Alfalfa Weevil

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Introduction

In South Dakota, the most economically damaging insect pest of alfalfa, *Medicago sativa* (L.), is the alfalfa weevil, *Hypera postica* (Gyllenhal) (Coleoptera: Curculionidae). The alfalfa weevil is native to Europe, South Central Asia, and Northern Africa (Pellissier et al. 2017). Alfalfa weevil was first reported from observations of the pest in Utah during 1904 (Webster 1912, Hamlin et al. 1949). Alfalfa weevils quickly spread across the United States and were recorded in western South Dakota in 1936 (Kantach et al. 1965). However, it wasn't until 1972 that they were detected on the eastern side of the state (Kantach et al. 1965). There are three strains of alfalfa weevil present in the United States that include the Western strain (originated from the initial 1904 introduction in Utah), the Eastern strain (originated from a 1951 introduction in Maryland), and the Egyptian strain (originated from a 1939 introduction in Arizona) (Kingsley et al. 1993, Pellissier et al. 2017).

The Eastern and Western strains are known to coexist in areas east of the Rocky Mountains, whereas the Western and Egyptian strains coexist in the Southwestern United States (Bundy et al. 2005). It's important to note that the strains are not easily distinguished based on their morphological characteristics but can be identified by differences in their defensive strategies against parasitoid wasps, pupation strategy, and the presence of the *Wolbachia* endosymbiotic bacterium (Western strain) (Salt and van den Bosch 1967, Leu et al. 1989, Maund and Hsiao 1991, Bundy et al. 2005).

Identification

Adults (Webster 1912, Pellissier et al. 2017):

- Oval shaped
- Light brown with a distal dark brown band running from the back of the head to the distal end of the elytra (Figure 1)
- Approximately 3.0-5.5 mm in length
- Rostrum is dark brown and stout

Figure 1. Alfalfa weevil adult. Photo courtesy of Adam Varenhorst.

Eggs (Webster 1912, Brewer et al. 2008, Pellissier et al. 2017):

- Yellow to light orange glossy color after oviposition (Figure 2)
- As eggs develop, their color changes to olive-brown color

- Oval shaped
- Approximately 0.5 mm in length

Figure 2. Alfalfa weevil eggs in the center of an alfalfa stem. Photo courtesy of Sue Blodgett, Bugwood.org.

Larvae (Pellissier et al. 2017):

- White in color immediately after hatching
- 3rd-4th instar larvae are approximately 8 mm in length
- Lime green body with evenly spaced white stripes running the length from the thorax to the distal end of the abdomen on back and each side (Figure 3A)
- Head capsule is dark brown to black in color (Figure 3B)

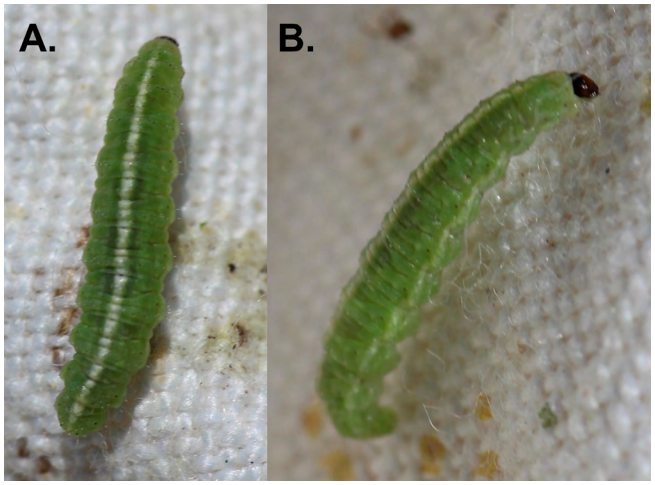

Figure 3. Alfalfa weevil larva. Photo courtesy of Adam Varenhorst.

Pupae (Webster 1912)

- Light green
- Wing pads and appendages discernable when not in cocoon (Figure 4)
- Cocoon consists of fine white fibers that create a circular lattice work around the pupae
- Located around base of the plant in the leaf litter

Figure 4. Alfalfa weevil pupa without white lattice of fibers. Photo courtesy of Frank Peairs, Colorado State University, Bugwood.org.

Lifecycle

Alfalfa weevils undergo one generation per year in South Dakota. In the fall, the adults return to alfalfa fields and mate (Prokopy and Gyrisco 1963, Prokopy et al. 1967). Females oviposit eggs in alfalfa stems as well as stubble by chewing holes in the stem and then depositing a cluster of approximately 9-10 eggs (Burbutis et al. 1967, Niemcyzk and Flessel 1970, Hillburn 1985). A single female can lay over 6,000 eggs with oviposition beginning during the fall and continuing through the spring (Coles and Day 1977, Hillburn 1985). Both adults and the eggs laid during the fall will overwinter, but the adults have a much higher survival rate due to increased cold hardiness and the ability to burrow into leaf litter or soil (Hillburn 1985). Of the adults that burrow into the soil, approximately 84-90% will burrow 10-20 mm below the soil surface (Tysowsky and Dorsey 1970). Armbrust et al. (1969) found that alfalfa weevil eggs have a lower supercooling point than the adults, but their decreased overwintering survival compared to adults further suggests that adult overwintering locations serves a critical role in their survival.

During the spring (April-May), the adults begin emerging from their overwintering sites with peak flights occurring during May-June depending on seasonal conditions (Pamanes and Pienkowski 1965). The adults will feed for a few days and then begin mating (Kantach et al. 1965). After mating, the females will begin laying eggs into alfalfa stems. When the daily average temperature is at or above 70 °F, egg hatch will occur in approximately 12 days (Evans 1959). After hatching, the larvae will initially feed within the stems on soft tissues for three to four days before exiting the stem and crawling to the top of the plant to feed on the leaf buds (Kantach et al. 1965, Hillburn 1985). The duration of the larval feeding period differs based on season conditions, specifically

temperature and food quality. The time from hatch to pupation varies from 21-58 days (Kantach et al. 1965, Hillburn 1985). During the last larval instar, the larvae will crawl down the plant to the soil surface where they will spin the lattice or net like cocoon and pupate (Kantach et al. 1965, Hillburn 1985). Pupation last approximately 10 days until the new adults emerge and continue feeding on alfalfa until early fall (Kantach et al. 1965).

Although Kantach et al. (1965) reported that alfalfa weevils do not exhibit fall oviposition in South Dakota, other studies have found that a low percentage of oviposition occurs in the fall (i.e., less than 2%) (Litsinger and Apple 1973). In South Dakota, recent observations of alfalfa weevil larvae that are present in the field shortly after adult emergence suggests that 1) females are ovipositing in the fall, and 2) egg mortality is not 100%. However, due to an absence of information, future research needs to evaluate fall oviposition rates and egg survival.

Damage to Alfalfa

Both alfalfa weevil adults and larvae feed on alfalfa, but the larvae cause more damage (Radcliffe and Flanders 1998, Pellissier et al. 2017). Defoliation by first and second instar larvae results in small "pinholes" in the leaves at the growing tips (Pellissier et al. 2017). Third and fourth instar larvae feed on the growing tips and open leaves that results in large, irregularly shaped holes (Pellissier et al. 2017). Large larval population densities can cause rapid and extensive defoliation of plants, which results in the skeletonization of the leaves (Pellissier et al. 2017). These leaves will dry down quickly causing them to have a "frosted" appearance (Pellissier et al. 2017) (Figure 5). Several studies have demonstrated that alfalfa that is severely damaged by alfalfa weevil larvae has reduced yield and the regrowth will be stunted for the subsequent cuttings (Webster 1912, Berberet et al. 1981, Berberet and McNew 1986). Webster (1912) observed alfalfa weevil larval populations that persisted well into the second cutting. Alfalfa weevil larvae have been observed feeding on stubble below windrows in the field and preventing regrowth of the next cutting (Onstad and Shoemaker 1984). More recently, this issue has been observed in South Dakota due to large populations (Varenhorst and Wagner, personal observations). Although most of the emphasis is placed onto the larvae, the adults will feed throughout the growing season and consume 4.5 times as much as the larvae (Bjork and Davis 1984). Most of this feeding is unnoticed due to smaller populations, but large adult populations in the spring can also prevent alfalfa regrowth (Hillburn 1985).

Figure 5. Feeding damage caused by alfalfa weevil resulting in a white or "frosted" appearance of the remaining leaf tissue. Photo courtesy of Whitney Cranshaw, Colorado State University, Bugwood.org.

Scouting

In South Dakota, the alfalfa weevil degree day model (Peterson and Meyer 1995, Brewer et al. 2008) is not accurate, and alfalfa weevils are often active before the documented degree days are accumulated (Varenhorst, personal observation). In addition, the alfalfa weevil activity often continues past the thresholds outlined by the degree day model (Varenhorst, personal observation). As a result, the degree day model should not be relied on in South Dakota. Monitoring for alfalfa weevil adult and larvae activity should be conducted on a weekly basis from the start of alfalfa growth and continue until the last cutting. Within each field, several locations should be sampled due to the potential patchiness of infestations (Miller 1972). We suggest walking in a "Z" pattern and randomly sampling a bouquet of five plants. For the "shake-bucket" method, the sampled stems should be cut close to the soil surface and inserted into the bucket with the top of the plant first, followed by aggressively shaking the stems against the inside of a five-gallon bucket (white buckets make it much easier to observe the green larvae) to

dislodge any adults and larvae (Hoff et al. 2002). After shaking the stems, remove them from the bucket and count the number of larvae present at the bottom of the bucket and record the number (Hoff et al. 2002). Stems should not be overly jostled or pulled prior to being placed into the bucket as this may cause the larvae to fall off the plant (Pellissier et al. 2017). These steps need to be repeated twice per leg of the "Z" (30 plants total per field) with approximately 20-30 feet between each sampling point. After 30 stems have been sampled, the larvae counted at each sampling point should be added together and compared to the appropriate table below based on alfalfa height at the time of sampling. The "shake-bucket" method is more accurate than sweep net sampling, especially for shorter alfalfa (Blodgett et al. 1996, Hoff et al. 2002). However, the shake bucket method takes approximately five times as long to collect an adequate sample (Hoff et al. 2002). We recommend using the sweep net sampling to determine if alfalfa weevil larvae are active in the field prior to conducting the shake bucket evaluation. An alternative is to evaluate the amount of defoliation at the stem terminals and conduct the "shake-bucket" evaluation when 30-50% of the evaluated terminals are damaged (Blodgett et al. 1996).

Management

The most common form of alfalfa weevil management in South Dakota is the application of foliar insecticides. Thresholds for alfalfa weevils consider the height of the alfalfa during sampling, the cost of applying the insecticide, and the value of the hay. Precalculated threshold information is provided in tables 1-4. For a list of insecticides that are labeled for the management of alfalfa weevils in South Dakota please refer to the most current edition of the South Dakota Pest Management Guide: Alfalfa and Oilseeds.

Table 1. Alfalfa 0 to 12 inches tall. Economic thresholds for alfalfa weevils based on larvae per stem and calculated from the total larvae in a 30-stem sample.

Value of hay per ton	Insecticide application cost per acre			
	$8	$12	$16	$20
	Total alfalfa weevil larvae per 30 stems			
$60	84	127	169	211
$80	63	95	127	158
$100	51	76	101	127
$120	42	63	84	105
$140	36	54	72	90
$160	32	47	63	79
$180	28	42	56	70
$200	25	38	51	63
$220	23	35	46	58

Table 2. Alfalfa 12 to 18 inches tall. Economic thresholds for alfalfa weevils based on larvae per stem and calculated from the total larvae in a 30-stem sample.

Value of hay per ton	Insecticide application cost per acre			
	$8	$12	$16	$20
	Total alfalfa weevil larvae per 30 stems			
$60	91	137	183	225
$80	68	102	136	171
$100	54	81	95	137
$120	45	68	91	114
$140	39	59	77	99
$160	34	51	68	86
$180	30	45	60	77
$200	27	41	54	69
$220	25	37	49	63

Table 3. Alfalfa 18 to 24 inches tall. Economic thresholds for alfalfa weevils based on larvae per stem and calculated from the total larvae in a 30-stem sample.

Value of hay per ton	Insecticide application cost per acre			
	$8	$12	$16	$20
	Total alfalfa weevil larvae per 30 stems			
$60	99	149	199	240
$80	75	113	150	186
$100	62	90	120	149
$120	50	75	100	124
$140	43	64	86	107
$160	37	56	75	93
$180	32	50	67	84
$200	29	45	60	76
$220	26	41	55	69

Table 4. Alfalfa 24 to 30 inches tall. Economic thresholds for alfalfa weevils based on larvae per stem and calculated from the total larvae in a 30-stem sample.

Value of hay per ton	Insecticide application cost per acre			
	$8	$12	$16	$20
	Total alfalfa weevil larvae per 30 stems			
$60	104	156	182	260
$80	78	117	137	195
$100	63	94	110	156
$120	52	78	105	130
$140	45	67	90	112
$160	39	58	79	98
$180	35	52	70	87
$200	31	47	63	79
$220	28	42	57	72

Cultural methods for reducing alfalfa weevil populations include early harvest of the first cutting, and grazing alfalfa in the fall. Early cutting reduces the larval populations, but timing is critical to prevent late instar larvae from feeding on stubble in the windrows and preventing regrowth (Onstad and Shoemaker 1984). In South Dakota, grazing should occur in early spring as most oviposition will occur during this time (Pellissier et al. 2017).

As observed during the spring of 2025, sustained sub-zero temperatures during the winter without snow cover can greatly reduce the spring alfalfa weevil populations. There are also several insect predators or natural enemies that attack alfalfa weevils. The most common predators of the larvae include lady beetles (adults and larvae) (Coleoptera: Coccinellidae), damsel bugs (Hemiptera: Nabidae), and lacewing larvae (Neuroptera: Chrysopidae) (Ouayogode and Davis 1981). Research has found that predation is decreased when aphid populations are present in the alfalfa as the predators prefer easier prey (Kalaskar and Evans 2001). There are eight species of parasitoid wasps that have been introduced to attack the alfalfa weevil (Bryan et al. 1993). In South Dakota, we observed 15% parasitism of alfalfa weevil larvae by two parasitoid species, *Bathyplectes curculionis* and *Bathyplectes anurus*, in the southeastern region of the state. However, the contribution of these parasitoids to the biological control of alfalfa weevil populations in South Dakota has not yet been documented (Shrestha and Varenhorst, personal observation) (Figure 6).

Figure 6. Mixed cocoons of *Bathyplectes curculionis* and *B. anurus* recovered from alfalfa weevil larvae collected and reared at SDSU Entomology lab in 2026. Photo courtesy of Govinda Shrestha.
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