



Learning with an Aversive Stimulus in *Helicoverpa zea* (Lepidoptera: Noctuidae)

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Abstract

- Condition *Helicoverpa Zea* larvae using an aversive stimulus paired with a non-aversive stimulus
- Perform experiments to test memory formation and retention
- Pairing olfactory stimulus with an electric shock
- Pairing a tactile stimulus with an electric shock
- Pairing a tactile stimulus with aversive prodding
- Use choice tests to determine effectiveness of conditioning



Introduction

- *H. zea* larvae grow to 25mm and 500-600mg, and undergo complete metamorphosis
- Extensive learning studies have been done on *Lepidoptera*, but none specifically with *H. zea*



General Methods

- **Conditioning.** Larvae exposed to non-aversive stimulus for 10 sec then exposed to non-aversive and aversive stimulus for 10 more seconds (5 sessions, 45 min apart)
- **Testing.** Allow larvae to choose between different non-aversive stimuli for both test and control groups

Experiment 1: Forward Shock-Pairing with Olfactory Stimulus (vanilla/ethyl acetate and ambient air)

Experiment 2: Forward Shock-Pairing on Two Different Agar Substrates (1% and 3% agar)

Experiment 3: Prodding as an Aversive Stimulus on Two Different Surfaces (Rough and Smooth Agar)

Results

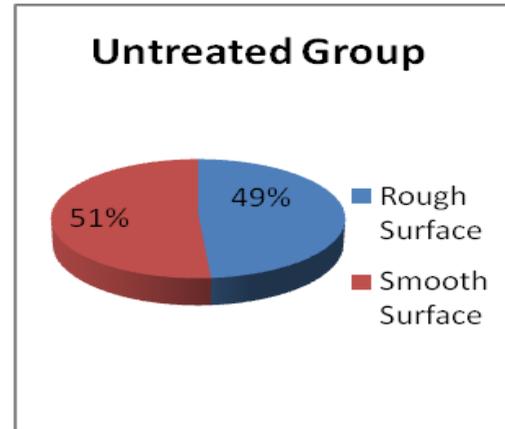


Figure 1. Experiment 3 Control

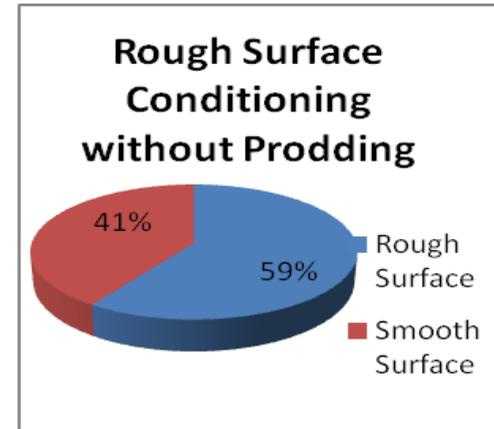


Figure 2. Experiment 3 Control

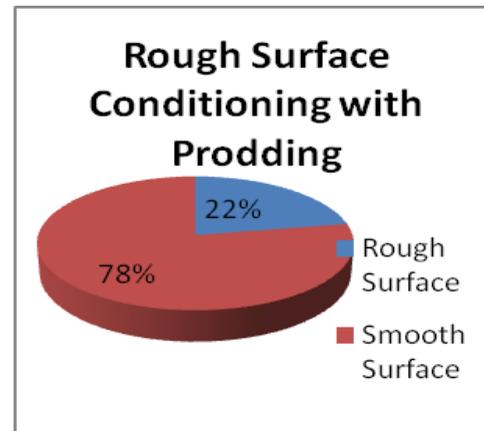


Figure 3. Experiment 3 Test Group

Experiment 1 (N = 40 larvae per group)

- Larvae didn't move from starting location; no results

Experiment 2 (N = 15 larvae per group)

- Majority of larvae from all groups chose 3% agar

Experiment 3 (N ~ 40 larvae per group)

- Larvae conditioned without prodding did not prefer one surface over another
- Larvae that were prodded on a rough surface significantly preferred the smooth surface in subsequent choice test (Chi-square, $p=0.002$)

Discussion

Experiment 1

- The lack of results suggests (a) experimental error in conditioning or testing apparatuses or (b) lack of olfactory-associated behaviors in *H. zea*

Experiment 2

- 1% agar may have been too unstable for larvae to select despite their conditioning
- Shock might not have worked in all cases or wasn't enough to deter larvae their conditioning

Experiment 3

- Prodding is a simulated form of predation that clearly elicited strong avoidance behavior

Other Explanations

- *H. zea* are nocturnal but Experiments 1 and 2 were performed around noon
- *H. zea* are different from other species used in conditioning experiments



References

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