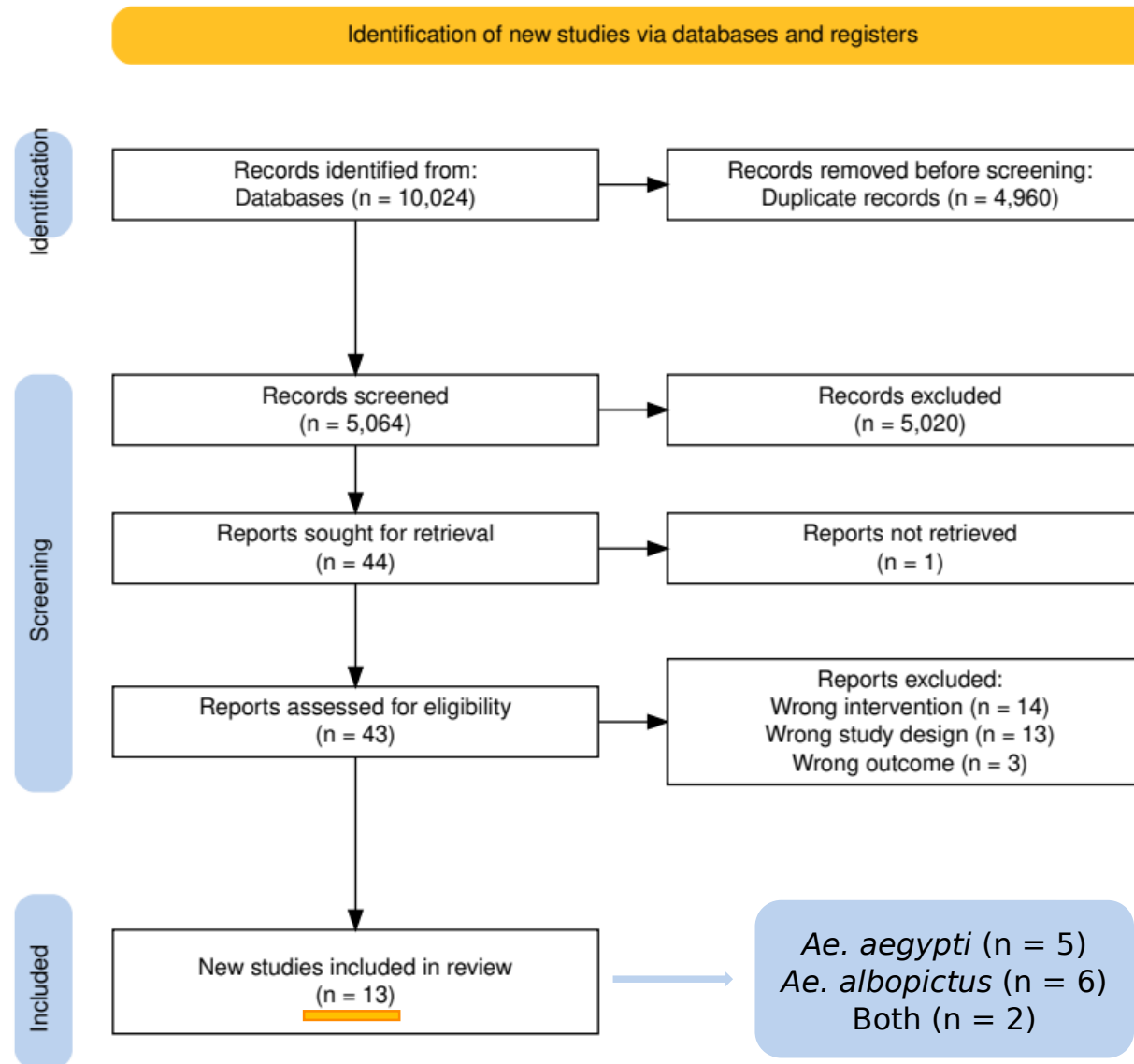
- Embase
- Scopus
- Web of Science

Inclusion criteria:

- Laboratory experiments
- Rainfall, evaporation
- No time, location, or language restrictions

Topics	Keywords
<i>Aedes aegypti</i>	" <i>Aedes aegypti</i> " OR "Yellow Fever mosquito" OR " <i>Stegomyia aegypti</i> "
OR	
<i>Aedes albopictus</i>	" <i>Aedes albopictus</i> " OR "Tiger mosquito" OR " <i>Stegomyia albopicta</i> " OR "forest mosquito"
OR	
<i>Aedes japonicus</i>	" <i>Aedes japonicus</i> " OR "Asian Bush mosquito" OR "Asian Rock Pool mosquito" OR " <i>Ochlerotatus japonicus</i> " OR " <i>Hulecoeteomyia japonica</i> "
OR	
<i>Aedes koreicus</i>	" <i>Aedes koreicus</i> " OR "Korean Bush mosquito" OR " <i>Ochlerotatus koreicus</i> " OR " <i>Hulecoeteomyia koreica</i> "
AND	
Precipitation	"Rain" OR "Precipitation" OR "Water" OR "Humidity" OR "Moisture" OR "Shower" OR "Flood"

PRISMA chart: laboratory evidence on rainfall-Aedes traits



Results

Survival

- Precipitation
 - Length exposure
 - Water speed
- Water availability
 - No evaporation
 - Evaporation

Development

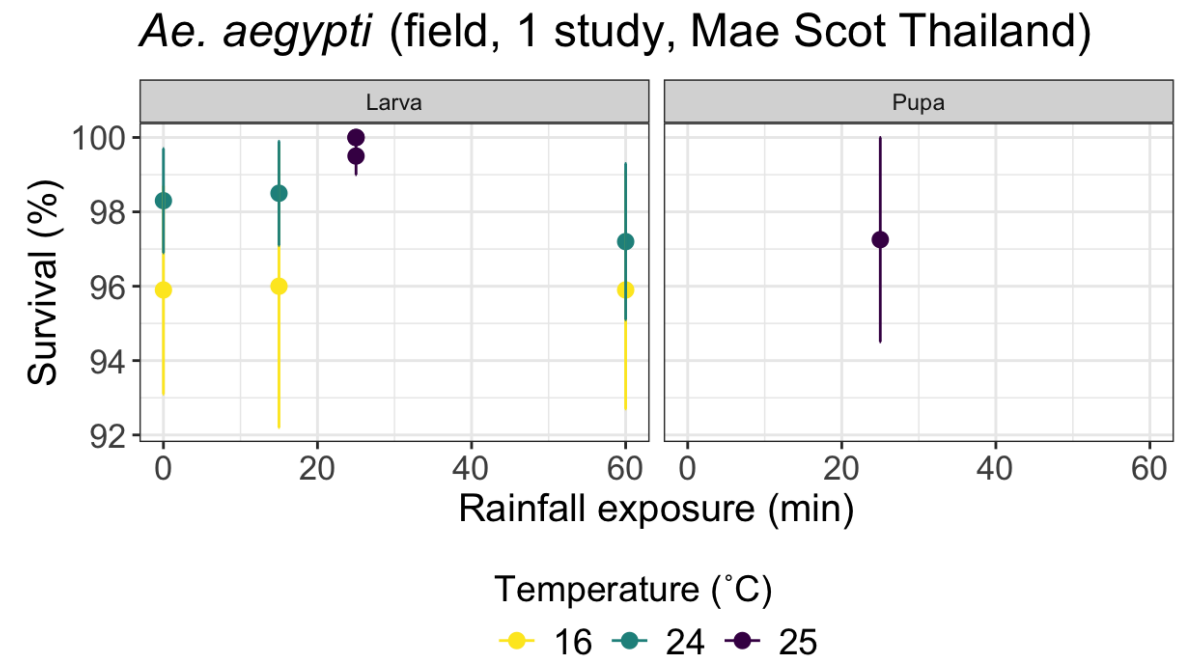
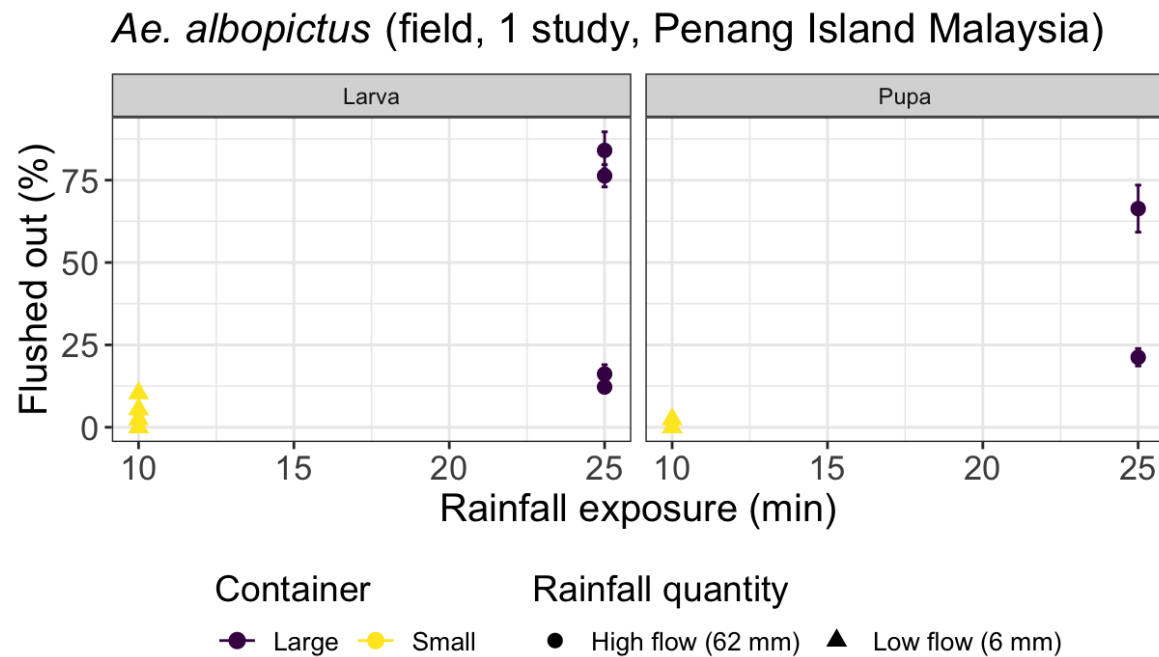
- Precipitation
 - Length exposure
- Water availability
 - No evaporation
 - Evaporation

Reproduction

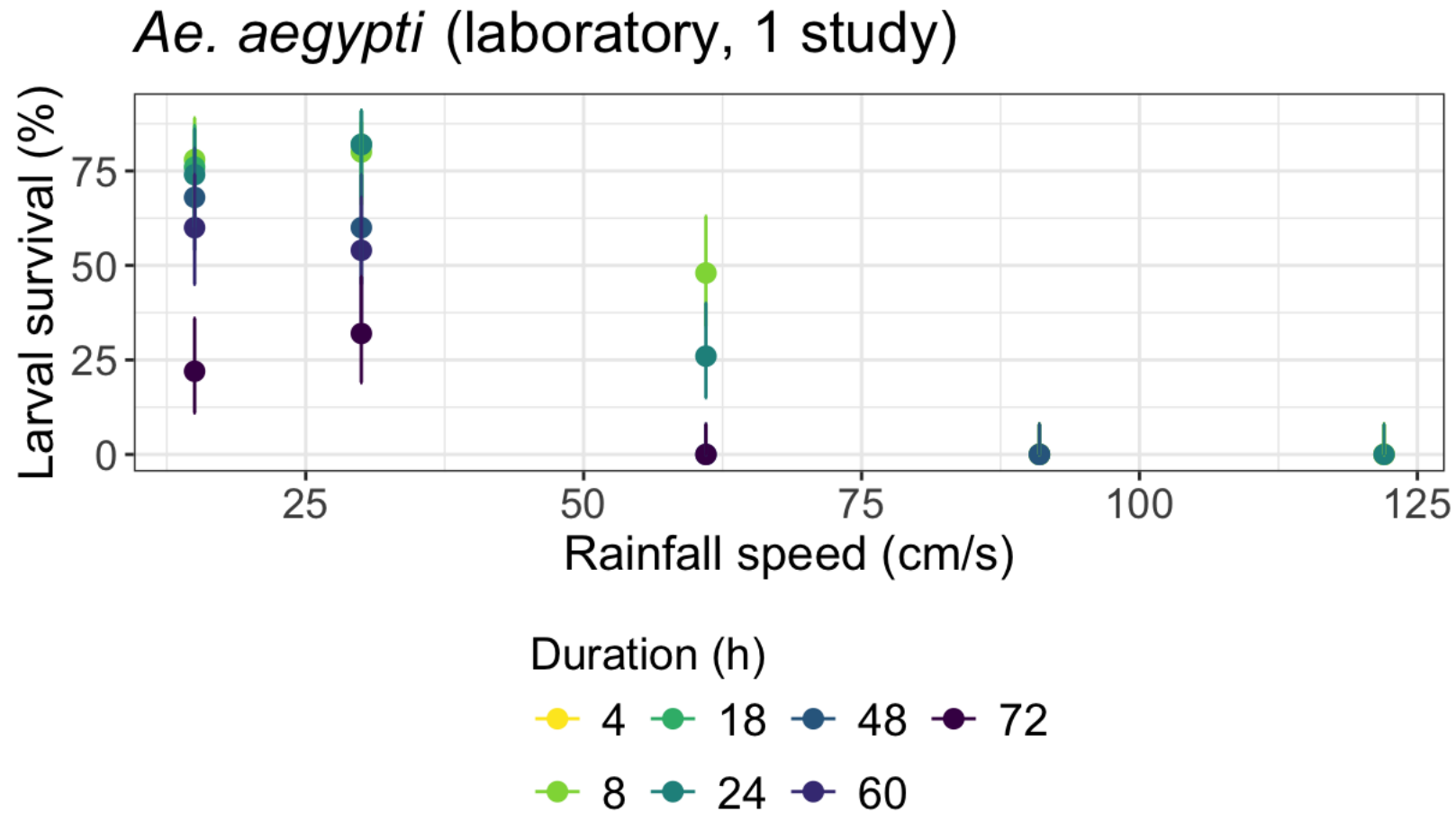
- Water availability
 - No evaporation
 - Evaporation

Survival

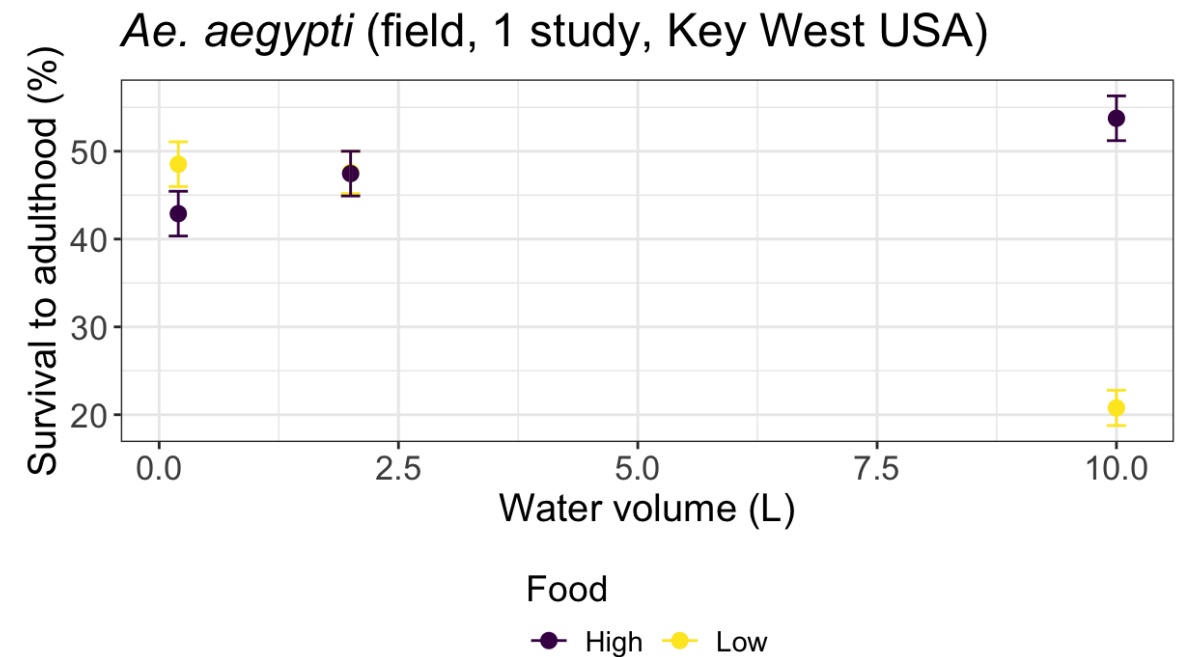
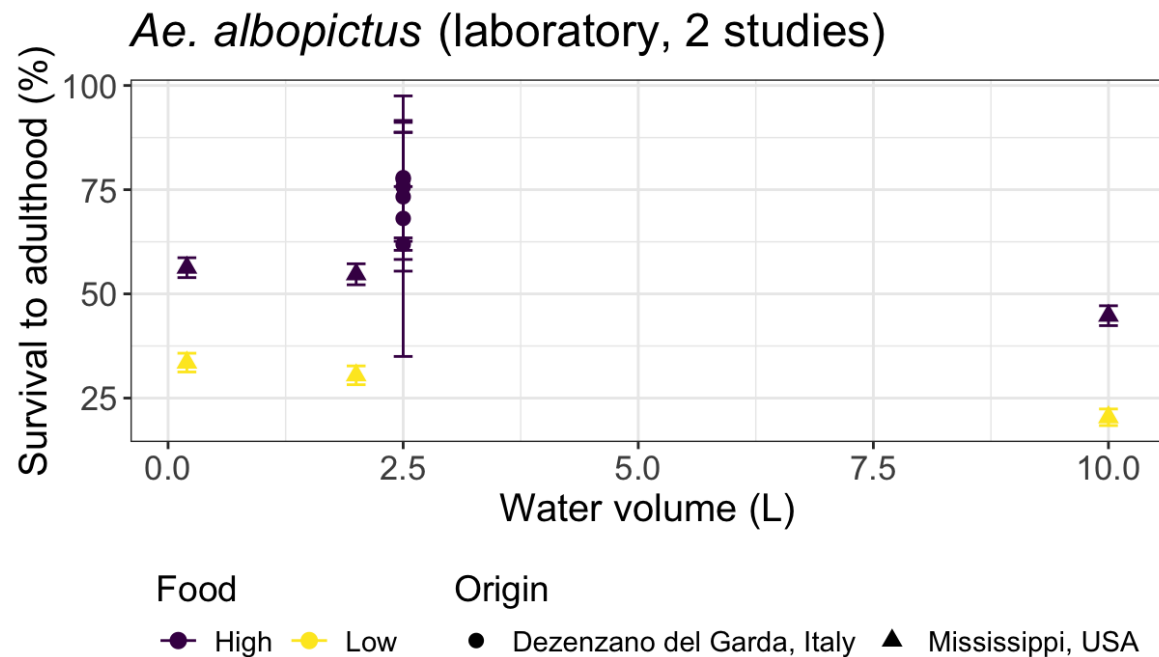
Prolonged exposure to precipitation may cause higher mortality for *Ae. albopictus* immature stages, but not for *Ae. aegypti*



Heavier precipitations cause higher mortality for *Ae. aegypti*

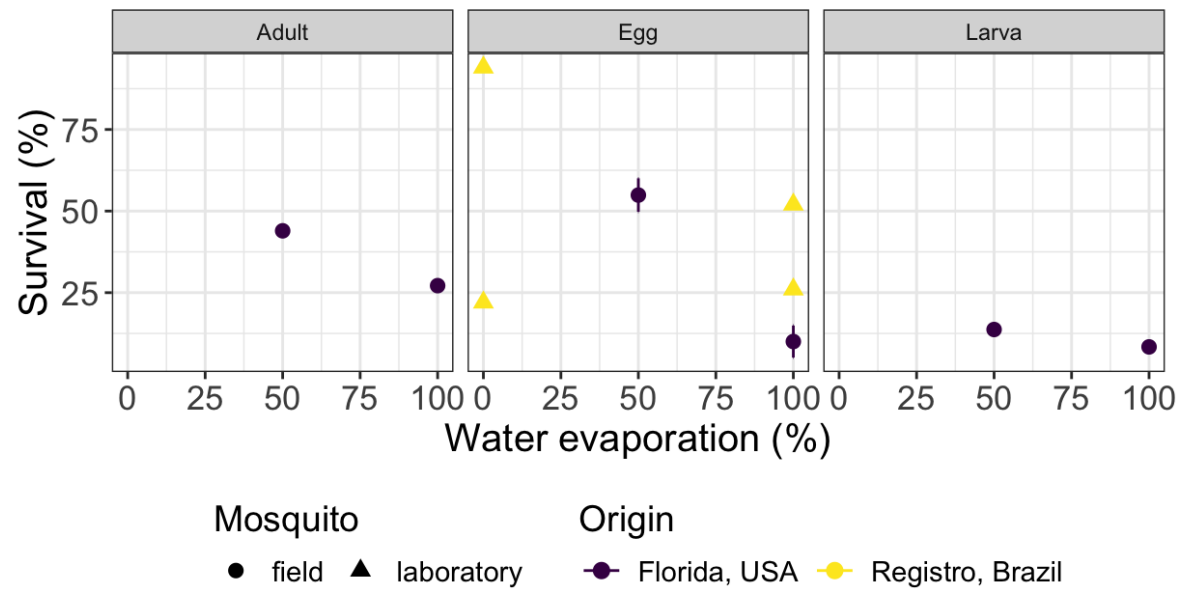


Higher water volumes (no evaporation) cause higher mortality for *Ae. albopictus*, but not for *Ae. aegypti*

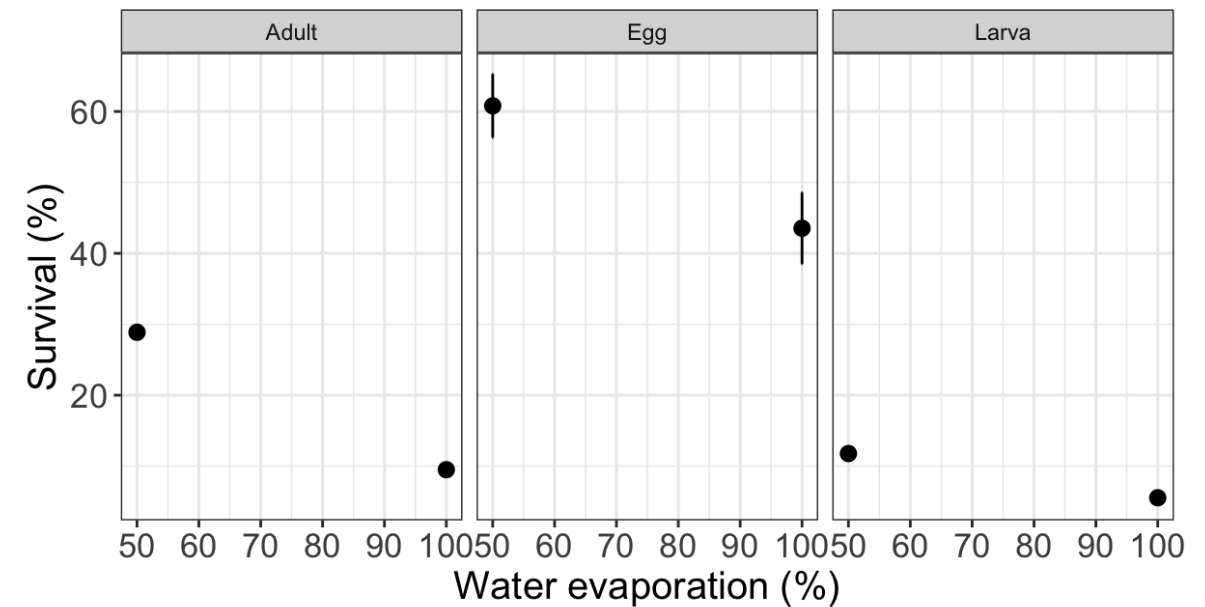


Higher levels of evaporation lead to a decrease in the survival of mosquitoes

Ae. albopictus (2 studies)



Ae. aegypti (field, 1 study, Florida USA)

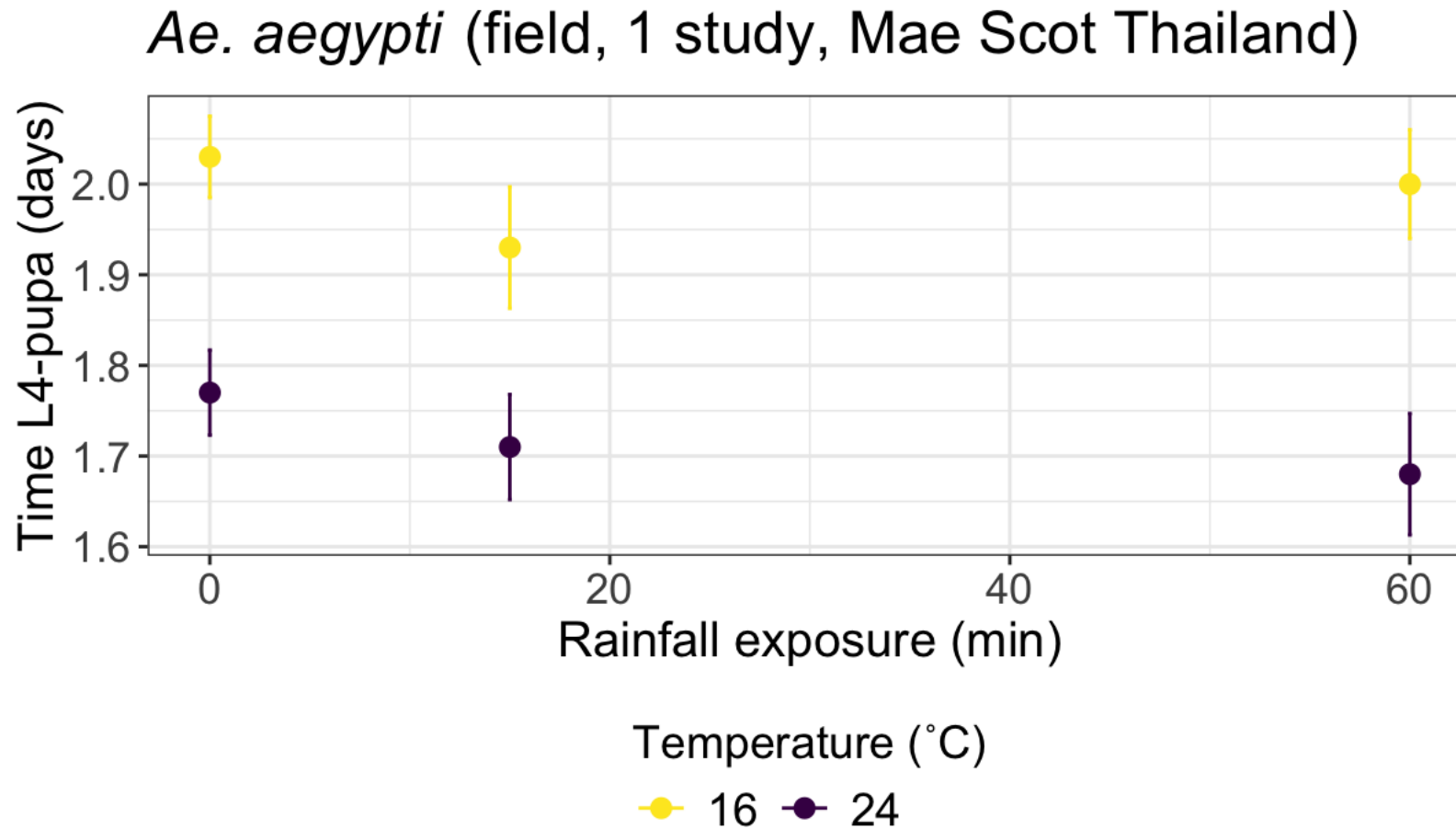


Effects of rainfall and evaporation on *Aedes* traits

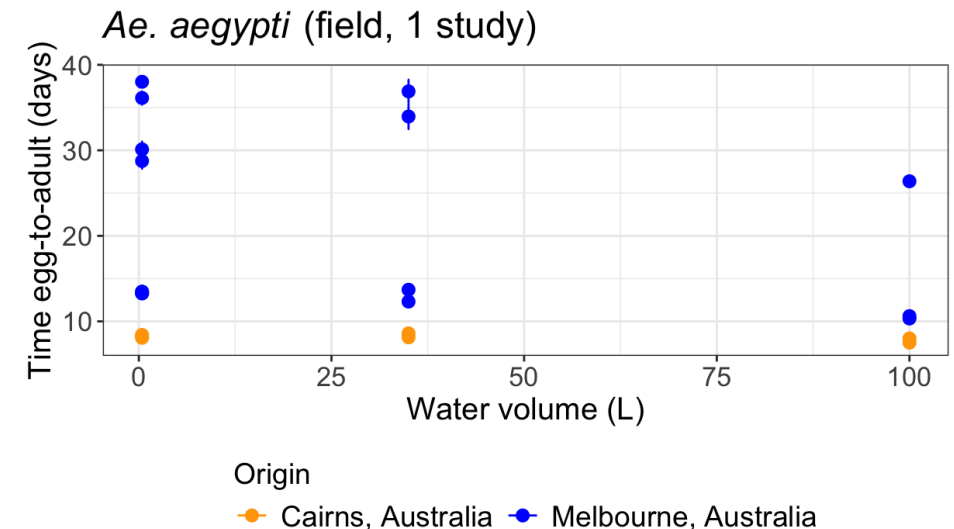
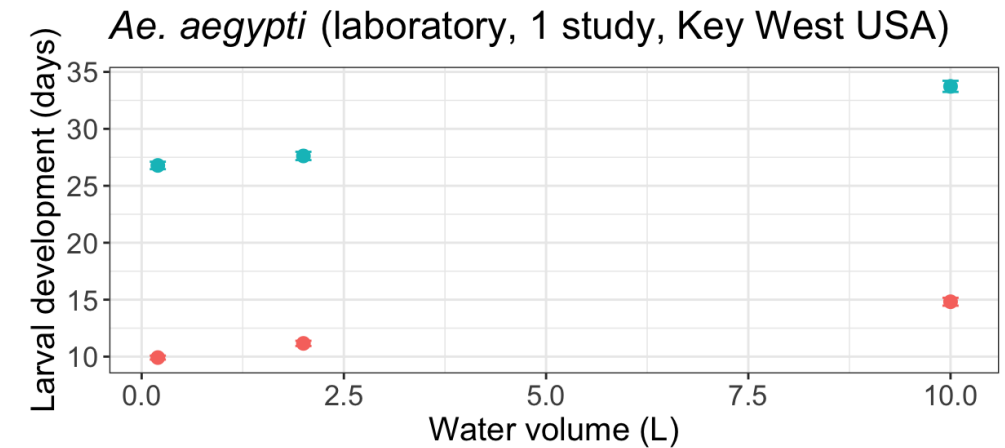
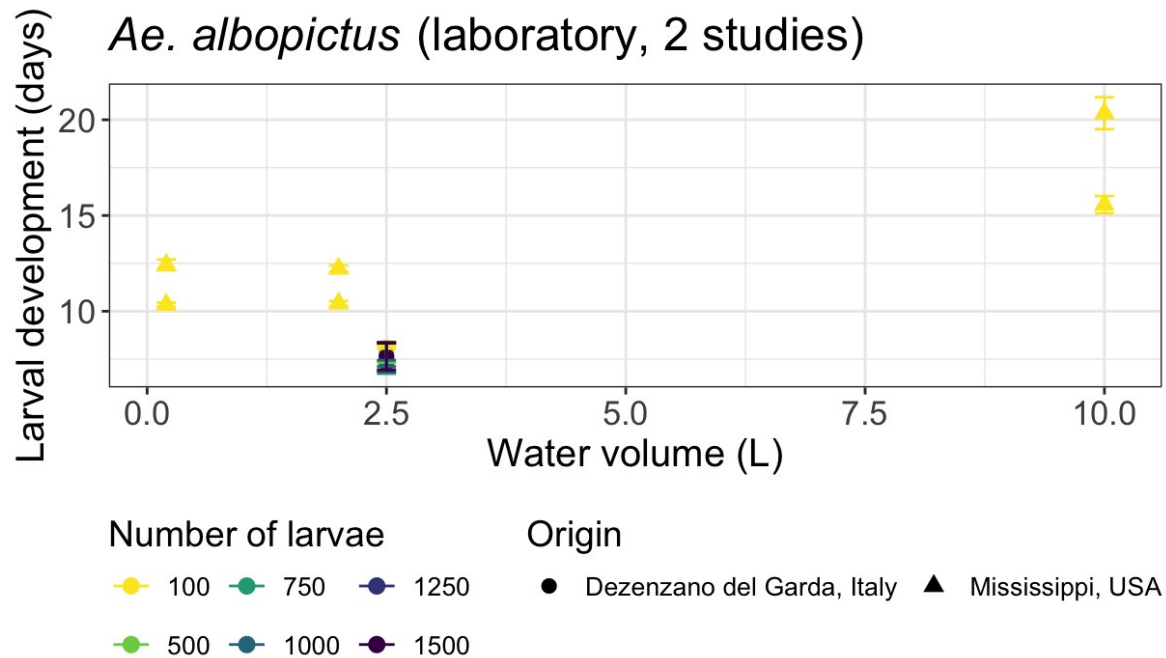
Outcome	Exposure	<i>Ae. albopictus</i>	<i>Ae. aegypti</i>
SURVIVAL	Longer precipitation	↓ survival (1) ?	no effect (1)
	Heavier precipitation	↓ survival (1) ?	↓ survival (1)
	↑ water volume	↓ survival (2)	↑ survival (1)
	↑ evaporation	↓ survival (2)	↓ survival (1)

Development

Prolonged exposure to precipitation does not significantly impact *Ae. aegypti* development



Higher water volumes (no evaporation) slow down larval development for *Ae. albopictus*, but it's unclear for *Ae. aegypti*

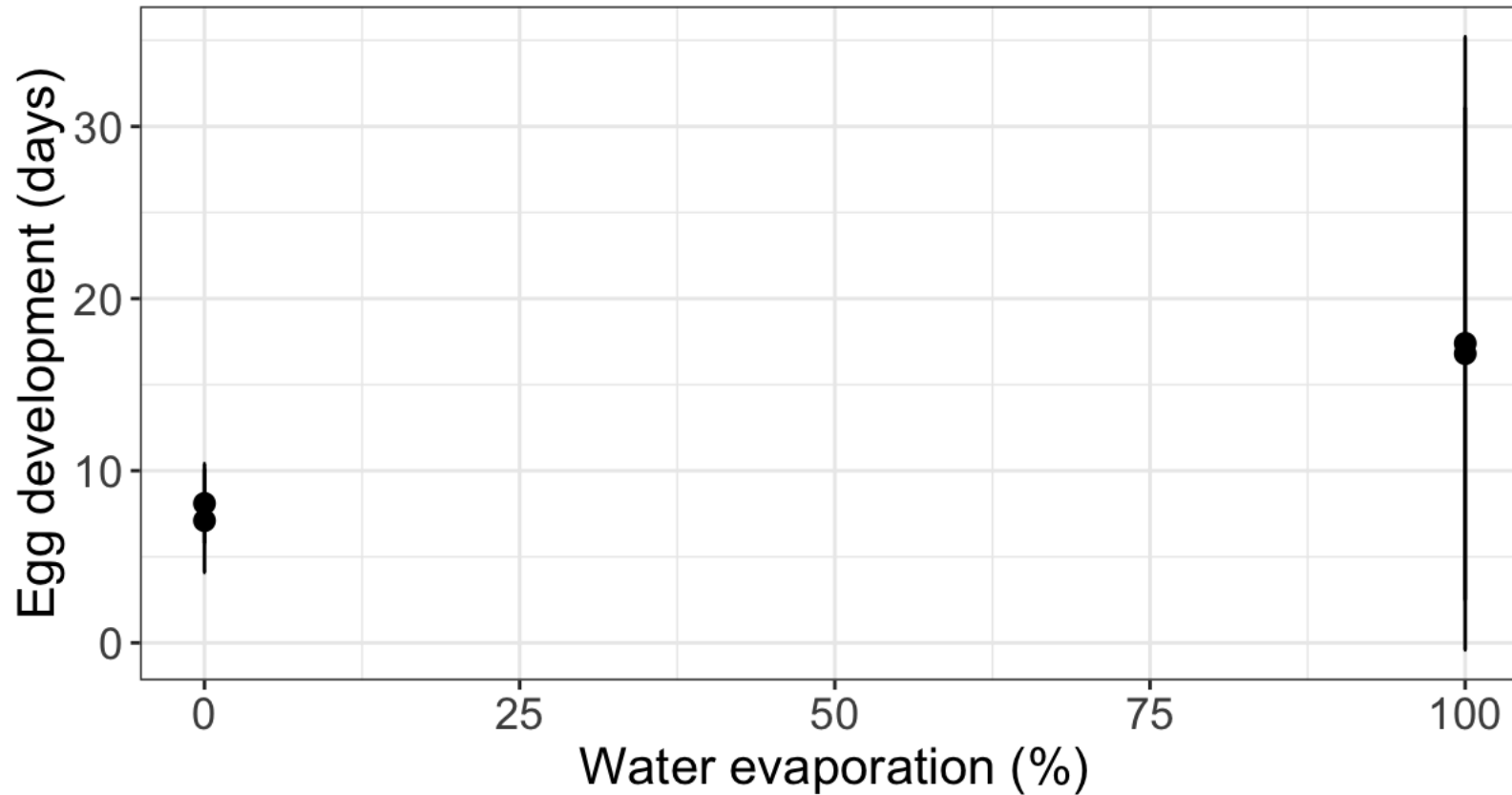


Parker et al. (2019) *Journal of Medical Entomology*

Medici et al. (2011) *Journal of Economic Entomology*

Higher levels of evaporation do not significantly impact *Ae. albopictus* egg developmental time

Ae. albopictus (laboratory, 1 study, Registro Brazil)

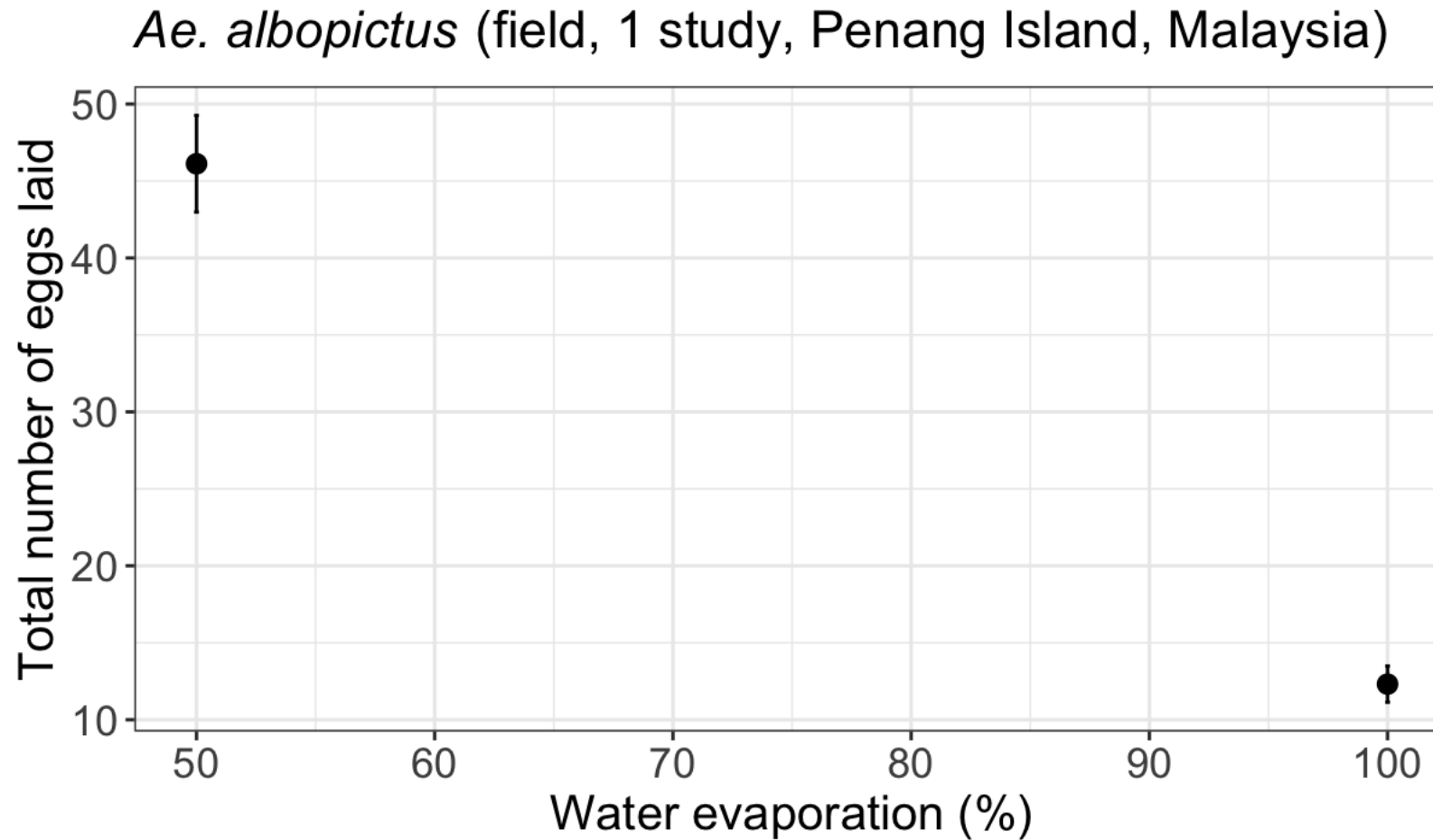


Effects of rainfall and evaporation on Aedes traits

Outcome	Exposure	<i>Ae. albopictus</i>	<i>Ae. aegypti</i>
SURVIVAL	Longer precipitation	↓ survival (1) ?	no effect (1)
	Heavier precipitation	↓ survival (1) ?	↓ survival (1)
	↑ water volume	↓ survival (2)	↑ survival (1)
	↑ evaporation	↓ survival (2)	↓ survival (1)
DEVELOPMENT	Longer precipitation	-	no effect (1)
	↑ water volume	↑ larval time (2)	unclear (3)
	↑ evaporation	no effect (1)	-

Reproduction

Higher levels of evaporation lead to a decrease in *Ae. albopictus* egg laying



Effects of rainfall and evaporation on Aedes traits: huge gap in literature!

Outcome	Exposure	<i>Ae. albopictus</i>	<i>Ae. aegypti</i>
SURVIVAL	Longer precipitation	↓ survival (1) ?	no effect (1)
	Heavier precipitation	↓ survival (1) ?	↓ survival (1)
	↑ water volume	↓ survival (2)	↑ survival (1)
	↑ evaporation	↓ survival (2)	↓ survival (1)
DEVELOPMENT	Longer precipitation	-	no effect (1)
	↑ water volume	↑ larval time (2)	unclear (3)
	↑ evaporation	no effect (1)	-
REPRODUCTION	↑ evaporation	↓ eggs (1)	-

My experiments on *Ae. albopictus* at Fondazione Edmund Mach

Effect of evaporation on survival to adulthood



Effect of heavy rainfall on immediate larval survival

(Scallop shells, 100% survival)



Acknowledgements



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