

What Can We Learn from Housefly Saliva?

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A Look at *MdSGHV*'s Impact on Saliva Production

Abstract

The *Musca domestica* salivary gland hypertrophy virus (*MdSGHV*) is a double stranded circular DNA virus that causes hypertrophy of salivary glands in the common housefly. The virus also hinders ovary development in females and is believed to reduce reproduction in both sexes after infection. The purpose of this study has been to determine differences in saliva production between healthy flies and flies infected with *MdSGHV*. This information could lead to the development of a major biocontrol agent as well as help us understand saliva-transmitted viruses in general. We found that infected flies overall produce larger amounts of saliva than non-infected flies.

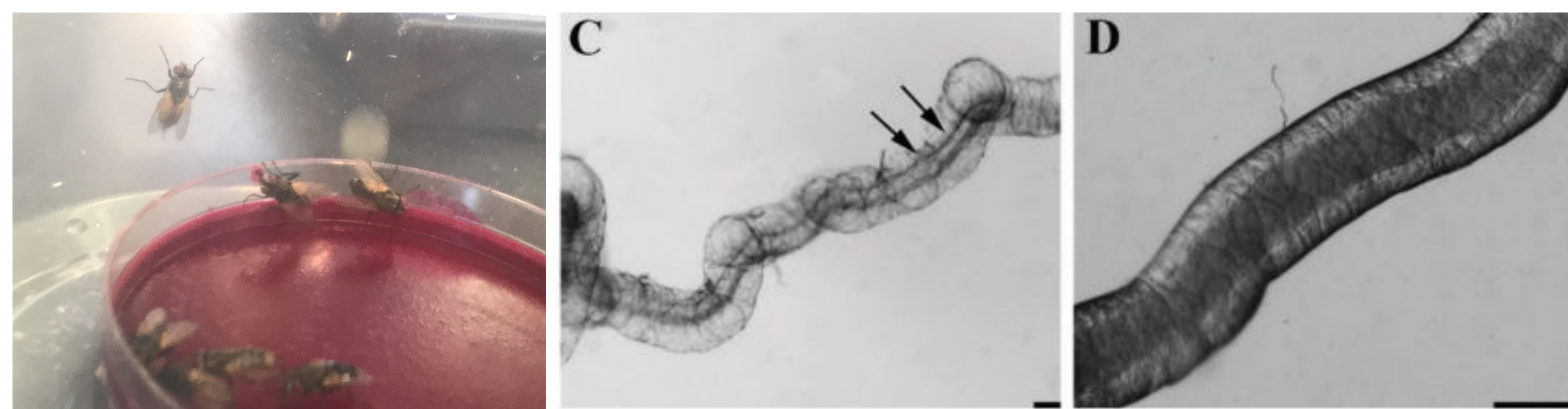


Figure 1: Flies feeding from a protein plate. C: Healthy fly salivary gland. D: Salivary gland infected with *MdSGHV*

Background Information

Houseflies are considered a common pest in many homes, however in the dairy and food packing industry, these insects can transmit pathogens such as *E. coli* and *Salmonella*. In addition, houseflies are quick to develop resistance to pesticides, and their larvae are often buried in areas sprays cannot reach. *MdSGHV* has potential to be used as a biocontrol agent to reduce the housefly populations and restrict pathogen transmission. The virus is believed to be transmitted through saliva, although rates of transmission to healthy flies are only as high as 24% in lab settings, and as low as 3%.

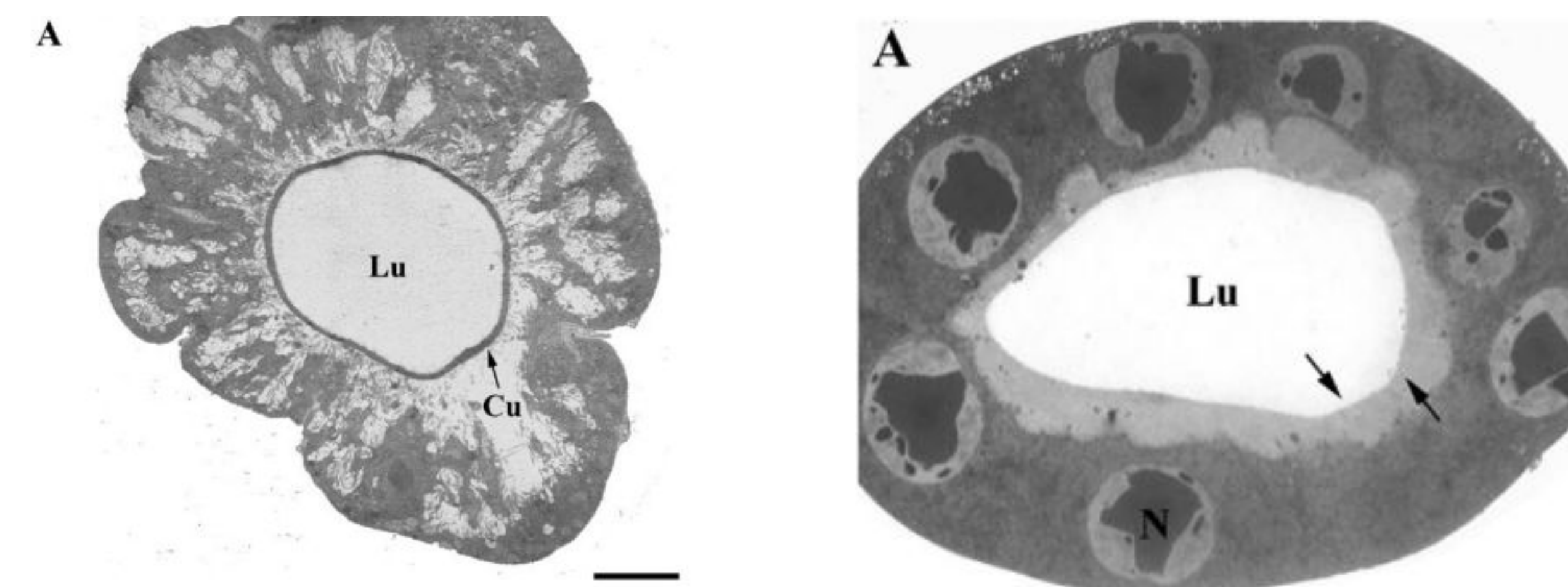


Fig. 2: Transmission electron micrographs of a healthy salivary gland vs an infected one, showing breakdown of chitin wall.

Specific Objective

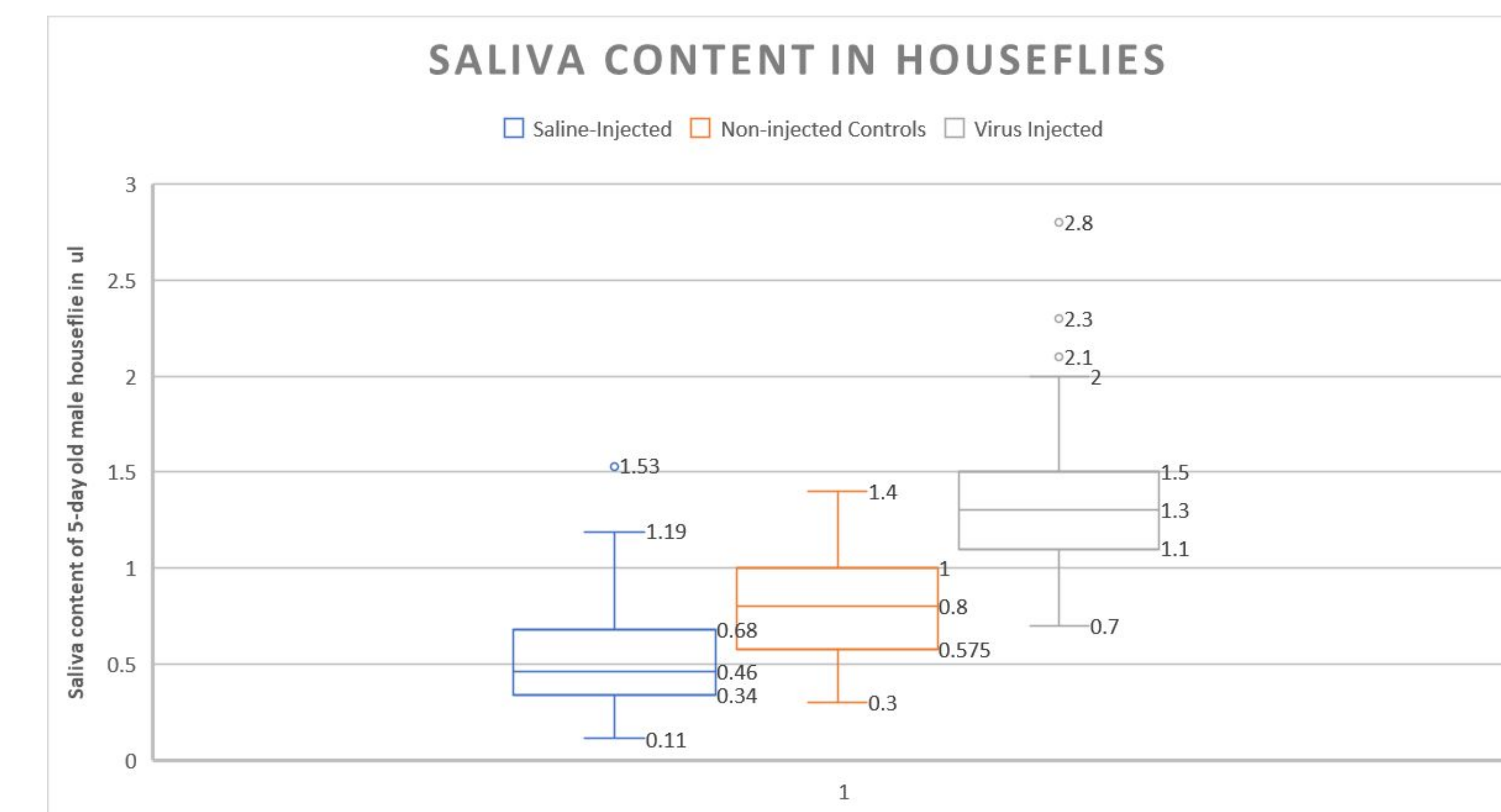
The objective of the author's work has been specifically to repeat the controls of a previous experiment. The repeat controls included a mock injection in order to eliminate the possibility of an injection bias influencing the results of prior experiments.

Methods

Each week fly pupae were obtained from the Dr. Geden Lab in Florida. The pupae were raised in wire cages and at 1 day old, injected with the virus. Four days later the flies were starved for 16 hours. The flies then fed for 20 minutes on a sugar-amaranth mixture and were dissected. The liquid content of each fly's crop was measured to determine saliva production. This process was executed by Abigail Holmes. Control flies were treated in the same way, the only difference being a saline injection rather than the virus.

Results

Results confirmed a higher volume of saliva in infected flies vs non-infected flies. The initial control was done without a saline mock-injection, however follow-up experiments using a mock injection showed similar results.



Conclusion

This shows that the virus may have evolved to increase its own transmission by increasing saliva production. This information could help future researchers in understanding saliva-transmitted diseases such as Zika, as well as developing a useful biocontrol agent for houseflies. Future research should focus on determining the method the virus uses to increase saliva production.

Acknowledgements

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References

- Prompiboon, P., Lietze, V. U., Denton, J. S., Geden, C. J., Steenberg, T., & Boucias, D. G. (2010). *Musca domestica* salivary gland hypertrophy virus, a globally distributed insect virus that infects and sterilizes female houseflies. *Applied and environmental microbiology*, 76(4), 994–998. <https://doi.org/10.1128/AEM.02424-09>
- Lietze, V.-U., Geden, C. J., Doyle, M. A., & Boucias, D. G. (2012). Disease dynamics and persistence of *Musca domestica* salivary gland hypertrophy virus infections in laboratory house fly (*Musca domestica*) populations. *Applied and Environmental Microbiology*, 78(2), 311–317. <https://doi.org/10.1128/aem.06500-11>
- Molina Palacios, D., Stoffolano, J. G., Fausto, A. M., Gambellini, G., & Burand, J. (2021). The effect of the hypertrophy virus (*mdsgHV*) on the ultrastructure of the salivary glands of *Musca domestica* (Diptera: Muscidae). *Journal of Insect Science*, 21(2). <https://doi.org/10.1093/jisesa/icab015>
- University of Nebraska - lincoln digitalcommons@university of Nebraska ... (n.d.). Retrieved September 12, 2022, from <https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1021&context=biocsihcbets>