OZONE FUMIGATION OF COMBS: USE, SAFETY & ENVIRONMENTAL CONSIDERATIONS

Rosalind R. James

USDA ARS
Pollinating Insects Research Unit
Logan, Utah, USA

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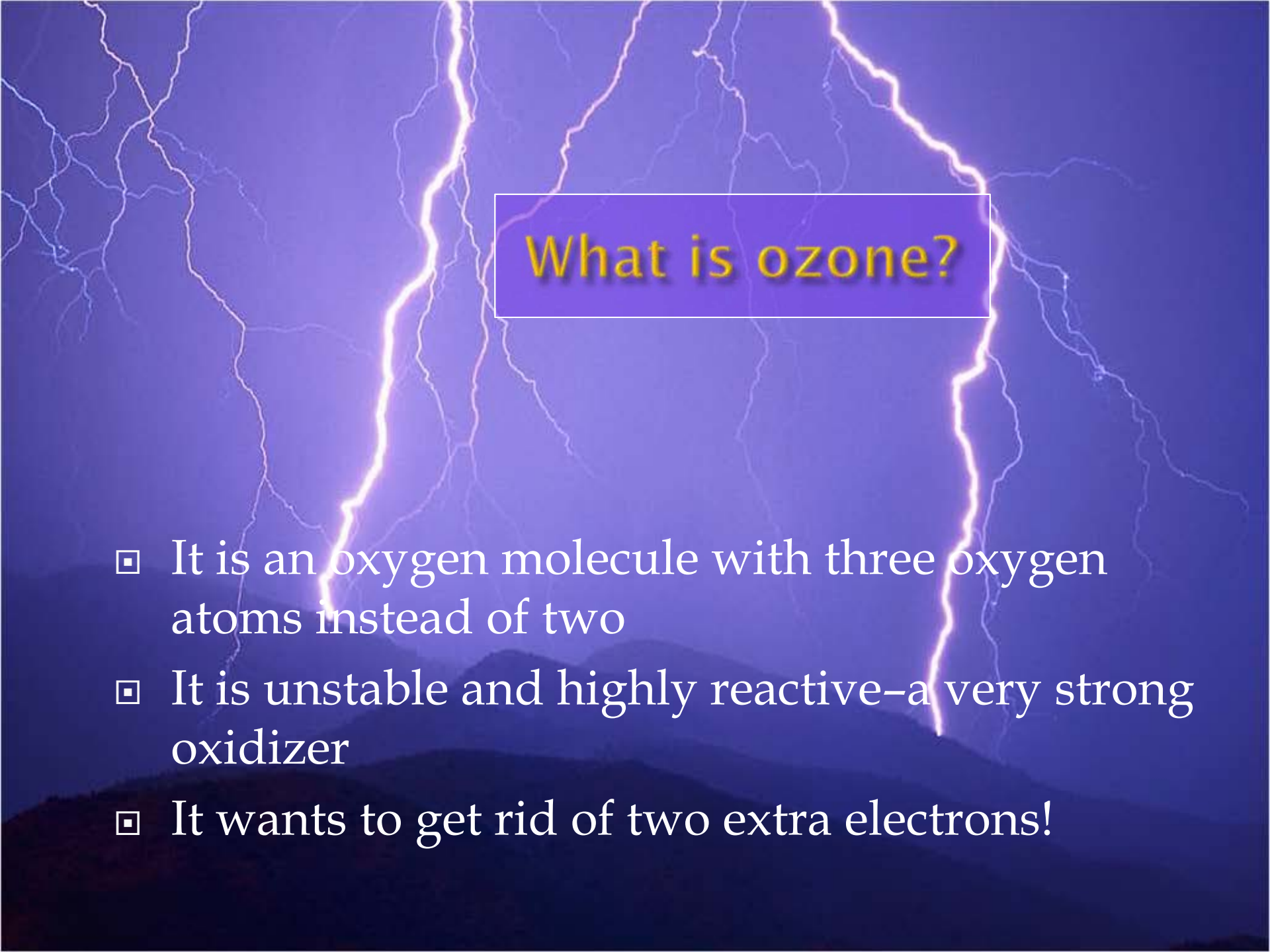

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- It is unstable and highly reactive–a very strong oxidizer
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Why use ozone to treat bee nesting materials?

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- Ozone breaks down to water and O_2
- Ozone is used in other ag commodities in high concentrations
- Why not for bees?

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- **Ethylene oxide.** Regulated fumigation method. HAZARD
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- Breaks down pesticides
- Kills pathogens
- Safe for wax
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2. Degradation of pesticides
3. Decontamination of pathogens
   - Chalkbrood
   - Foulbrood
4. How to set up an ozone chamber
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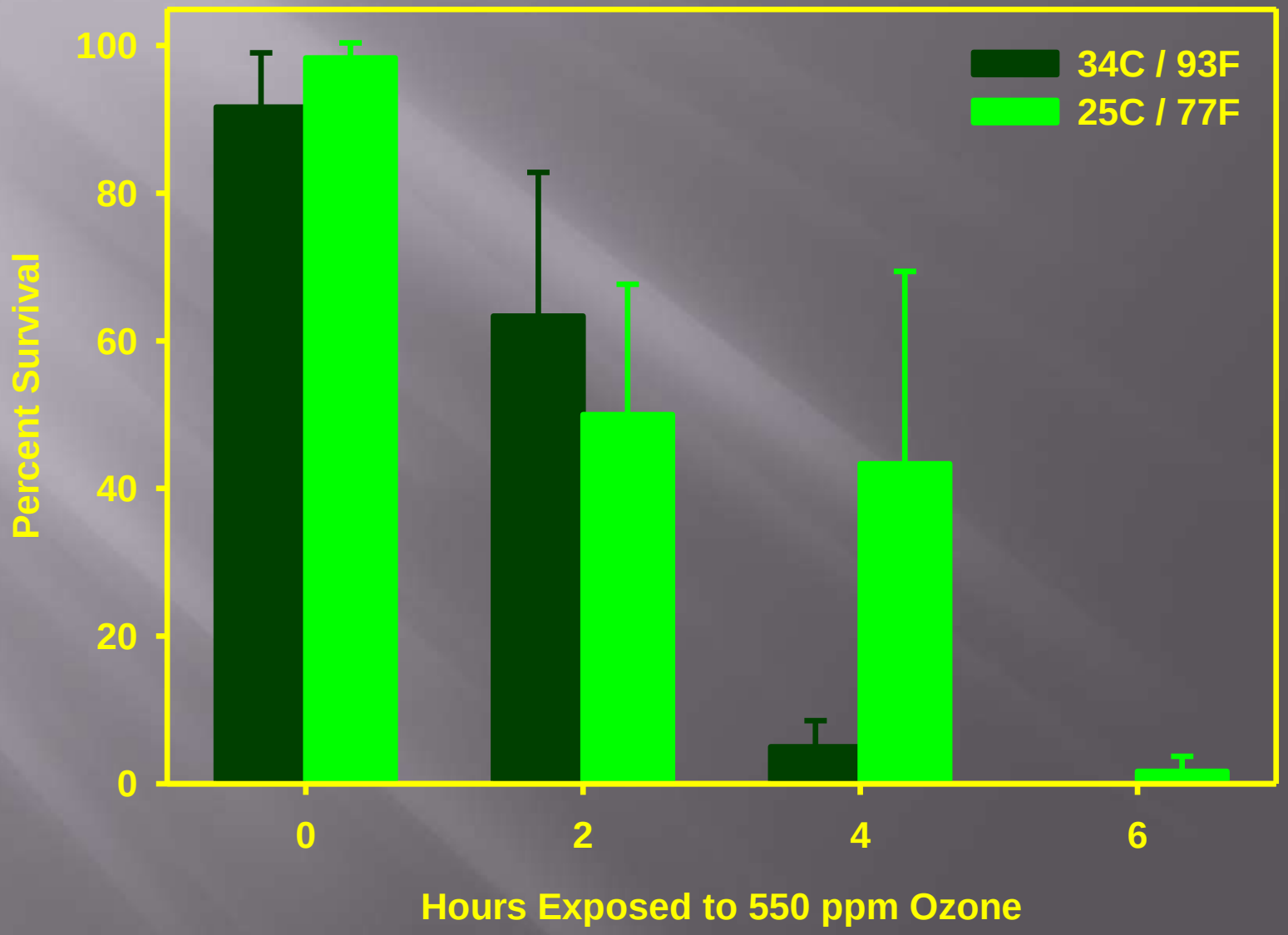
Initial Tests: Greater Wax Moths

Adult Wax Moths, 550 ppm O_3



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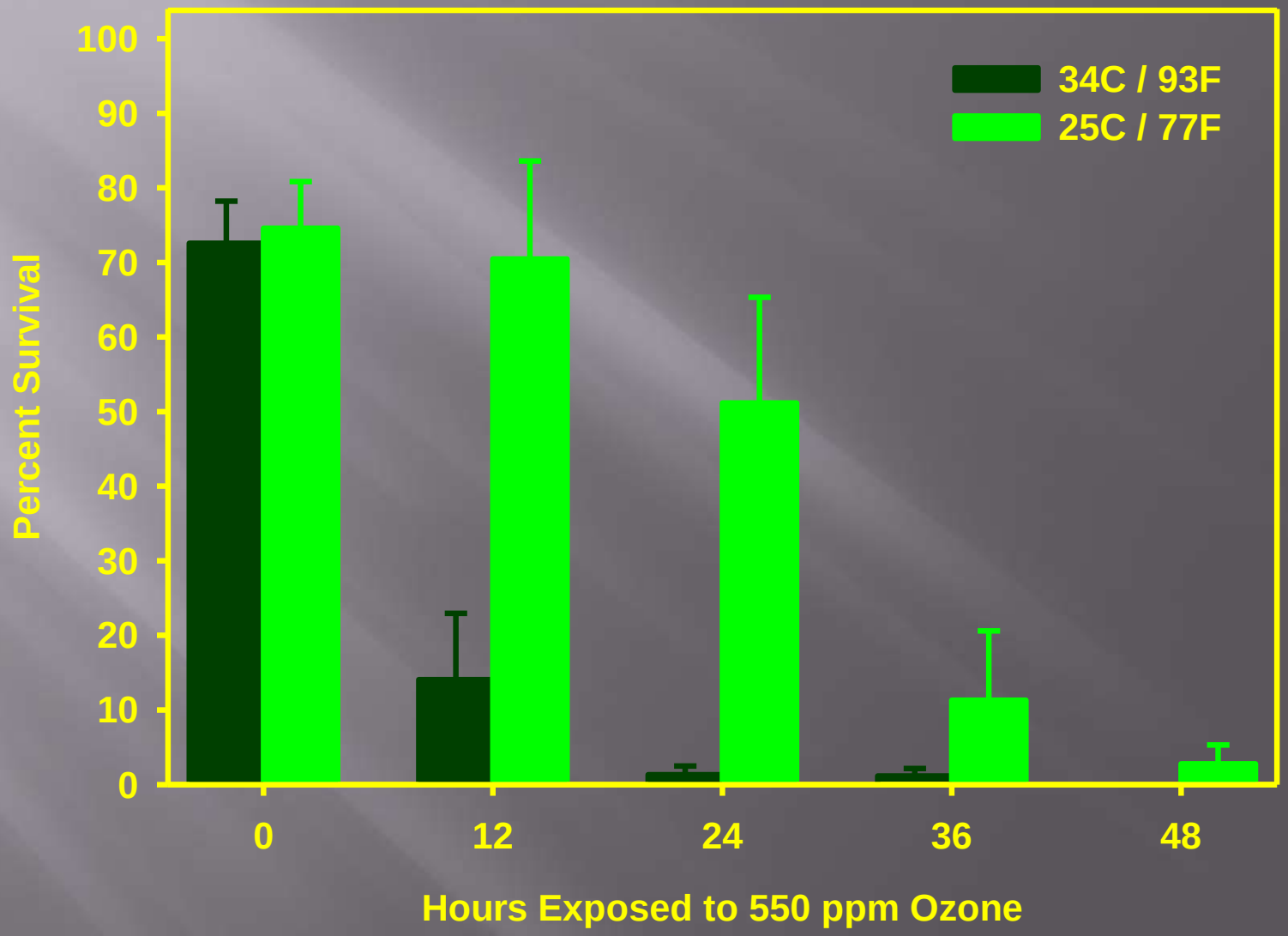

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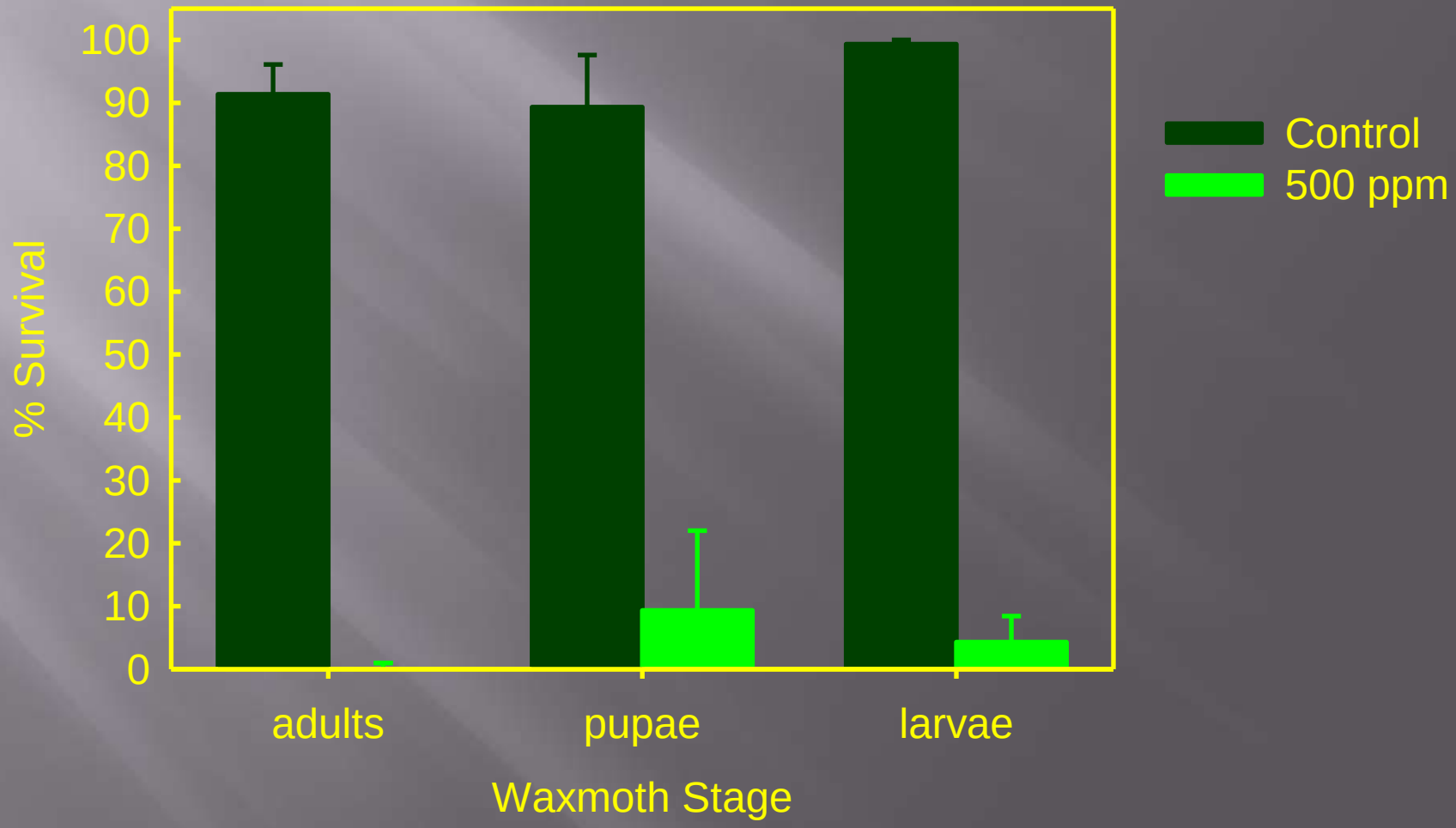

Conclusions for Wax Moth Control

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- Eggs and pupae are more resistant
- Treatments affected by temperature, but not humidity
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- If so, what concentrations and exposure times are needed?

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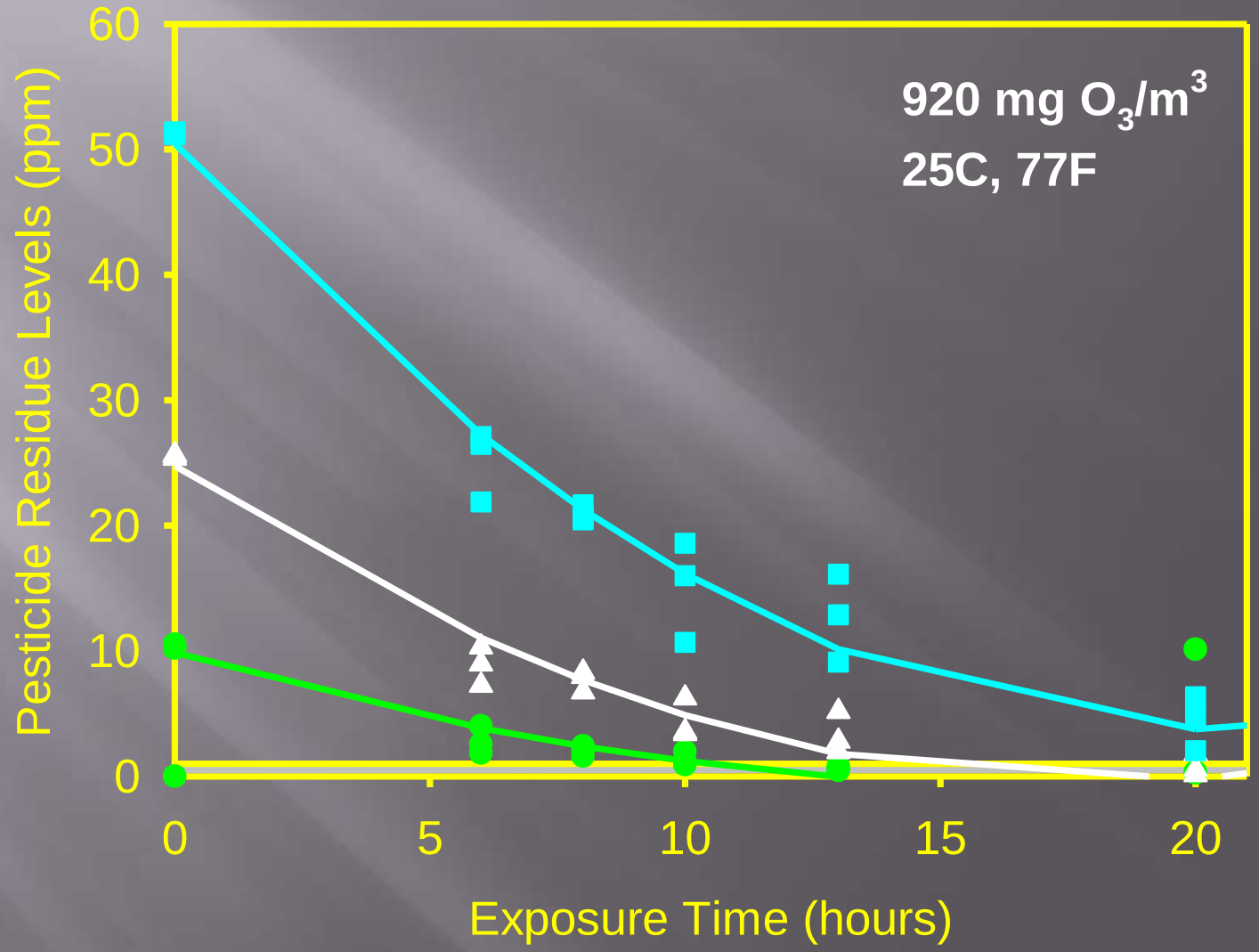

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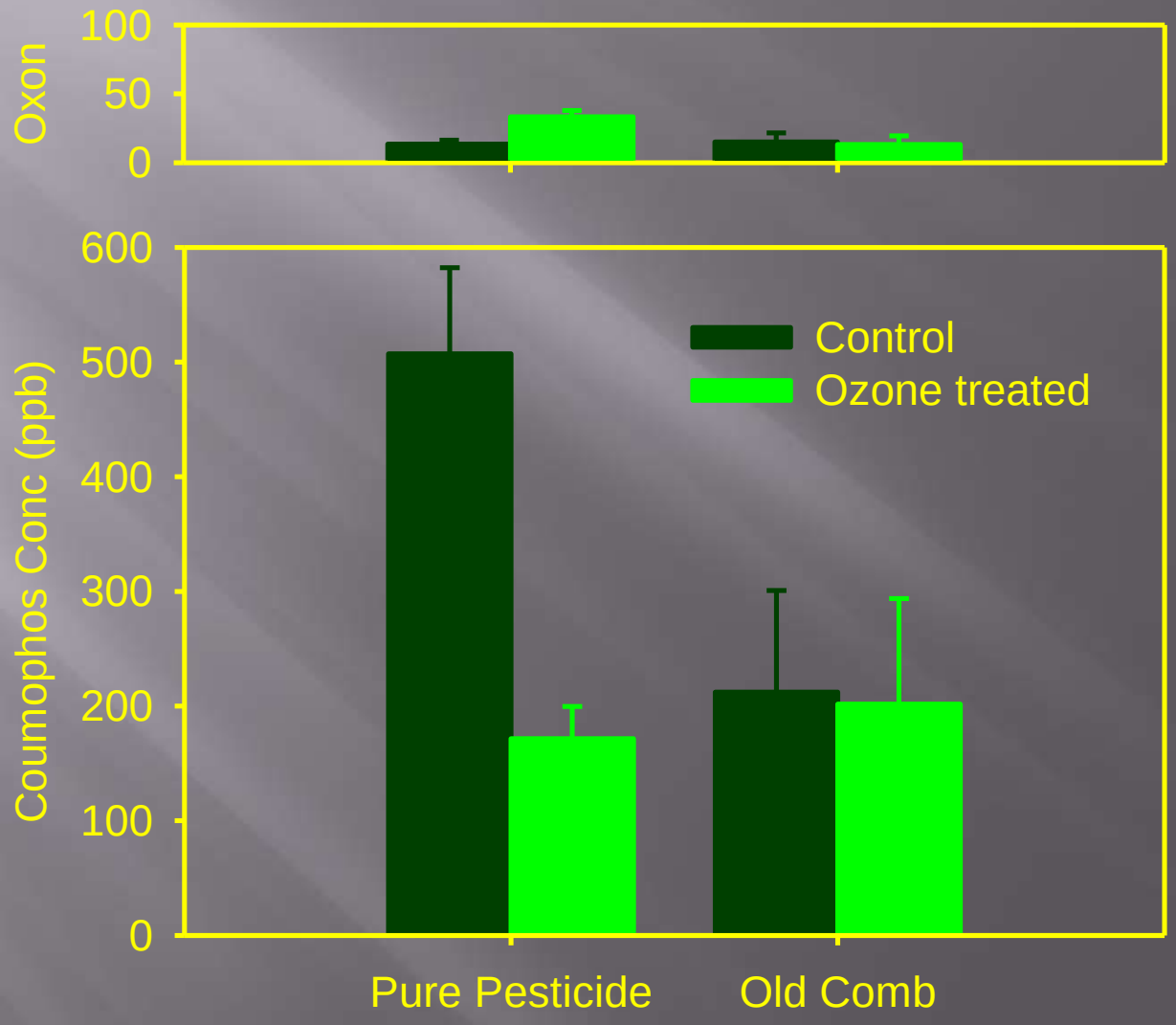

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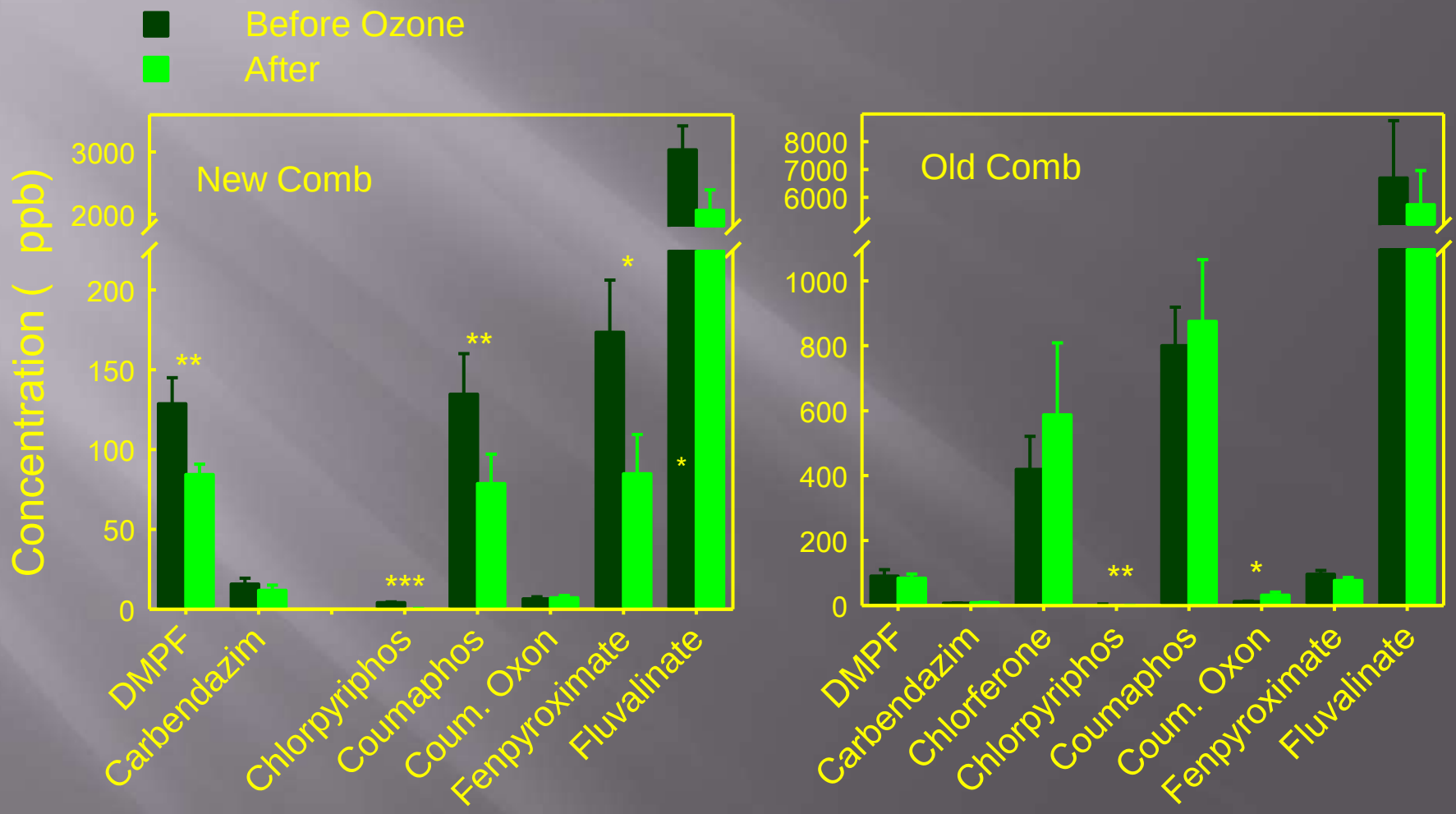

Summary
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Ozone for Bee Pathogens: Chalkbrood

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- Spores can last for many years
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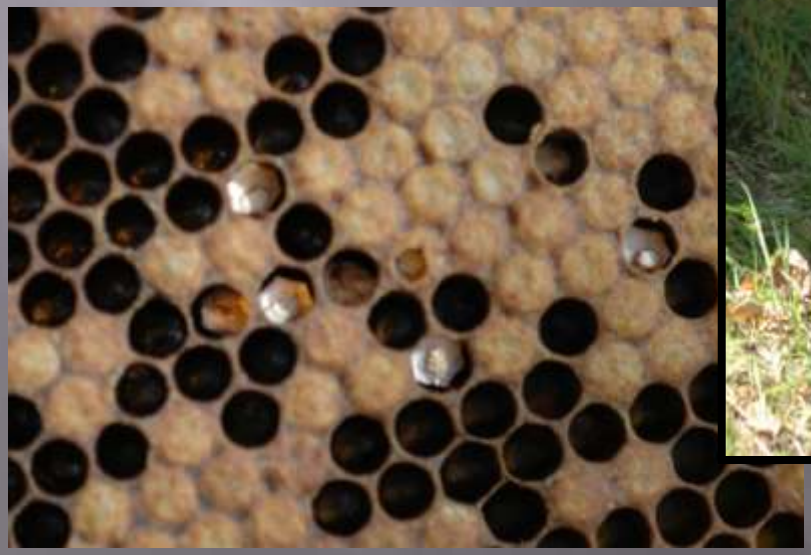

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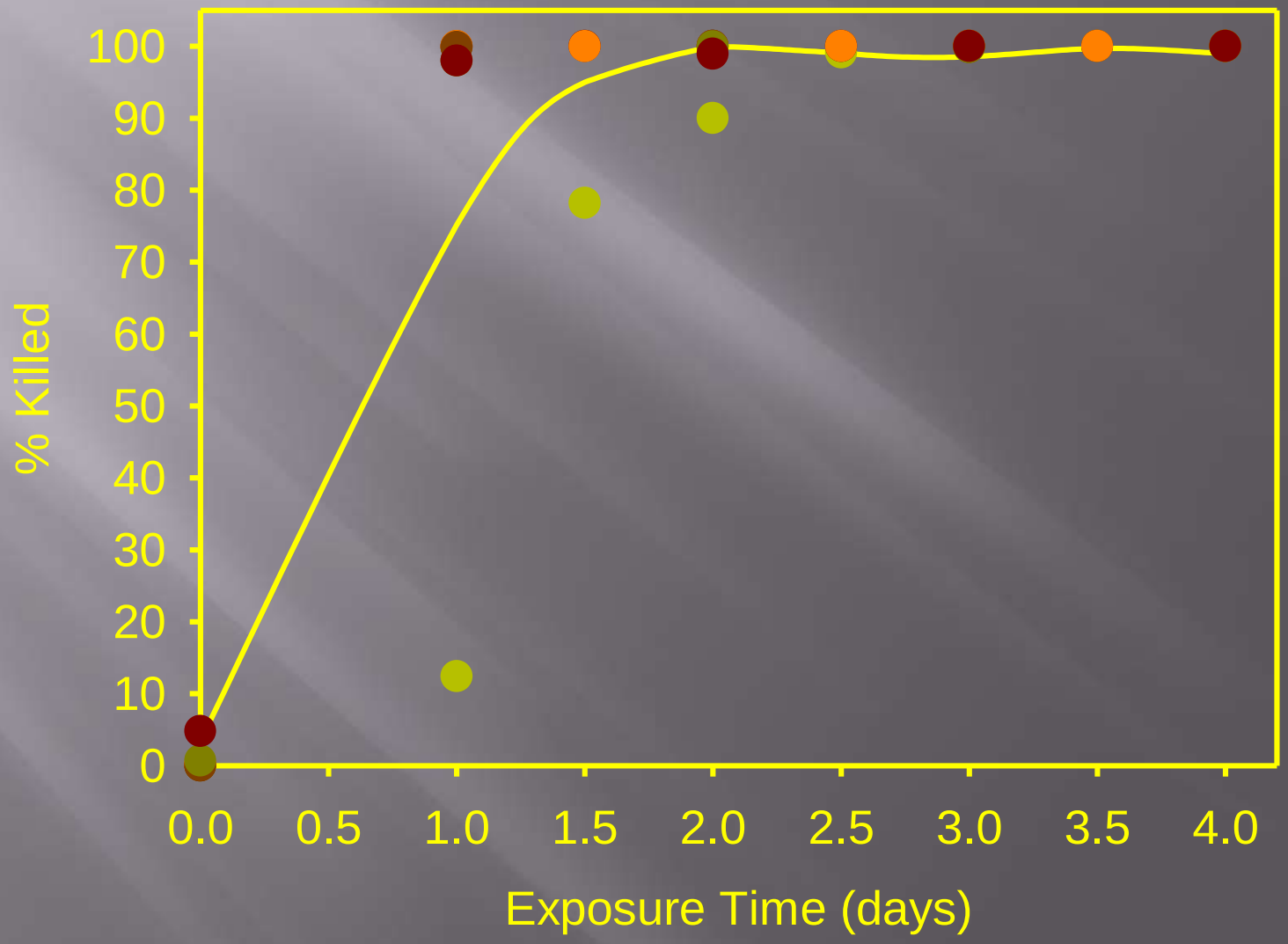

American Foulbrood

- Diseased caused by a spore forming bacterium.
- Bacterial spores are among the most recalcitrant living things on earth
- Very resistant to high temperatures (withstands boiling)
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- Very low metabolic rate when dormant
- Several conditions tested before success

Ozone and Foulbrood Spores (3 days exposure)

Vita Ltd

Ozone Conc (ppm)	% Humidity	Temp (F)	Spores Killed[1]
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[1] Percent killed out of ~100,000,000 spores, as compared to controls

Equipment Requirements Typical Set-up

- Fumigation chamber
- Internal air circulation
- Oxygen concentrator
- Air compressor and drier
- Ozone generator
- Ozone analyzer
- Ozone destructor for exhaust

Logan Bee Lab Test Chamber

Oxygen concentrator by Aercept. Ozone generator by O3Zone Co.

Analyzer by InUSA. Chamber is a Nuaire incubator. Destructor by Ozone Solutions

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Commercial Size Chamber

Chamber is a freight container

External = 8 x 10 x 10 ft

2.7 x 3.3 x 3.3 m

Ozone generator, oxygen concentrator, and destructor by Ozone Solutions

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Ozone room constructed by Slide Ridge Honey, Mendon, UT

Chamber:

20’ x 15’ x 10’

3.3 x 5 x 3.3 m

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- Ozone generated in grams per hour (g/hr)

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Martin James: Air Circulation *NO* Rubber or Urethane Belts

Notice: supers are stacked to allow increased air flow

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- "The Ozone process seems to dry out all of the equipment, boxes, frames, comb, pallets, etc."
- Rosalind: Solution may be to increase humidity, this also provides better pathogen kill

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- Pesticide residue destroyed.
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- Comb readily accepted by Honey Bees.
- Dry Rot fungus may be stopped.

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- Use to sanitize supers & comb
- Nesting materials ONLY
  - kills bees!
  - causes rust in steel
- Useful only as *part* of a pest/disease control strategy

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- More development is needed to improve wax penetration
- *Trade-off* between chamber size and generator size. The cost is in the generator.

Acknowledgements

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- Martin and Elmer James, Slide Ridge Honey, UT
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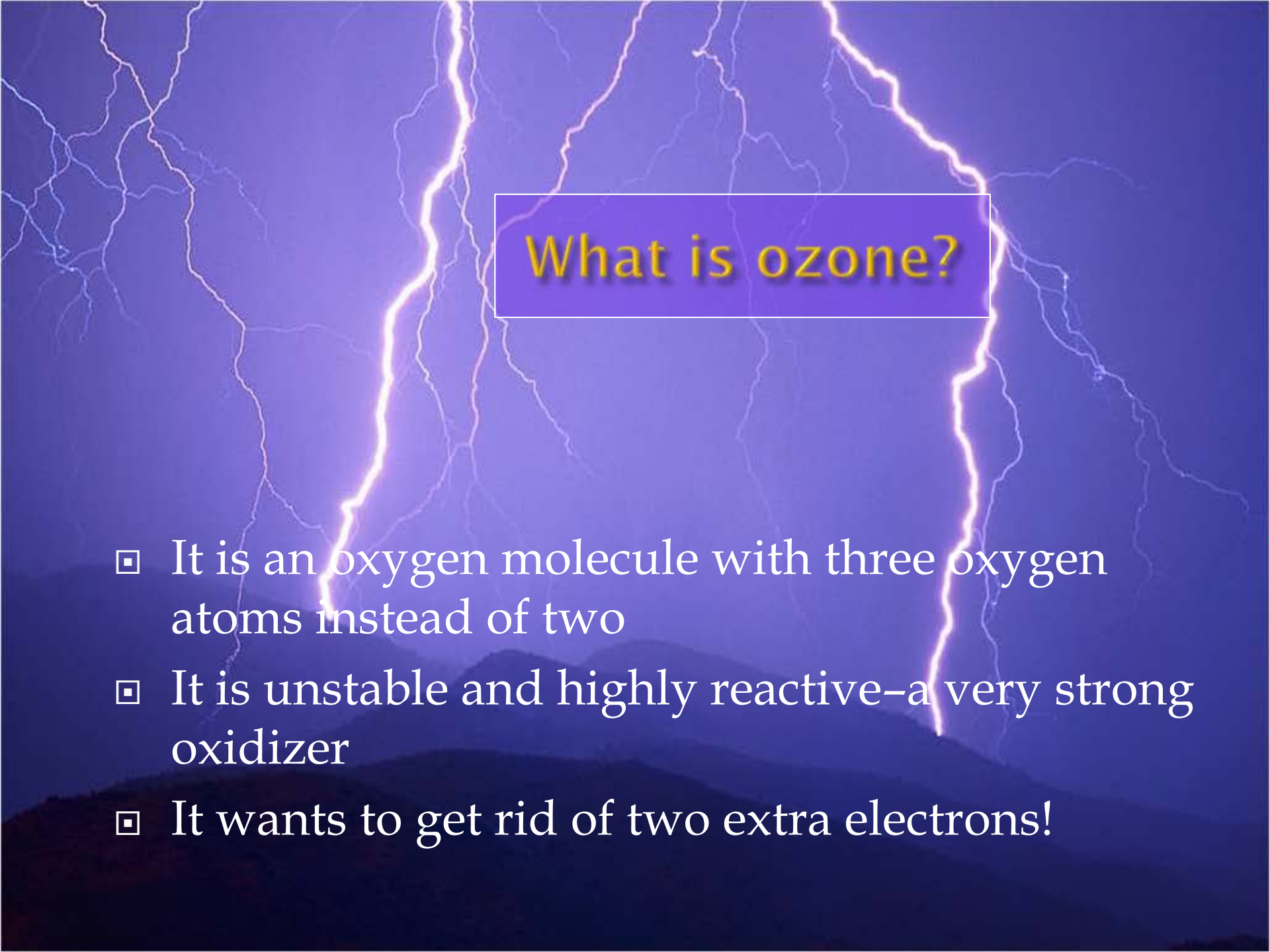

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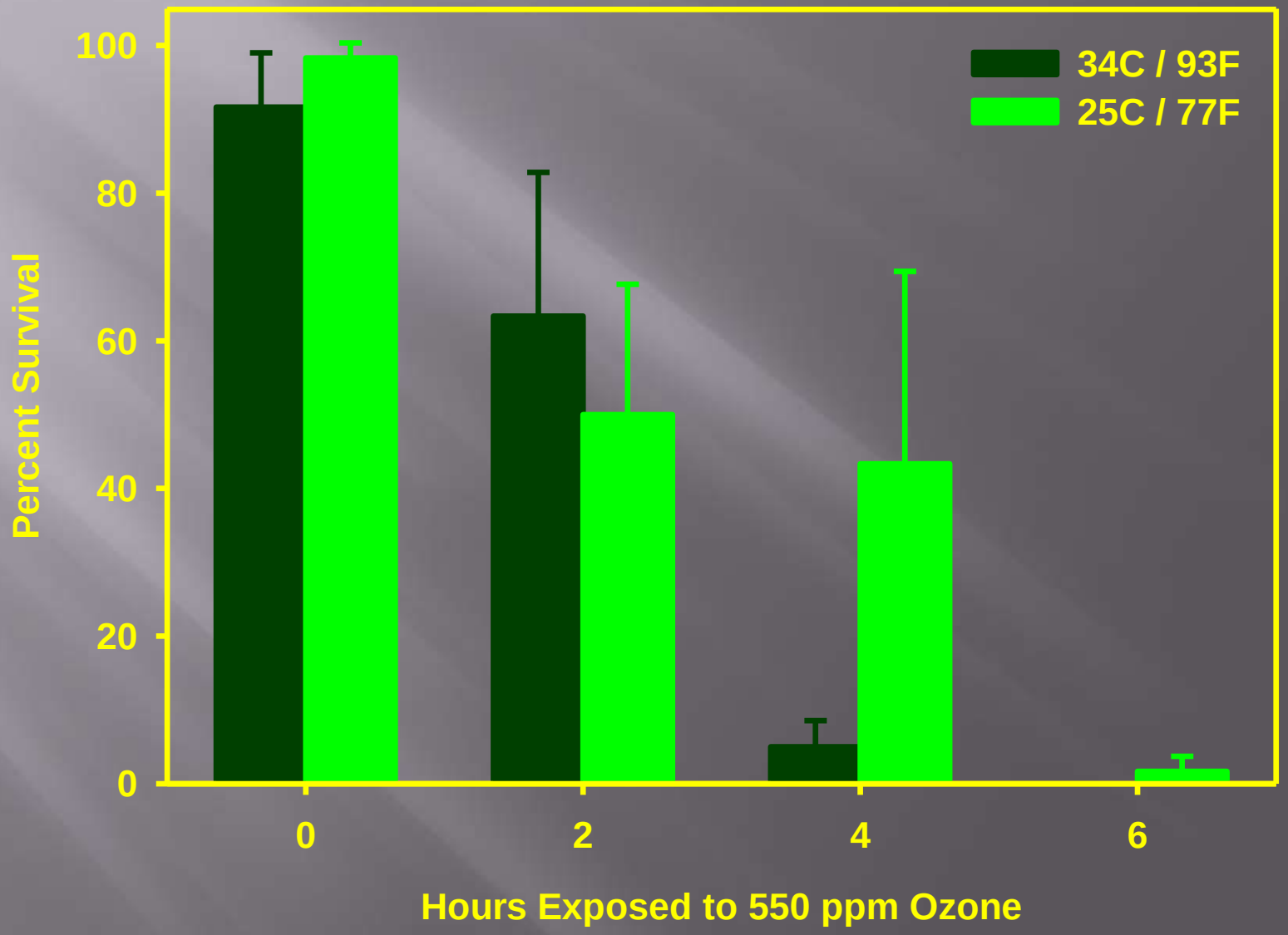

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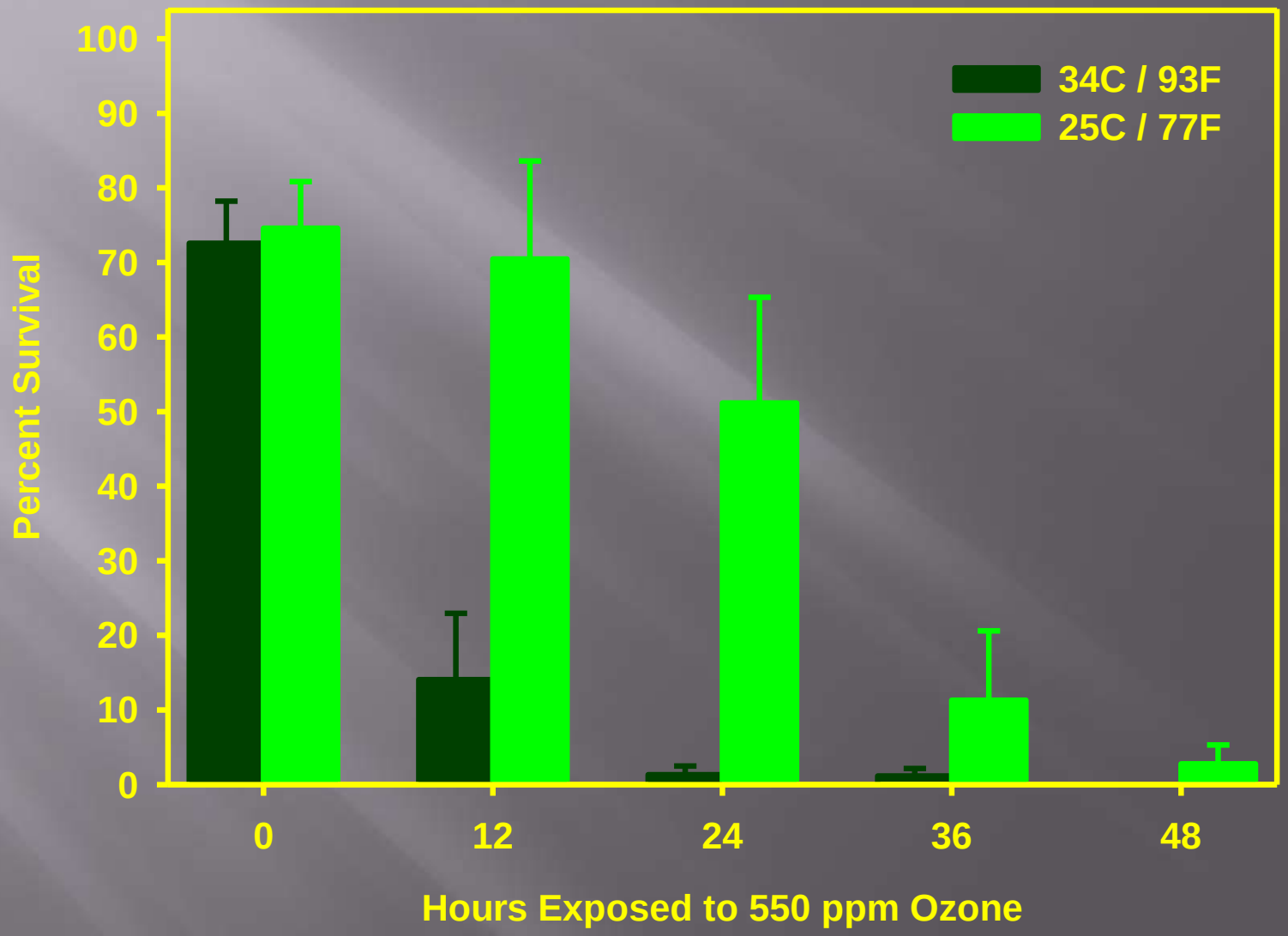

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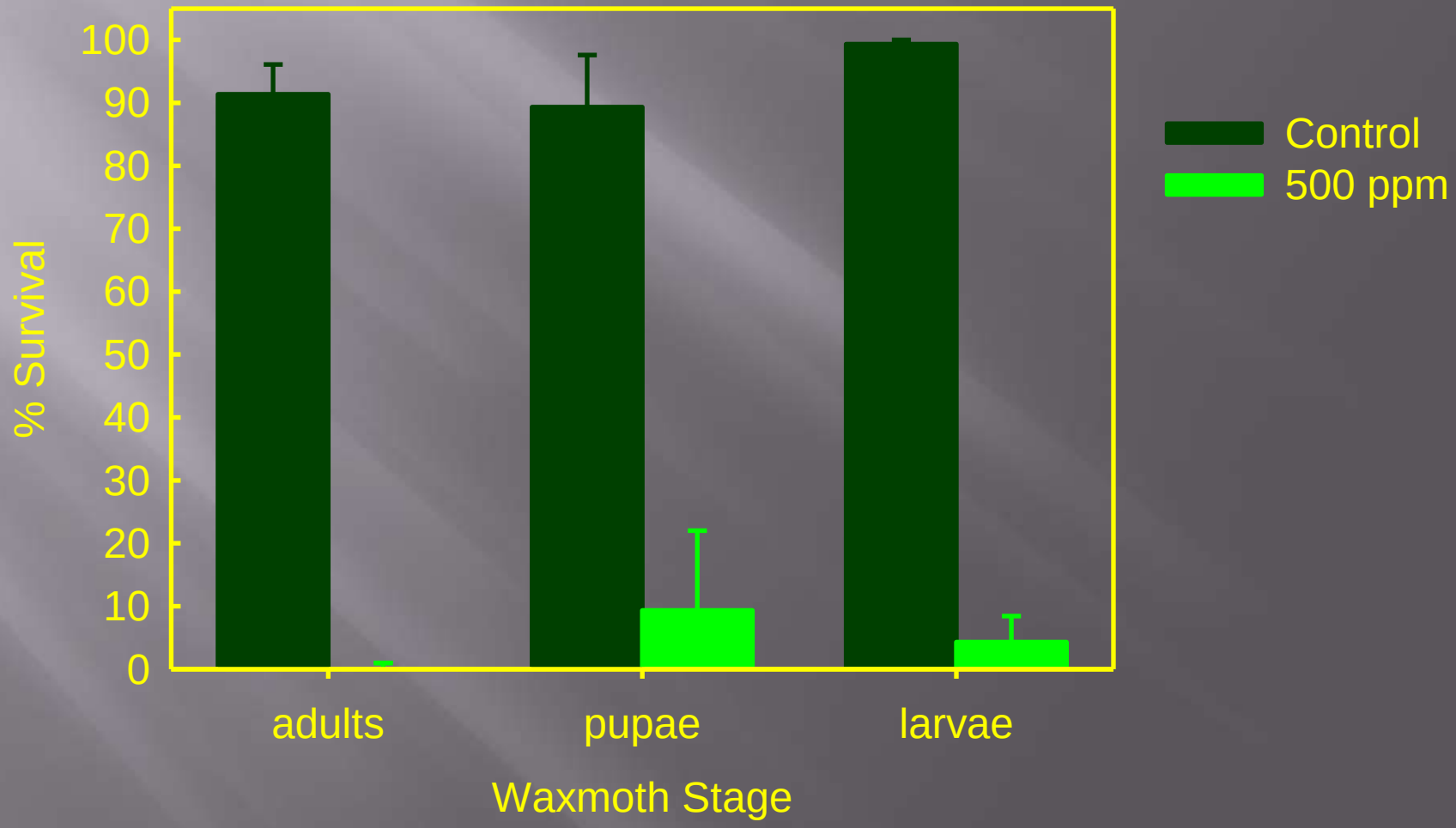

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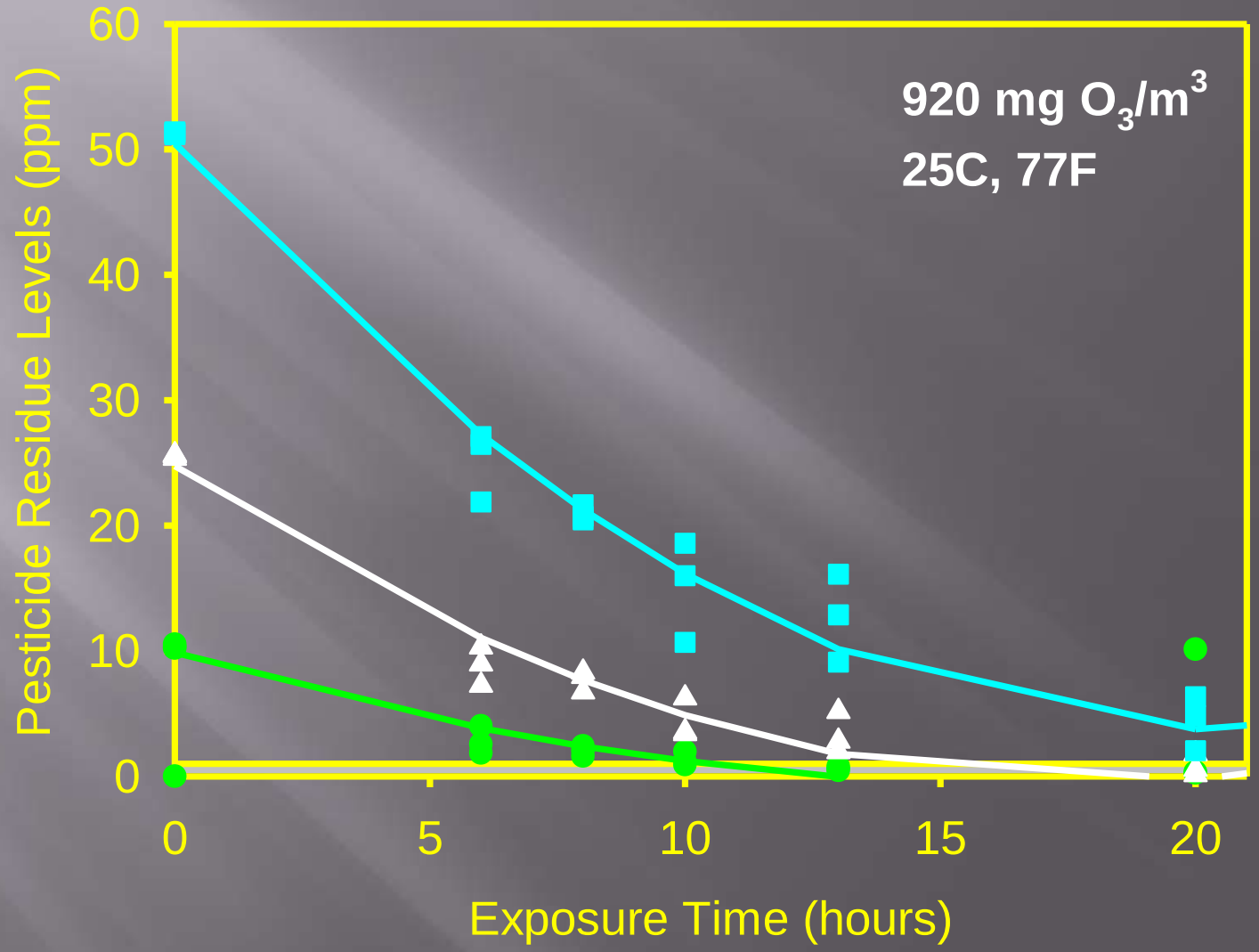

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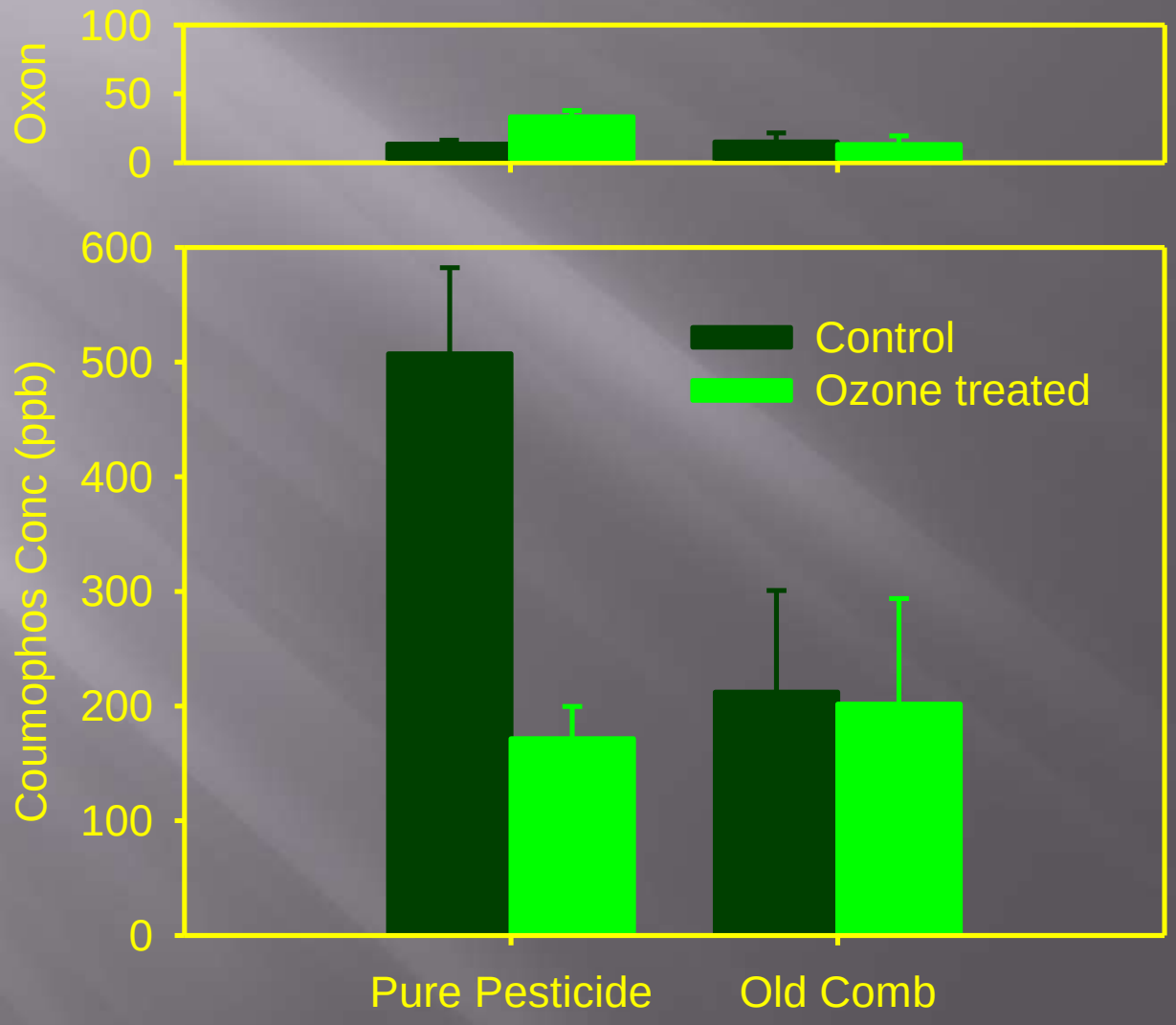

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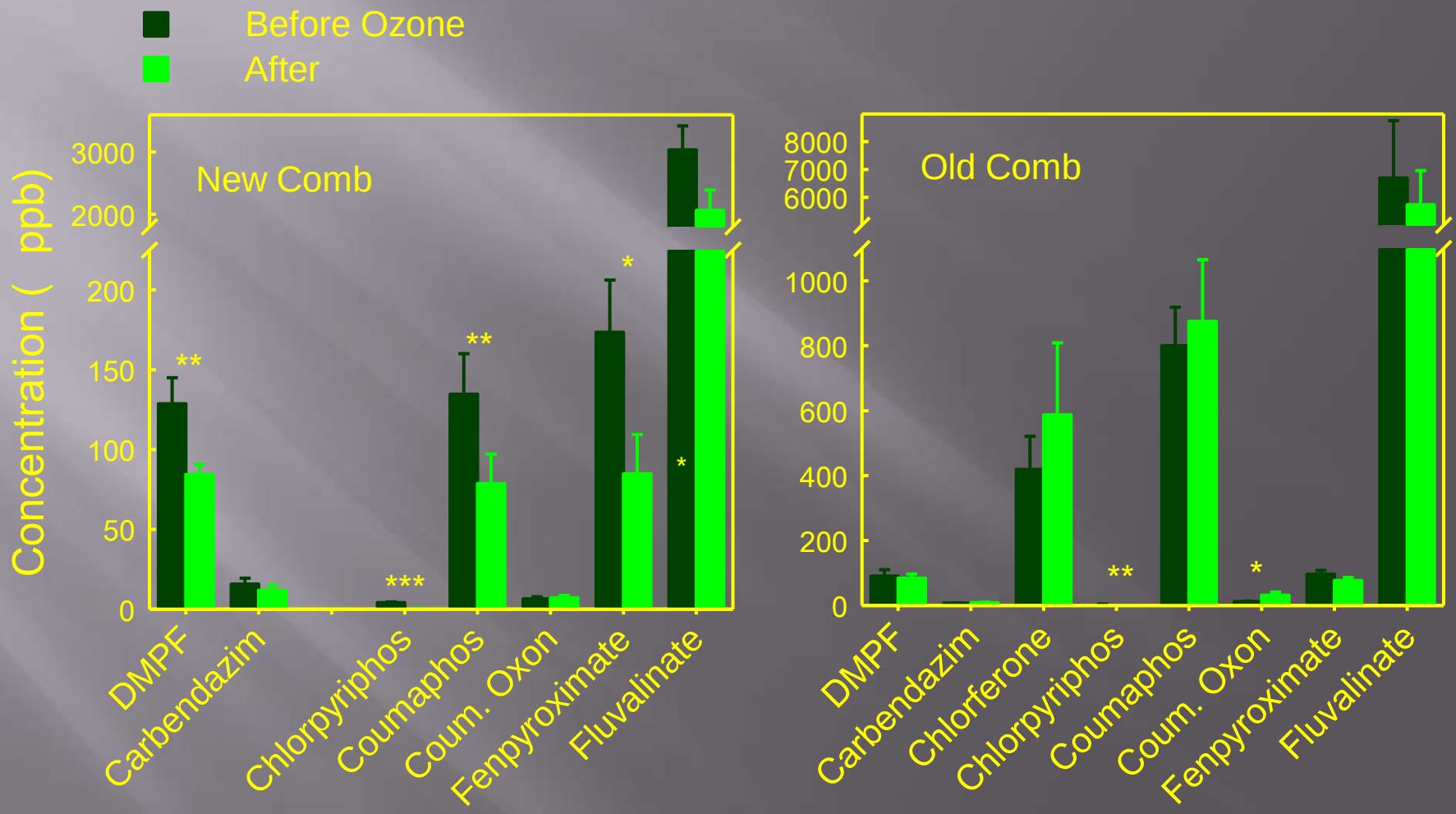

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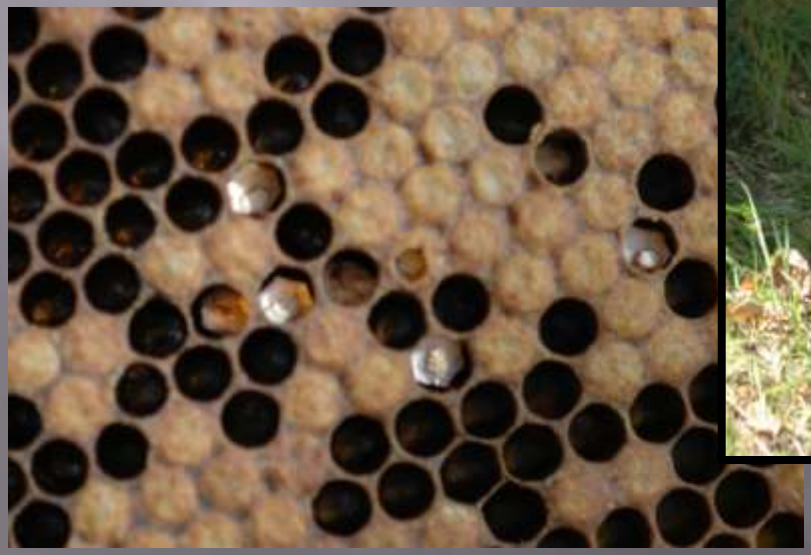

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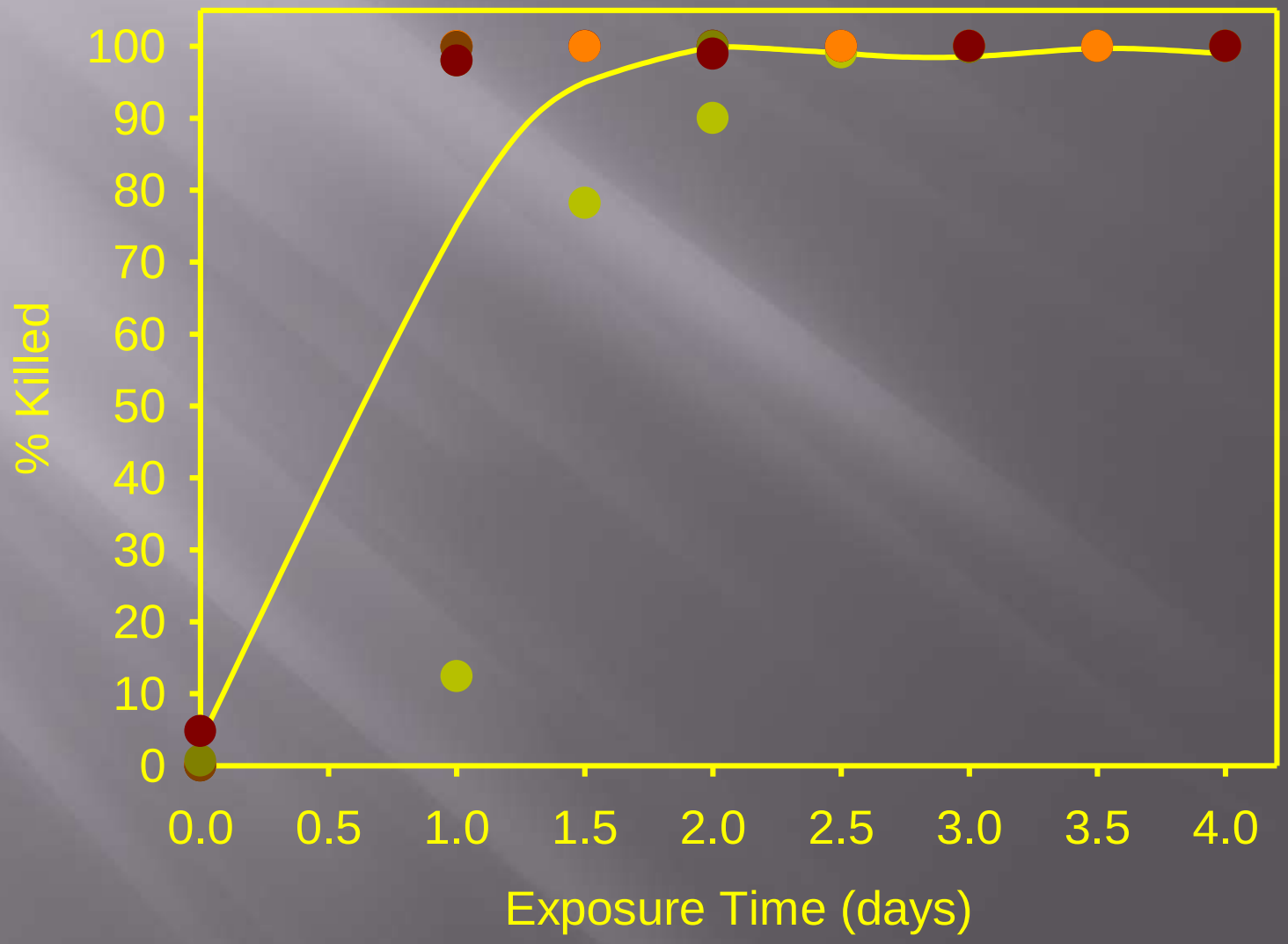

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