

# Bionomics of *Aedes albopictus* (Skuse) vector of chikungunya and dengue in the Indian Ocean



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# Context



- Chikungunya outbreak 2005-2006
- Major vector: *Ae. albopictus* (Reiter et al., 2007)
- Lack of knowledge

# ENTOMOCHIK



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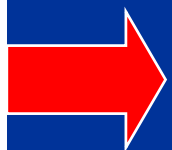
# Entomological factors of emergence of Chikungunya disease and other human arboviruses

Wkp 1: Population **biology** of *Aedes albopictus*

Wkp 2: **Phylogeography** & population **genetics** of *Ae. albopictus* in the Indian Ocean islands

Wkp 3: Relations between **virus-vector** (CHIKV & DENV) in *Ae. albopictus* & *Ae. aegypti* populations

Wkp 4: Modelisation of the **entomological risk**

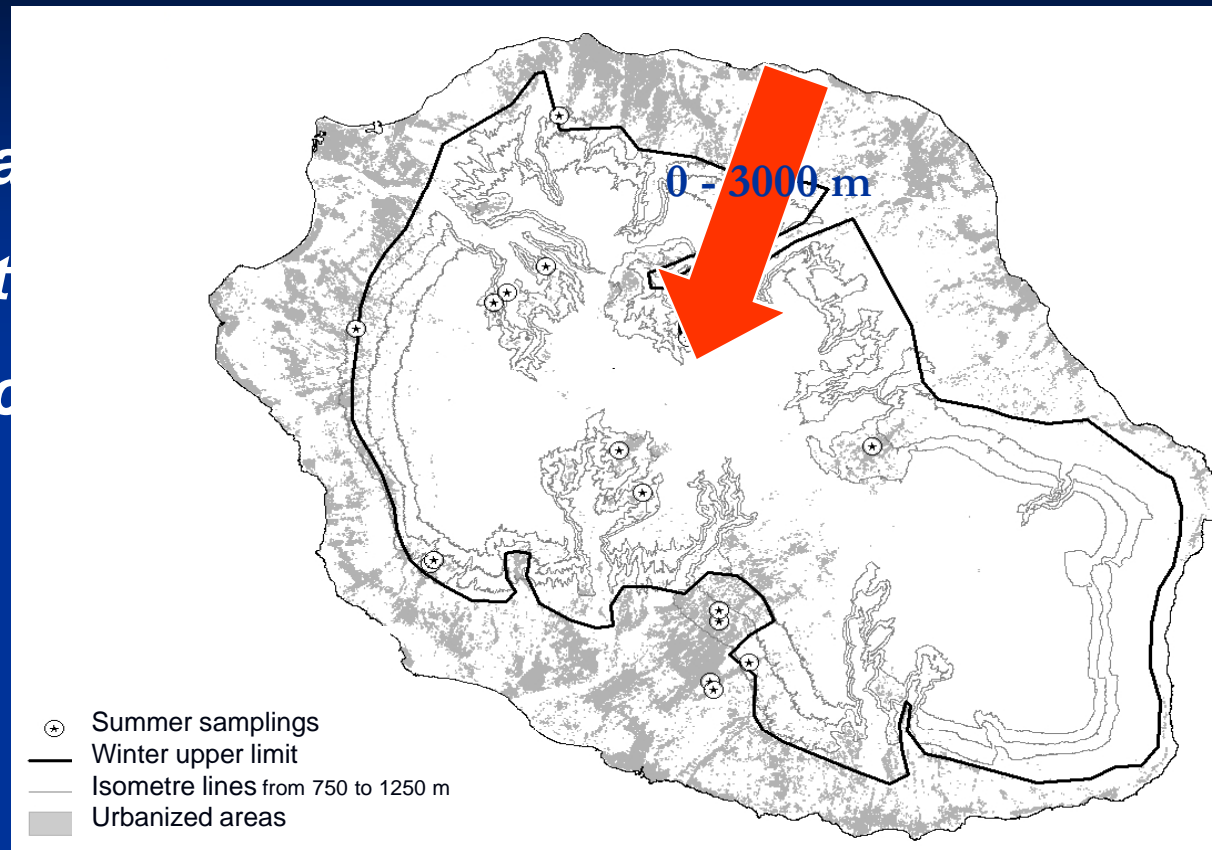


Improve knowledge on vectors  
Forecasting entomological risks  
Develop new strategies of vector control

# Introduction

## Context

- 12 *Culicida*
- *Ae. aegypti*
- *Ae. albopictus*



- Highly abundant throughout the island (from urban to natural habitat) up to 1200 m in dry winter season (*Delatte et al, 2008, VBZD*)
- Vector of DENV (1977-78 & 2004) & CHIKV (2005-2006)

# Introduction

## Objective

➤ What are the life history traits of *Ae. albopictus* population from la Réunion according to different temperatures ?

- Immature stages
- Adult stage

# Material and Method

Lab studies on F2 field populations at 8 different constant temperatures (5 to 40°C)

## Immature stages

Daily records:

- Survival
- Length of development

## Adult stage

Daily records:

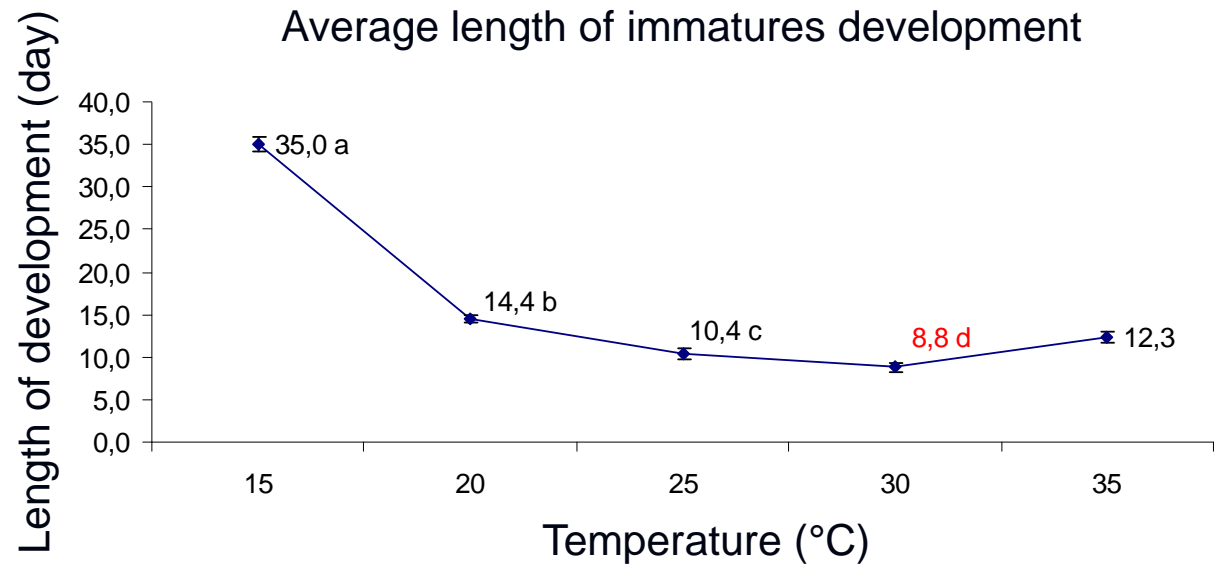
- Longevity
- Fecundity
- Blood feeding activity



# RESULTS Immature stages: development (L1 - adult)

## ➤ Length of development

- Fastest development at 30°C (8.8 days)



## ➤ Survival rate

T°C	15	20	25	30	35
Survival rate (%)	50.0 a	77.5 b	76.3 b	67.5 b	2.5 c

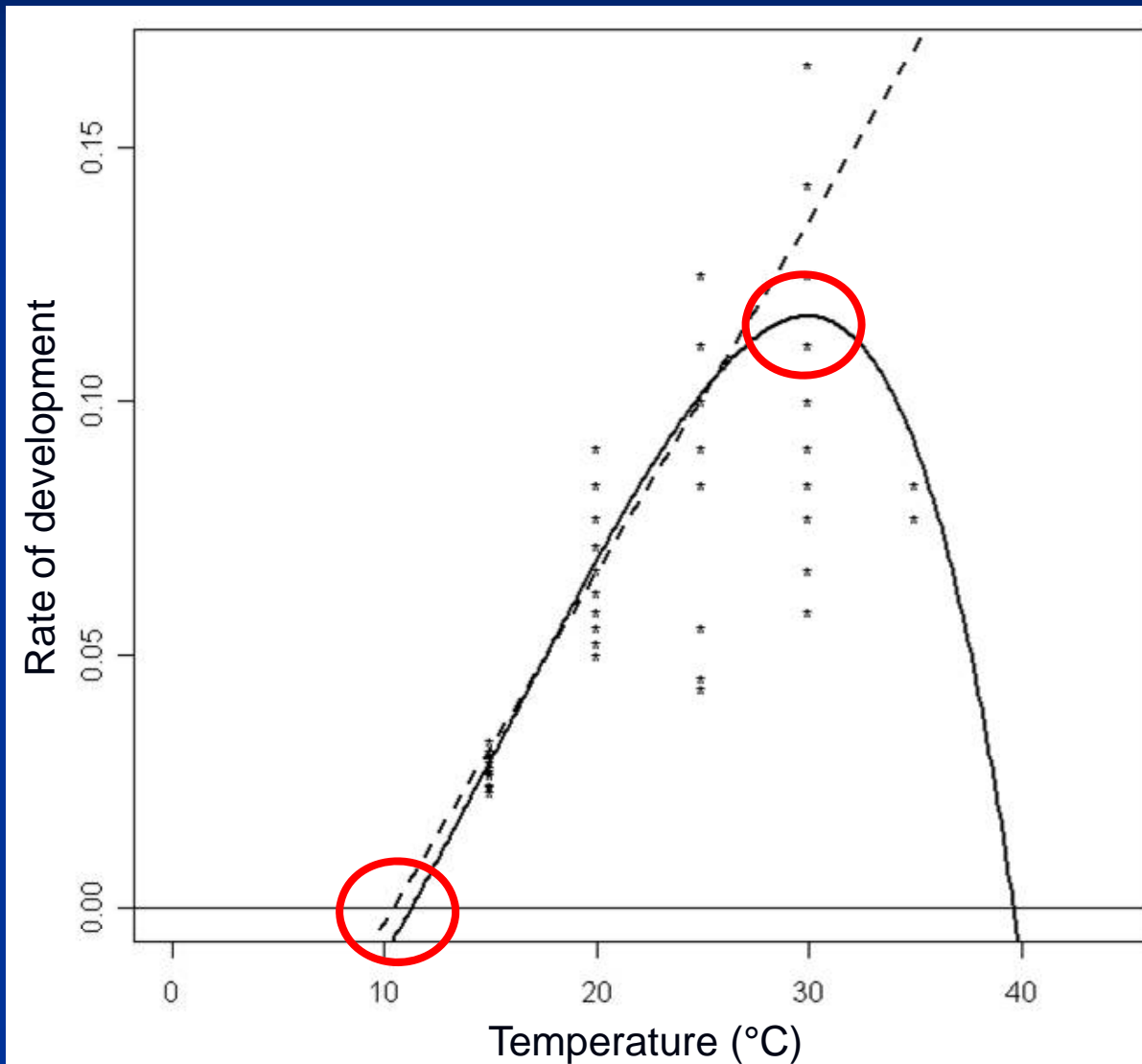
- Best survival rates from 20°C to 30°C



# RESULTS Immature stages: development (L1 - adult)

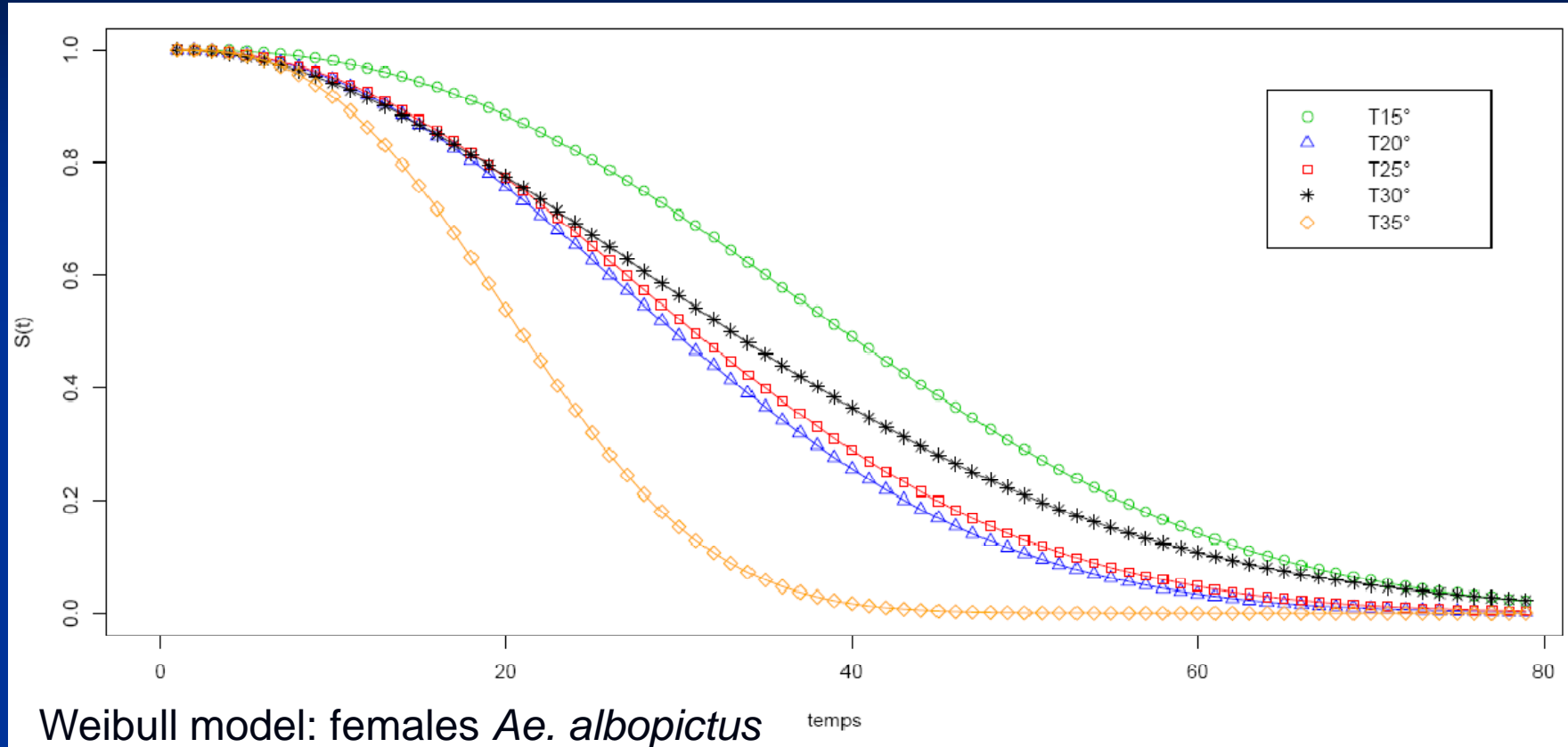
➤ Temperature threshold of development: 10.4°C

➤ Optimal development temperature: 29.7°C



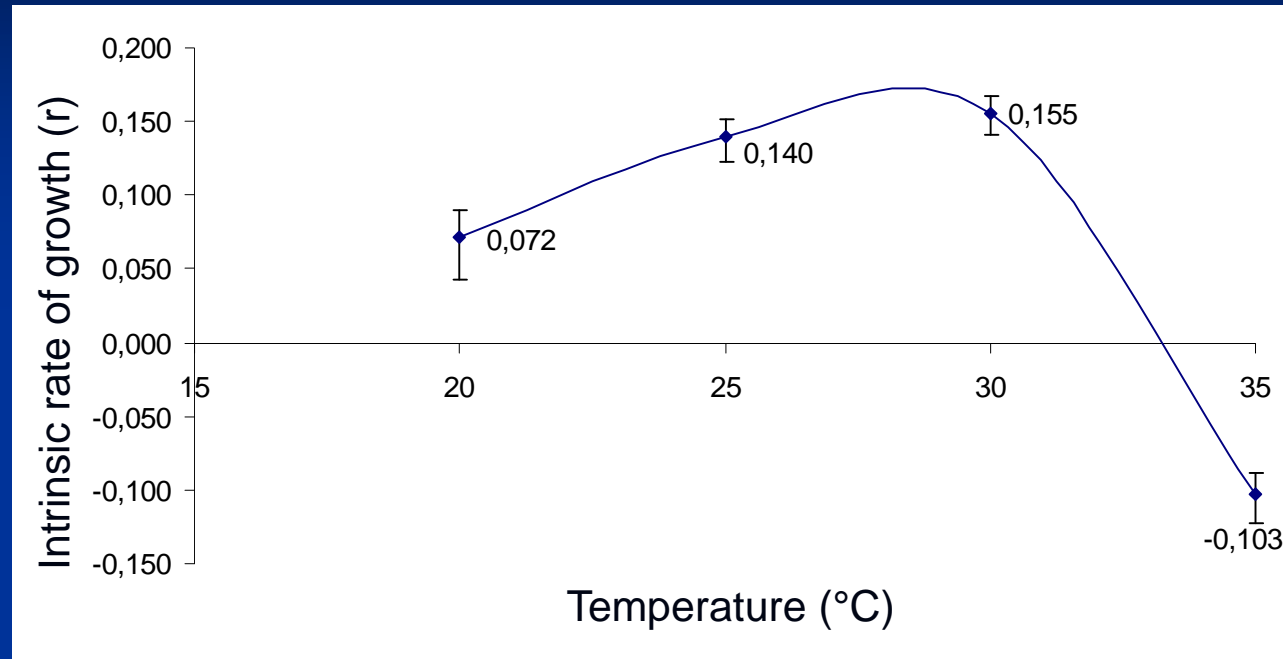
Model of Logan (1976) corrected by Lactin (1995)

# RESULTS Adult stage: longevity



T°C	15	20	25	30	35
Males (days)	<b>31.3</b>	19.3	18.4	17.2	14.9
Females (days)	<b>38.6</b>	28.7	29.9	32.1	19.9

## Results all stages: Intrinsic rate of growth ( $r$ )



- Optimum  $r$  between 25 and 30°C
- Negative value at 35°C: population decrease

## Results adult stage: Trophogonic cycle

The trophogonic cycle was considered as starting with a blood meal including the succession of physiological phenomena of oocytes maturation and ending by oviposition (Clements 1992).

### Trophogonic cycle



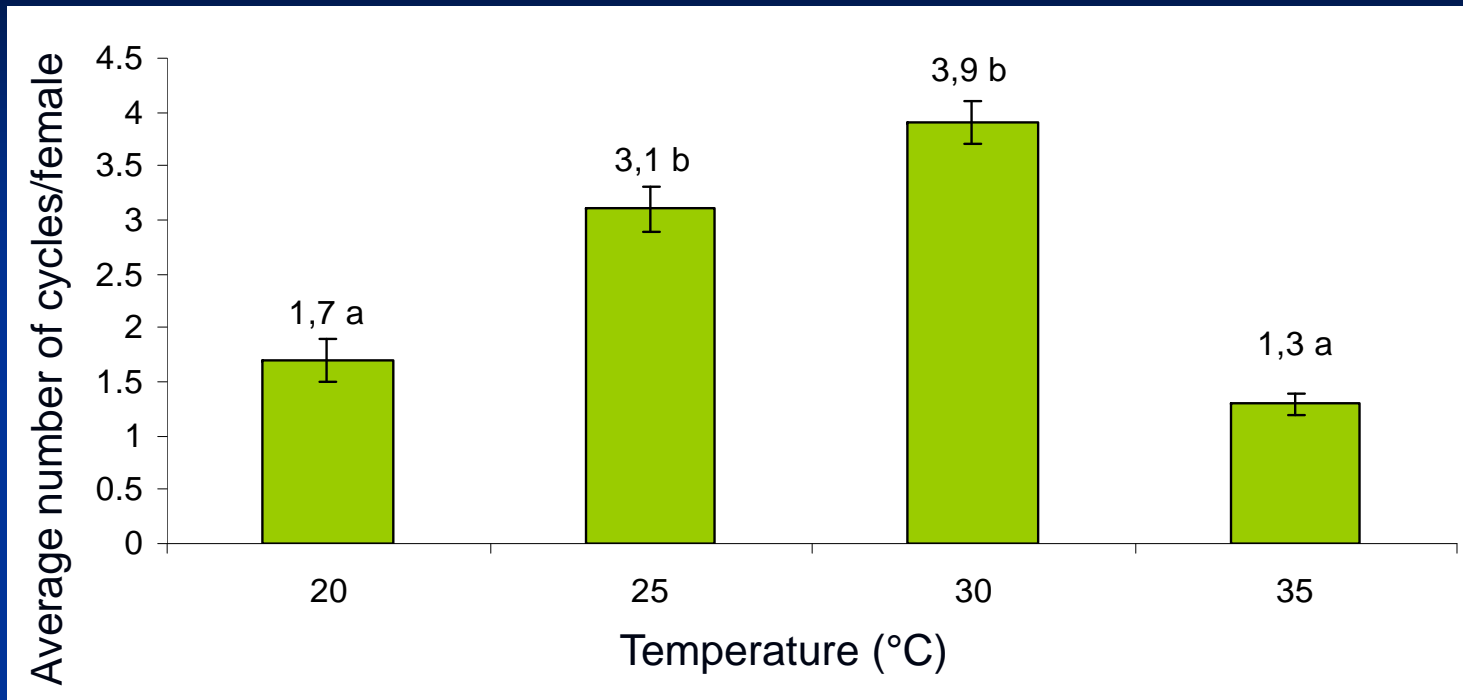
Blood  
meal



Egg  
laying



## Results adult stage: Trophogonic cycle



### Fecundity & average duration / trophogonic cycle

Temperature	<u>20°C</u>	<u>25°C</u>	<u>30°C</u>	<u>35°C</u>
Eggs (number)	50.8 a	65.3 a	74.2 a	48.7 a
Length of cycles (d)	4.3 a	3.1 a	3.9 a	2.9 a
Min. pre-blood meal p. (d)	2	2	2	2

## Conclusion

➤ **20 to 30°C**: the most favourable range for *Ae. albopictus* development of immatures and adults, with the optimum in a range between **25 to 30°C**

+

➤ Biological characteristics observed for the *Ae. albopictus* Reunionese population are closer to the asian populations

**High (ideal) temperatures** of subtropical summers

+

Good **vectorial competence** for CHIKV & DENV (Vazeille et al., 2008)

+

**Enough viremic travellers** carrying an arbovirus

=

Partly explain the 2 explosive epidemics transmitted by *Ae. albopictus* for DENV & CHIKV in the Indian Ocean in 1977-8 and 2005-6

Thanks for you  
attention !!

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« ENTOMOCHIK DREAM TEAM »

FROM THE 4 WORKPACKAGES

