

# Warmer temperature and aging have complex and interactive effects on the number of sessile hemocytes in mosquitoes

Saksham Saksena<sup>1</sup>, Jordyn Barr<sup>1</sup>, Julián Hillyer, PhD<sup>1</sup>

<sup>1</sup>Department of Biological Sciences, Vanderbilt University, Nashville, TN, USA

## Background

- The mosquito immune response is made up of both humoral and cellular components.
- Cellular immunity is mediated by hemocytes.

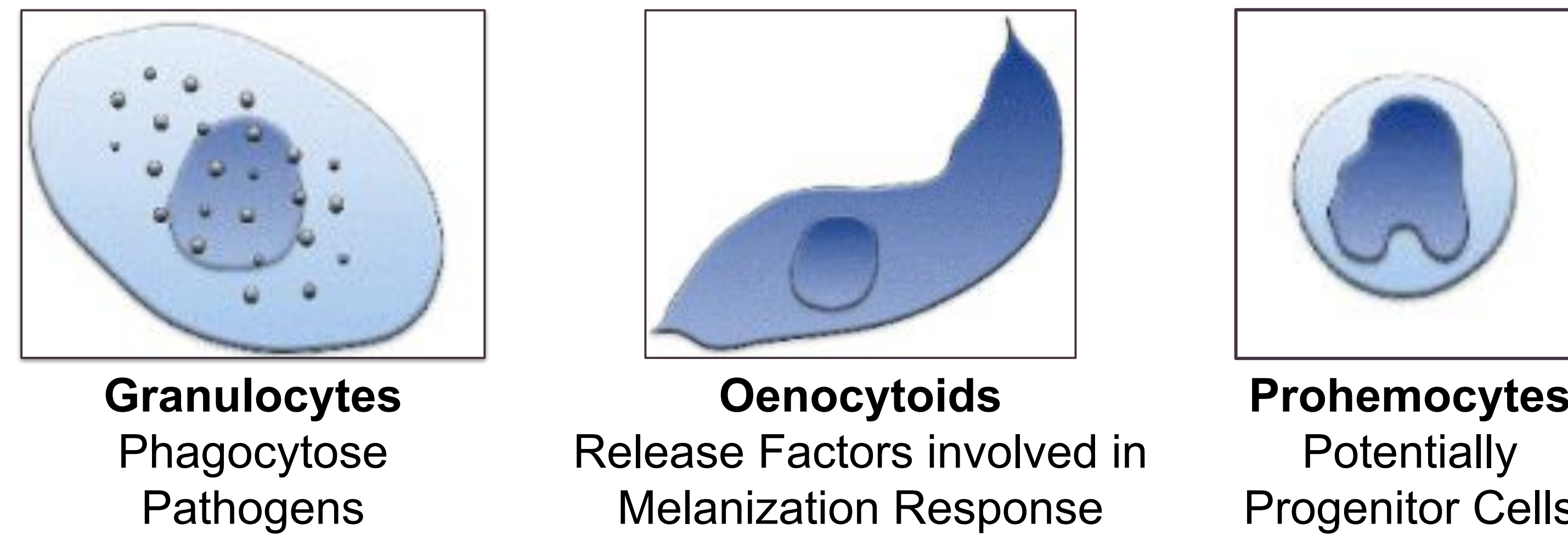


Fig. 1. Functional classes of hemocytes. (Images adapted from [1]). Hemocytes can also be divided into circulating (flowing in the hemocoel) and sessile (attaching to tissues) hemocytes.

- Many factors, including temperature and aging, impact the ability of mosquitoes to mount an immune defense against pathogens and transmit disease.
- Mosquitoes are ectothermic poikilotherms, so their internal functions are dictated by environmental temperature.
- Mosquito body condition deteriorates with aging, which is a process called senescence



Fig. 2. The effects of temperature and age on different mosquito processes.

- Temperature and aging have been studied in isolation, so how temperature affects the aging process in mosquitoes remains unknown.

## Research Question & Hypotheses

How do warmer temperature and aging affect cellular immunity of mosquitoes?

- At warmer temperatures, the mosquito ages faster physiologically than chronologically, leading to earlier progression of immune senescence.
- The number of sessile hemocytes decreases with older age and warmer temperature.
- The age-dependent decrease in hemocytes accelerates with warmer temperatures.

## Methods

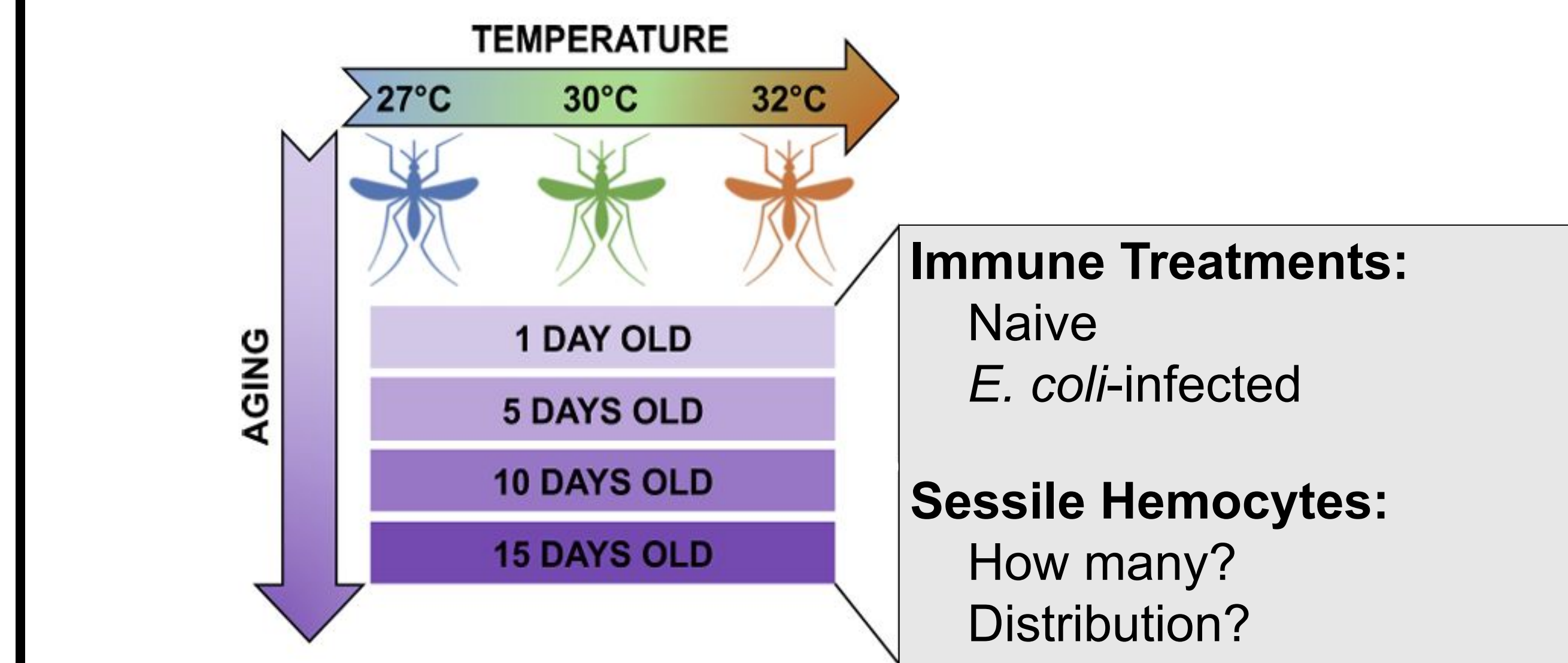


Fig. 3. Experimental overview (Adapted from [2]).

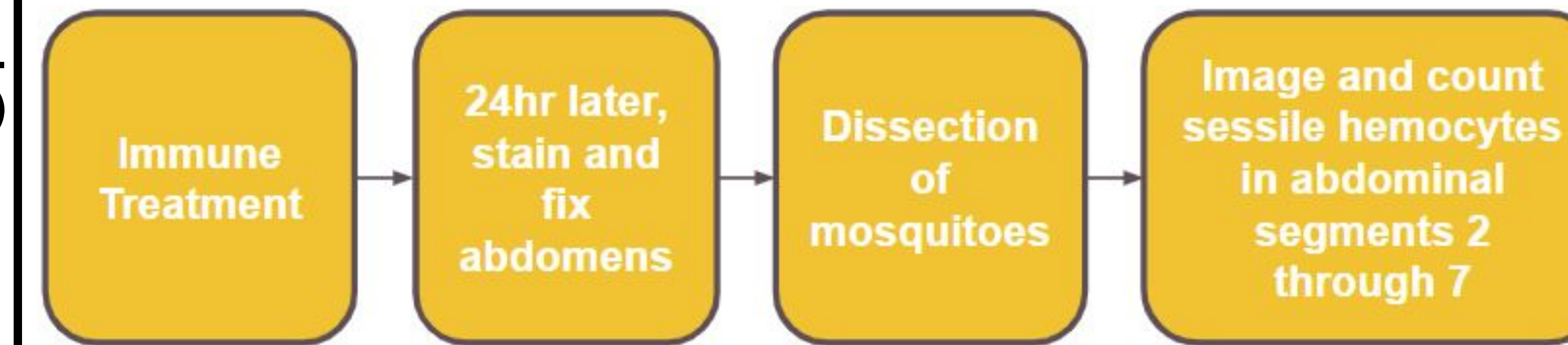


Fig. 4. Methodology to quantify sessile hemocytes in mosquitoes.

## Results

How do infection, warmer temperature, and aging impact the number of sessile hemocytes?

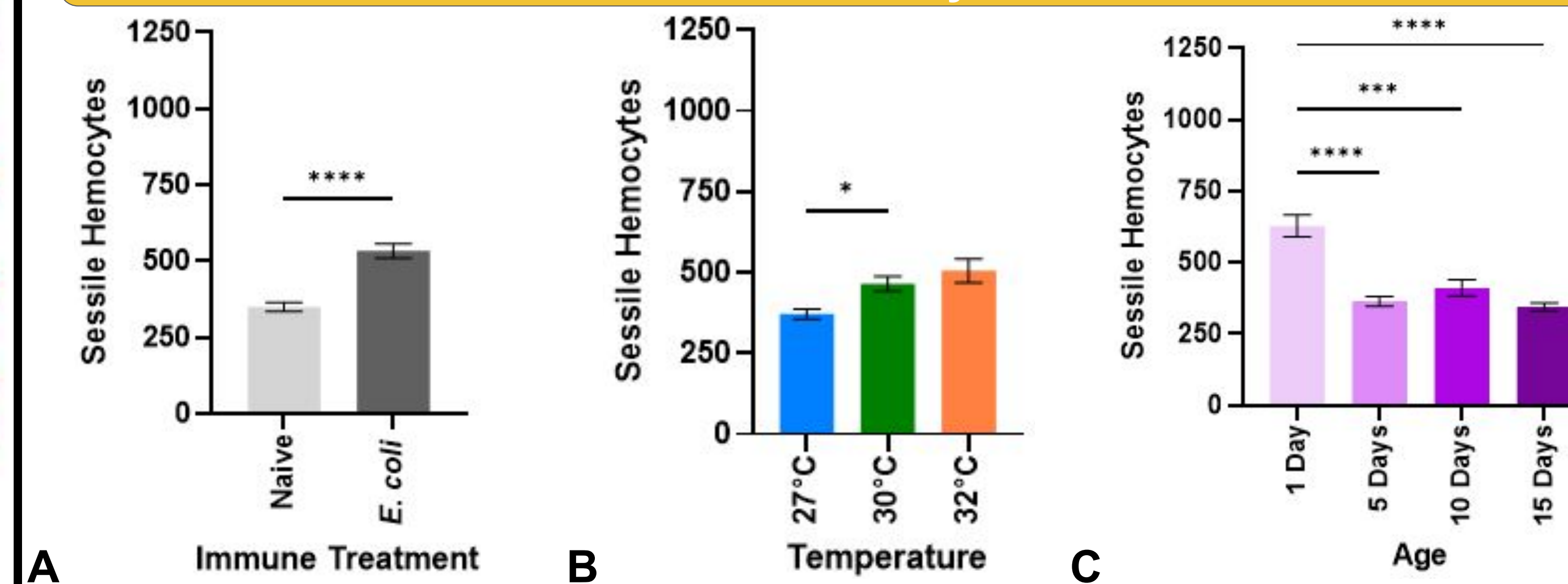


Fig. 5. The number of sessile hemocytes increases with infection (A) and warmer temperature (B), and decreases with aging (C).

How do temperature and aging interactively affect the number of sessile hemocytes in naive mosquitoes?

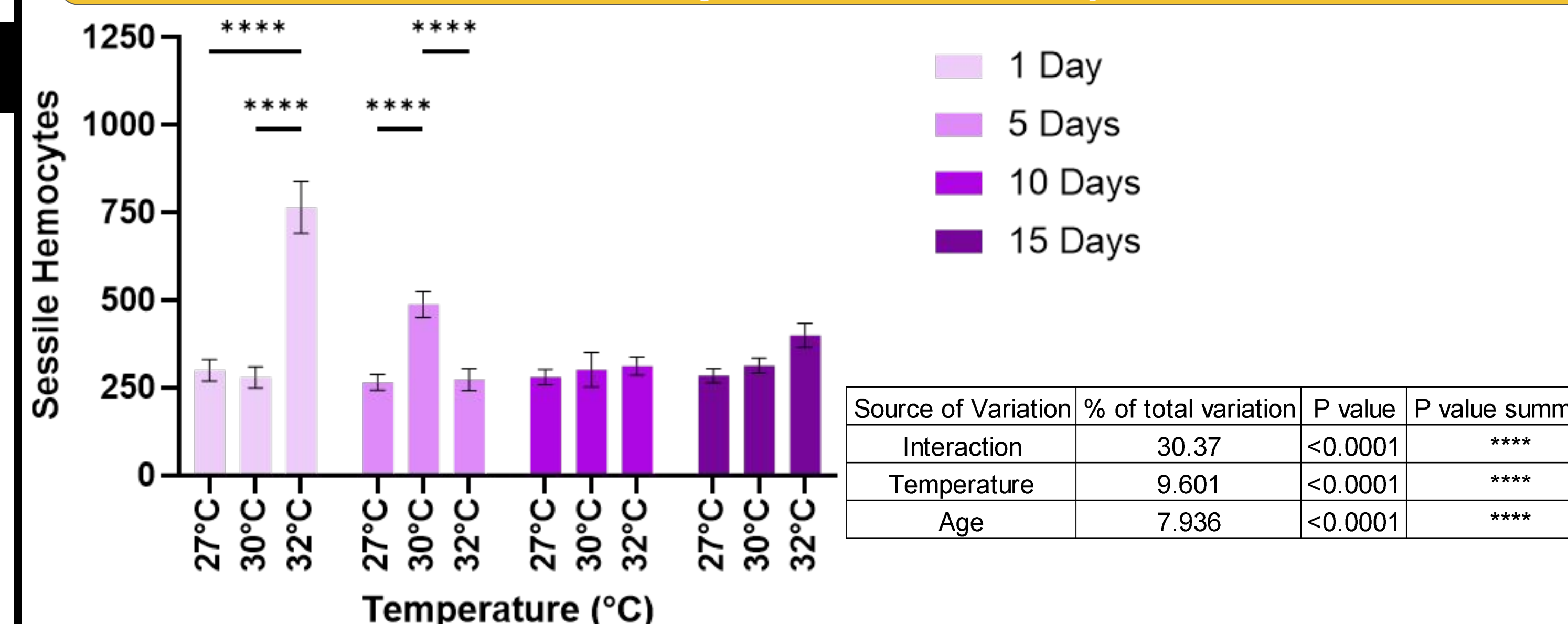


Fig. 6. Warmer temperatures cause greater variation in sessile hemocytes at the younger ages.

## Results (cont.)

How do temperature and aging interactively affect the number of sessile hemocytes in infected mosquitoes?

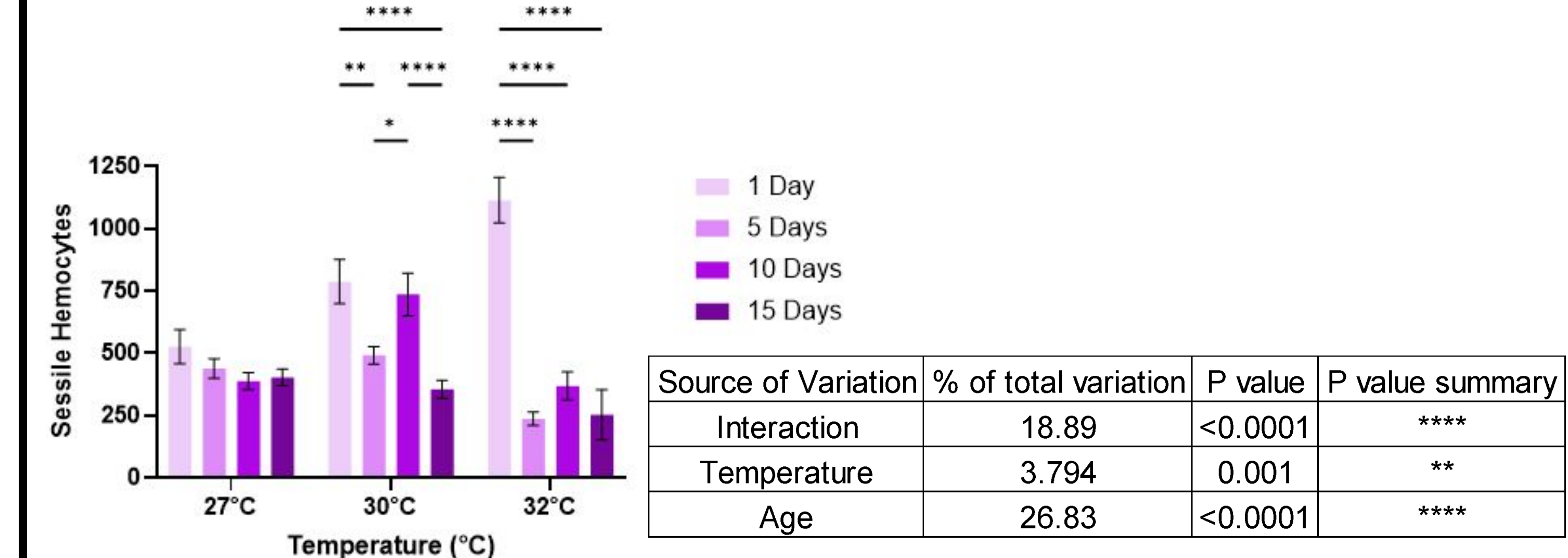


Fig. 7. The aging-dependent decline in the number of sessile hemocytes occurs earlier when the temperature is warmer.

How is the spatial distribution of sessile hemocytes affected by temperature, aging, and infection?

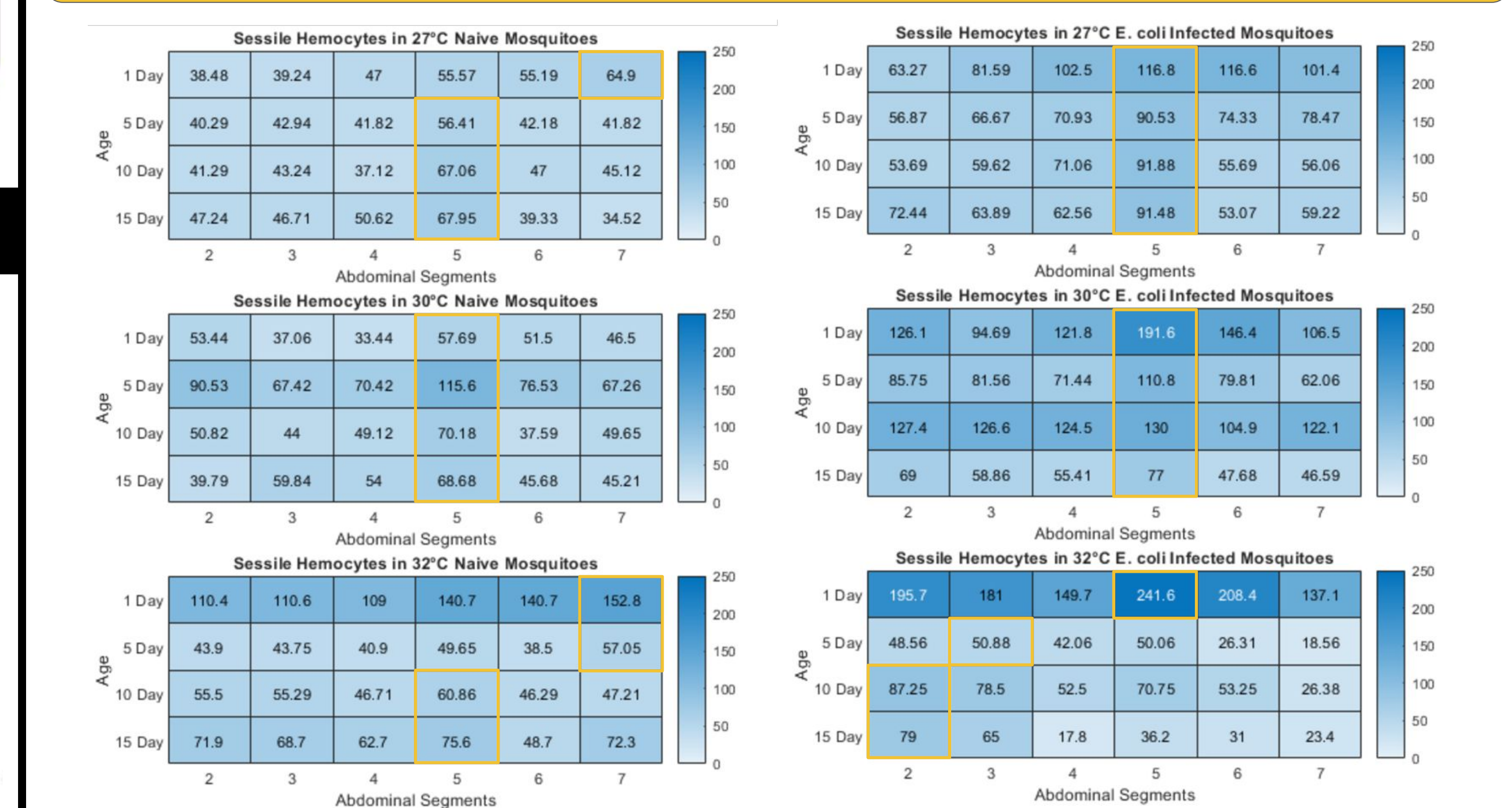


Fig. 8. Warmer temperatures cause greater spatial variation in sessile hemocyte distribution. Segments encased in yellow boxes have the greatest number of hemocytes, with segment 5 usually having the most.

## Conclusions

- The number of sessile hemocytes increases with infection and warmer temperature, but decreases with aging.
- In infected mosquitoes, the aging-dependent decline in sessile hemocytes occurs earlier when the temperature is warmer.
- Warmer temperatures cause greater variation in hemocyte spatial distribution.
- Future analyses will investigate how temperature and aging shape the number and functional efficacy of circulating hemocytes.

## Author Contribution Statement

SS & JB: Experimental design, data collection, data analysis; JH: Experimental design, oversaw the project design and execution

## References

- Moyetta NR *et al.* Morphological and Ultrastructural Characterization of Hemocytes in an Insect Model, the Hematophagous *Dipetalogaster maxima* (Hemiptera: Reduviidae). *Insects*. 2021;12(7):640.
- Barr JS *et al.* Temperature and age, individually and interactively, shape the size, weight, and body composition of adult female mosquitoes. *J Insect Physiol*. 2023;148:104525.

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