Improving Alfalfa Weevil Management in the Central High Plains: Resistance Screening, Overwinter Survival & Population Monitoring

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BACKGROUND AND OBJECTIVES

Alfalfa weevil (*Hypera postica* Gyllenhal; AW) is a major pest of alfalfa in the United States, capable of causing severe defoliation through larval feeding especially before the first cut (Fig. 1). Pyrethroid insecticides are commonly used for AW management, but resistance has recently been reported in western [1] and southern [2] U.S. AW populations. The extent of pyrethroid resistance in Midwest AW populations remains largely unknown. Historically, winter survival of AW eggs has presumably been low due to sustained freezing temperatures in northern states [3]. However, recent mild winters in central Midwest might potentially increase overwinter survival of eggs and subsequently change spring seasonality and infestations. Therefore, understanding insecticide susceptibility, overwinter egg survival, and spring population dynamics is critical for developing effective and sustainable management strategies.

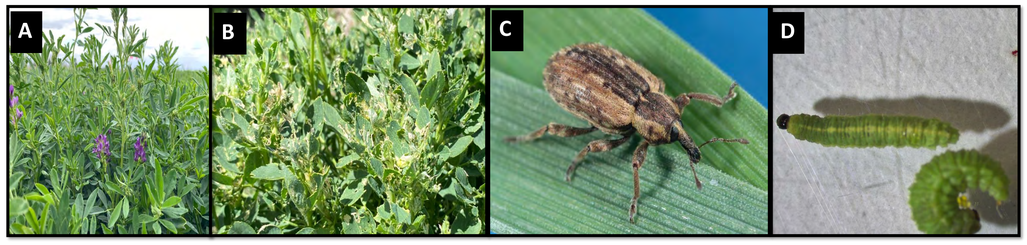


Fig. 1. Field alfalfa (A), AW damage (B), the AW adult (C) [4], and AW larvae (D).

Objectives

1. Assess pyrethroid susceptibility of AW populations across the Midwest.
2. Evaluate overwinter survival of AW eggs in western Nebraska.
3. Monitor AW seasonal occurrence before the first alfalfa harvest in western NE.

MATERIALS AND METHODS

1. Pyrethroid Resistance Screening

- **Weevil populations:** A total of 14 AW populations from Nebraska (10), Wyoming (1), Iowa (1), Illinois (1), and Ohio (1) were evaluated in spring 2026.
- **Active ingredients (a.i.):** lambda cyhalothrin (LC) and zeta cypermethrin (ZC).
- **Vial bioassay:** Six-step serial dilutions of a.i. plus a non-treated control (95% acetone) were coated inside glass vials. Ten second to third instars added to each vial with three to five reps per treatment. Mortality (moribund + dead/total larvae) was assessed after 24 hours.

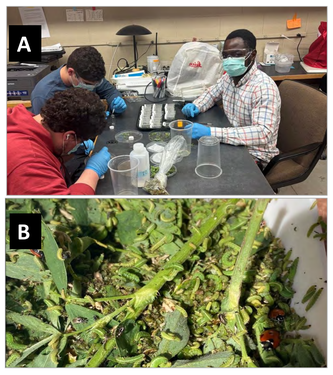


Fig. 2. Laboratory bioassay setup (A) and Sweep net sample for AW larvae collection (B).

- **Data:** Mortality at a diagnostic rate (close to the maximum recommended label rate) was compared among populations.

2. Overwintering Egg Survival

- **Field sampling:** Approximately 250 alfalfa stems total from 5 fields were collected at two weeks intervals from October 2025 through March 2026. Stems were dissected to recover eggs (Fig. 3,A).
- **Laboratory evaluation:** Eggs were incubated at room temperature (22°C) (Fig. 3,B) and monitored daily to record hatching.
- **Data:** Hatch rate (eggs hatched/total eggs recovered) was calculated for each sampling date.

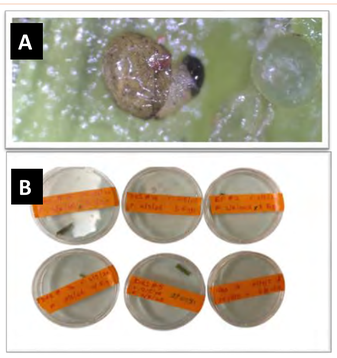


Fig. 3. Alfalfa weevil eggs in hatching process (A) and incubation of recovered eggs in Petri dishes (B).

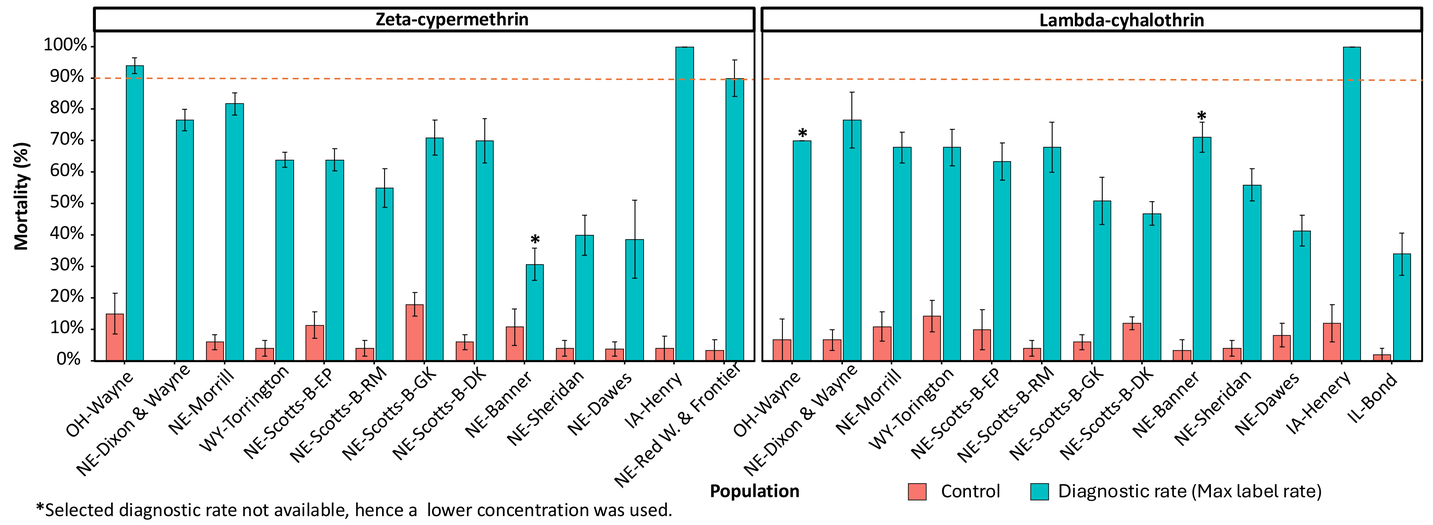
3. Population Monitoring

- **Sampling:** Using a vacuum, insects were collected from a quadrat (1 m × 0.5 m) at five locations per field following a zig-zag sampling pattern in two alfalfa fields in western NE from March through June 2026.
- **Data:** Adult and larvae abundance were recorded.

RESULTS

1. Pyrethroid Susceptibility

Substantial variation in susceptibility was observed among populations. Only three of the 13 populations achieved ≥90% mortality at the maximum labeled rate of ZC, whereas only one population achieved ≥90% mortality with LC, with the remaining populations exhibiting lower and more variable mortality.

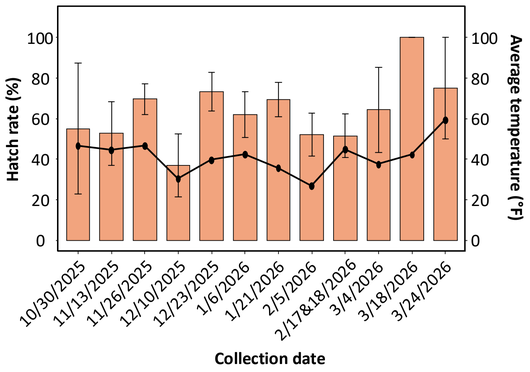


*Selected diagnostic rate not available, hence a lower concentration was used.

Fig. 4. Mean (±SE) mortality (%) of AW populations exposed to maximum recommended rate of lambda-cyhalothrin and zeta-cypermethrin.

2. Overwintering Egg Survival

37–100% eggs remained viable throughout winter. Hatch rates were lower when avg temperatures were lower (December & February).



Bars represent mean hatch rate ± SE; line represents average temperature.

Fig. 5. Mean (±SE) hatch rate (%) of AW eggs and associated temperature (F).

3. Population Monitoring

Both adults and larvae were detected as early as March 25 in the DK1 field. Larval populations increased rapidly during April and May in both fields, whereas adult abundance remained relatively low and peaked in late May and early June (Fig. 6).

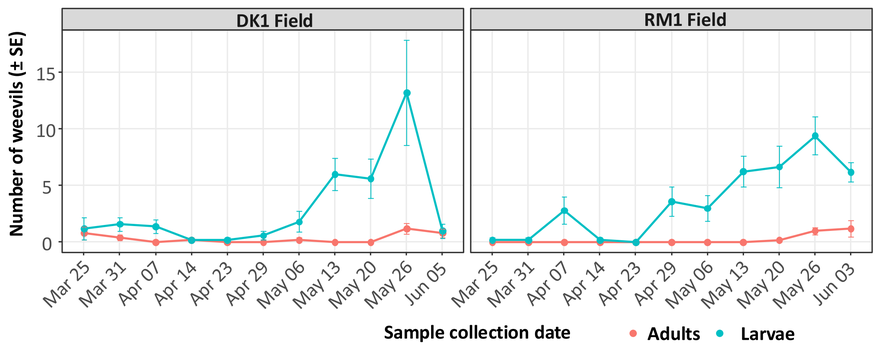


Fig. 6. Seasonal abundance of AW adults and larvae in DK and RM1 fields in western Nebraska during spring 2026.

SIGNIFICANCE

- Variation in mortality among populations indicates differences in pyrethroid susceptibility. Lower mortality in several western Nebraska and Illinois populations suggests reduced susceptibility and highlights the need for further study.
- On average, approximately 63% alfalfa weevil eggs survived the mild winter in western Nebraska, indicating that overwintering populations may contribute to earlier spring infestations. Consequently, management programs that focus solely on late-spring larval populations may be insufficient under mild winter conditions in central Midwest.
- Degree-day models are useful pest-forecasting tools; however, careful selection of the biofix date is essential. In this study, larvae were detected earlier than predicted using a March 1 biofix [5], whereas larval detection was consistent with predictions based on a January 1 biofix [6].
- Early detection of both adults and larvae in western Nebraska is consistent with reports of early AW activity from Kansas [7], Iowa [8], and Ohio [9] in 2026. These observations suggest that successful overwinter survival, together with a warm spring, may have contributed to earlier infestations, highlighting the importance of early-season scouting.
- Continued monitoring of insecticide susceptibility, overwinter survival, and population dynamics will be essential for sustainable AW management in the Central High Plains.

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