Questions and Answers about Miller Moths

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Prediction of Nuisance Problems with Army Cutworm (a.k.a. "Miller Moth") for April 25, 2014

There have been several reports that the larvae of the army cutworm are unusually abundant this spring on the plains of northeastern Colorado and adjacent areas of Kansas and Nebraska. This poses risk to infested crops, and some treatments are being made in wheat and alfalfa. However, army cutworm numbers are also a good predictor of the population size of the adults ("miller moths") to be expected as these insects complete development and make their annual migration to the higher elevations. Based on the stage of cutworm larvae present, adults likely will begin to appear in about a month and a half, but the peak of the migration will not pass through the northern Front Range until a bit later (end of May, early June). The numbers of caterpillars present suggest that the numbers of adults migrating across northeastern Colorado will be well above average.

Drought conditions that persist in southeastern Colorado apparently have decreased populations of army cutworms in that part of the state. There are no indications that army cutworms, and the adult "miller moths", originating out of southeastern Colorado will be unusually abundant this year; an average, perhaps somewhat below average, number of "miller moths" may be seen in that part of the state. However, those that are present will likely concentrate in irrigated areas where there are blooming plants in late May and June.

Weather, particularly temperature, affects the onset and duration of miller moth flights. Moisture and the abundance of flowering plants will also impact the numbers of miller moths seen. However, it is predicted that the annual migration of army cutworms ("miller moths") across the northern Front Range (including the Denver Metro area) in late spring 2014 should be well above average.

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What are miller moths?

'Miller moth' is a popular use term given to any type of moth that is particularly abundant in and around homes. In Colorado and parts of Wyoming, Nebraska, Kansas, New Mexico and Arizona the common 'miller' is the adult stage of the **army cutworm**, *Euxoa auxiliaris*.

What is the meaning of the name "miller moth"?

Fine scales that easily rub off cover the wings of all moths. These scales reminded people of the dusty flour that cover the clothing of one that mills grain.

What does the army cutworm ("miller moth") look like?

The moth of the army cutworm is typical of the size of many other cutworms found in the state with a wing span of 1.5-2 inches. It is generally gray or light brown with wavy dark and light markings on the wings. The wing patterns of the moths are quite variable in color and markings, but all have a distinctive kidney-shaped marking on the forewing.

How does the army cutworm get its name?

The caterpillar stage is a typical cutworm, the name given to various caterpillars in the family Noctuidae that often damage young plants. (Cutting plants near the soil line is a habit typical of many cutworms.) However, in high populations the army cutworm may band together in army-like groups and may be seen crawling across fields or highways in large numbers. (A few other regional insects share this habit of forming large bands, including Mormon cricket, the true armyworm, and forest tent caterpillars.)

How do army cutworms ("miller moths") develop?

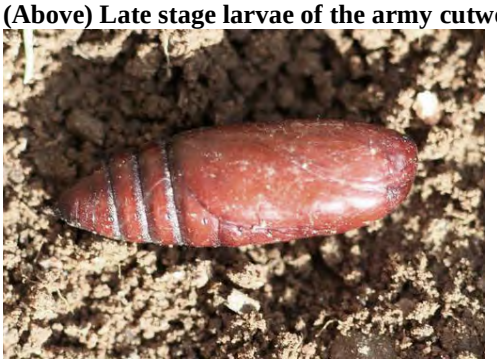
The army cutworm has an unusual life history. The army cutworm spends the winter as a partially grown caterpillar, and resumes feeding the following spring. At this time the cutworms may damage crops, including alfalfa, winter wheat (after the broadleaf weeds are mostly gone), and gardens. They become full grown by mid-Spring, burrow shallowly into the soil and pupate.

Between 3 to 6 weeks later, the adult 'miller' stage of the insect emerges. The moths then make their annual migration across

Three army cutworms ("miller moths") showing range of patterning.

the plains, ultimately settling at higher elevations by early summer.

(Above) Late stage larvae of the army cutworm. (Below) Pupa of the army cutworm



Throughout summer the army cutworms alternate between feeding of the nectar of flowering plants and resting in cool harborage areas, such as under loose rocks. Eggs are not laid, as the insects are in a state of *reproductive diapause*, during which egg maturation is suspended. Instead this time in the high elevations is used to build up fat reserves.

A reverse migration of the moths back to the lower elevations takes place at the end of summer and early fall. During this time eggs are laid, usually in areas of denser vegetation. Most eggs are laid in alfalfa fields, weedy areas in winter wheat, in gardens, lawns or other areas where vegetation is thick. Eggs hatch within a few weeks after being laid and the young (and very small) cutworm larvae begin to feed and grow. Growth continues intermittently throughout fall and winter, as long as temperatures allow activity.

Where do miller moths come from?

The army cutworm is a very common insect across the High Plains of North America, the most common cutworm in the region. The “miller moths” that annually migrate across the Front Range of Colorado originate from moths that developed across eastern Colorado and border areas of Wyoming, Nebraska, Kansas and Oklahoma where army cutworm also occurs.

Within the state, nuisance problems with 'millers' appear to be almost entirely limited to eastern Colorado. However, army cutworms also occur commonly in western Colorado. These similarly move to the mountains to spend the summer. However, they do not occur as such a serious nuisance as occurs along Front Range, perhaps because there is less area and suitable hosts at the lower elevations in which the cutworms develop, reducing overall numbers of the insect (relative to eastern Colorado).

Why do miller moths migrate?

A likely explanation is that the mountains reliably provide an abundance of summer flowers, which are a good source of nectar that they need as food. In addition, the relatively cool temperatures of the higher elevations are less stressful to the moths, allowing them to conserve

and store energy.

Whatever the reason, the army cutworm has a very different habit than all other cutworms that occur in the High Plains/Rocky Mountain west. Most cutworms remain in the soil for several months after pupation, typically emerging as moths in late summer and early fall. Other cutworms transform to the adult stage a few weeks after pupation, and produce a second or possibly even a third generation each per season.

How long do the spring flights last?

Typically, peak miller moth flights may last five to six weeks, generally starting the last week of May or early June. Often within this period they may be at peak numbers as nuisance problems for about two to three weeks. However, weather patterns greatly affect this and there is considerable in when the flights occur.

For example, in 2002 nuisance problems extended longer than at any other period of recent history - from late April through early July. During the extreme outbreak of 1991 very high numbers of moths were present along the Front Range for almost 6 weeks, from early May through midJune. However, in 1990, a year that also was above average for miller flights, heavy flights were not noted until early June and lasted about a month.

The return flights (mountains to the plains) in early fall usually stretch over a shorter period. However, since the majority of moths die during the summer the return flight is less obvious.

Why were the flights so extended during 2002?

The drought greatly affected miller moth behavior in 2002. Probably only average or perhaps slightly above average numbers of insects were present. However, due to the drought their activity was much more concentrated to those locations were conditions were most favorable. Since miller moths feed on nectar and seek areas of relative cool and higher humidity this meant that they were found in the 'oases' of irrigated landscapes. Since there were very few blooms beyond irrigated sites and hot, dry weather persisted the miller moths tended to accumulate and persist, rather than move on to summer feeding areas in the mountains.

Why were the flights in 1991 so large and early?

Flights during the year began early, probably due to the warm February which allowed them to push development. As they arrived into populated areas there was an abundance of flowering plants in yards and gardens. Furthermore, May and early June weather tended to be cool and overcast. This combination of factors caused many of the migrating moths to settle along the Front Range rather than continue into the mountains. Populations 'piled up' until high temperatures and reduction in nectar sources occurred in mid-June.

Although 1991 remains the biggest miller moth year in at least the past three decades, it is noteworthy that in the three seasons subsequent to the outbreak, populations of army cutworms crashed; cutworm activity in spring and nuisance miller moth problems were below average

during that period.

Why are millers more common some years than others?

The numbers of miller moths in late spring is primarily related to the numbers of army cutworm caterpillars which occurred earlier in the season. Outbreaks of the army cutworm are usually followed by large flights of miller moths.

Many things can influence cutworm outbreaks. Extremely cold winter conditions, especially without snow cover, may kill many caterpillars. Certain natural enemies, such as ground beetles and parasitic wasps help regulate numbers of cutworms. Plowing fields where cutworms are developing kills many. Normal mortality of army cutworm following egg hatch is ca 99%; females that produce 200 eggs (a fairly typical amount) would, on average, have only two progeny survive to reproduce. Small changes in the effects of natural enemies and other controls affecting caterpillar survival can lead to big changes in the numbers of adults present.

Miller moths may also concentrate around buildings more intensively during some years. The presence of flowering plants and local humidity conditions are suspected as being important in concentrations of miller moths. Overcrowding of moths in their mountain shelter areas, including competition for nectar, may contribute to poor survival in years when bloom in mountain areas is reduced.

Do any other moths have a similar migratory habit?

One notorious moth with a similar plains-mountain migration is the 'bogong moth' of Australia, *Agrotis infusa*. This species sometimes causes severe nuisance problems to population centers along its migration route, including the national capital, Canberra. Other moths with seasonal migrations include *Euxoa sibrica*, which migrates to the Alps of Europe and cutworms found in Africa (*Spodoptera exempta*) and Asia (*Mythimna separata*).

Are there other moths that are commonly seen outdoors?

Occasionally there are very large flights of other kinds of moths, but none approach the army cutworm in terms of visibility.

Perhaps the most common moth seen outdoors at this time of year is the alfalfa webworm. Alfalfa webworm moths are about 1/2 the size of the army cutworm moth and hold their wings in a distinct V-shape when at rest. They are commonly seen about lawn areas and fly a considerable amount during the day time, unlike the army cutworm. (Alfalfa webworms also do not have the nuisance habit of entering homes and cars.) Alfalfa webworms are of minor importance as crop pests, as the caterpillars will eat alfalfa, beets, spinach and a few other early season crops.

What eats millers?

The caterpillar stage of the army cutworm has many natural enemies. Predatory ground beetles, hunting wasps (*Podalonia* spp.) and many birds eat cutworms. The larvae of tachinid flies and parasitic wasps develop within and kill caterpillars. Adult millers may be eaten by bats or even

birds when the millers are forced to fly during the day.

One commonly observed phenomenon involving birds are swallows concentrating at intersections where they feed on miller moths. (House sparrows and other birds also are found at these sites, feeding on wounded moths.) This likely occurs because many miller moths that had sought shelter in an automobile chassis and warmed by the vehicles engine emerge while cars are idling. Furthermore, many moths are released as drivers open windows at intersections to promote escape of moths that become active in the car. As a result vehicles stopped at intersections provide a continuous source of new moths, which the swallows soon recognize as a site of reliable food.

Miller moths often aggregate in the crevices around doors.

Miller moths also may be fed upon by other wildlife as well. For example, they can be an important part of the diet of grizzly bears in the Yellowstone area, which feed on large numbers of the fat-rich moths that rest in large groups under loose rocks.

How do millers get indoors?

Miller moths avoid daylight and seek shelter before day break. Ideally, a day time shelter is dark and tight. Small cracks in the doorways of homes, garages and cars make perfect hiding spots. Often moths may be found together occupying particularly good shelters.

At night, the moths emerge from the day time shelters to resume their migratory flights and to feed. Since cracks often continue into the living space of a home (or a garage, car, etc.) a 'wrong' turn may lead them indoors, instead of outside.

Is the army cutworm 'miller' the only common moth found in Colorado homes?

Indianmeal moths

Although the army cutworm moth usually is the most common moth in eastern Colorado homes during the time of spring migrations, other moths are more common during other times of year. The Indianmeal moth is the most important moth found in homes since its caterpillar stage can be a serious pest of pantry items such as nuts, dried fruit, grains, pet foods, and seeds.

Indoors the most common moth is probably the Indianmeal moth. The caterpillars of this insect develop on many pantry items, including seeds, nuts, dried pet foods, cereals, dried fruits

and vegetables. The Indianmeal moth is much smaller than the army cutworm miller with light brown wings that have darker tips. Indianmeal moth is discussed in more detail in Extension Fact Sheet 5.598 (http://www.ext.colostate.edu/pubs/insect/05598.html).

Clothes moths can occur in Colorado, but are very uncommon, due to the low humidity. Most infestations of clothes moths in the state are associated with recent purchases of infested woolen goods from areas where clothes moths are chronic and common (e.g., Mexico, Central America, South Pacific, etc.). Clothes moths are small, pale colored moths found most commonly among woolens and furs on which the caterpillars feed.

Of course, many other insects may become periodically more abundant and several other moths sometimes enter homes.

Why are moths attracted to lights at night?

Moths, and many other night flying insects, can be confused by low point light sources. Many of these insect, including army cutworm, use the moon or other celestial lights to orient their flights. Such distant points of light allow the insects to fix their flights by maintaining a constant angle to the light source. Artificial lights close to earth confuse the insect response since they are so close - an unnatural situation. Trying to maintain the flight angle to these close light sources cause the insects to spiral to the source.

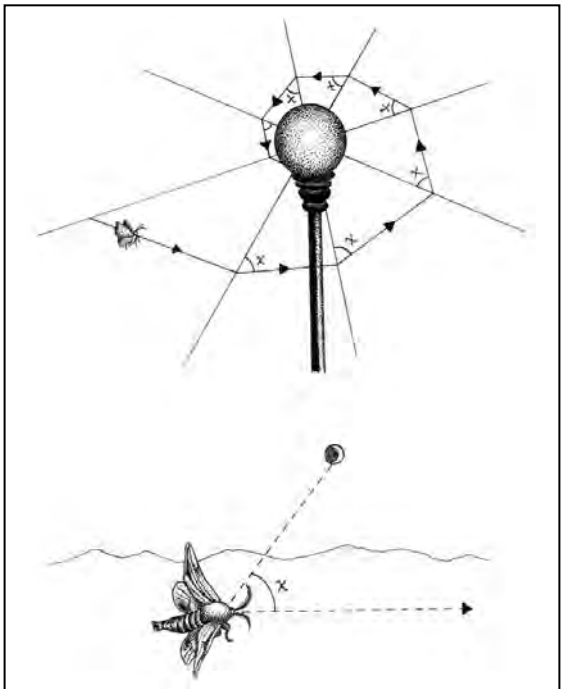


Illustration of moths using distant points of light (bottom) for navigation and the confusion caused by on-earth light sources. Drawing by Matt Leatherman.

Why do the eyes of miller moths glow?

Many of the moths that fly at night have specialized eyes that increase the light reaching the light-sensing receptor cells. In the base of the eyes of the miller moth there are a series of thread-like trachea, which carry oxygen. These are pale colored and reflect light, giving the appearance of glowing. There are also colored pigments in the eye which may give an iridescent color to the light.

Are miller moths harmful?

The caterpillar stage of the army cutworm is sometimes an important pest of crops in the spring and kill seedling plants. In addition, during outbreak years tens of thousands of acres of alfalfa, winter wheat and other crops may be treated with insecticides for army cutworm control.

However, the adult miller stage is primarily a nuisance - albeit a considerable nuisance at times. Moths in the home do not feed or lay eggs. During the migratory flights, the moths do not produce nor lay eggs. Furthermore, they do not feed on any household furnishings or other foods in the home. Moths in the home will eventually either find a way outdoors or die without reproducing.

Aggregations of dead miller moths collect around windows and behind walls.

When large numbers die in a home there may be a small odor problem (due to the fat in their bodies turning rancid). Also, unless they are cleaned out, old moths may serve as food for carpet beetles and other household scavengers. These secondary insects may become problems in subsequent years.

Miller moths also may spot drapes or other surfaces, such as unfinished wood. Probably the greatest damage done by millers is the lost sleep resulting from their flying about the room and the (generally needless) worry that they may cause some damage to the building or furnishings.

(It should be noted that some people are very discomforted by the presence of moths in a home. In extreme cases this may develop into a phobia (**mottephobia**) that can lead to disruptions in sleep, agitation, and other conditions that can interfere with normal functioning.)

Spotting on walls produced by the meconium of army cutworm moths.

What are the spots they leave behind?

Moths that have recently emerged from the pupa produce a reddish-brown fluid that often is deposited on windows, walls, or other areas where the insect rests. This is call meconia and is the waste stored during pupal development.

In addition, miller moths are able to produce and excrete fluid for most of their adult life (a process known as “rectal loading”). This product is slightly acidic and is sprayed by the moth. Presumably the purpose of this is defensive, although it is not particularly irritating to humans.

Miller moth spotting is usually not difficult to remove. Follow normal fabric care instructions on clothing. Spray and wash household cleaners can remove the spots from finished walls and most other surfaces. However, cleaning can be considerably more difficult when the spots have set on more porous surfaces, such as unfinished wood.

How does landscaping affect miller moth numbers around a home?

Landscape plants that provide food (nectar) and/or shelter for miller moths can increase local populations during migrations.

Some of the flowering plants most readily visited by miller moths along the Front Range include lilac, cherries, spirea, cotoneaster, horsechestnut, raspberry, and Russian olive. (Cherries and lilac are often blooming during early periods of moth migration; cotoneaster and spirea with peak migration periods; and Russian olive with late migrations.)

Dark dense plants will be used by miller moths for shelter. Cotoneaster shrubs, spruce and pines are among the plants most used by miller moths for shelter around homes.

Why do some people have more miller moths in their home than do other people?

The presence of suitable flowering plants and plants used for shelter, discussed above, is probably the biggest factor on why some homes within a neighborhood have more moths than do nearby homes. Other factors that may lead to increased incidence in a home are more openings (cracks/crevices around doors and windows) that allow access indoors and, perhaps, outdoor lighting that draws the moths into the near vicinity.

Do noises affect miller moths?

Army cutworm moths are very sensitive to certain noises, making erratic flying movements in response. Among the sounds which elicit greatest response are jingling keys, dog tags, rattling coins, and crumpled pop cans.

The likely reason for this is that certain frequencies are produced to which the moths are sensitive. Many moths make evasive movements in response to frequencies used by bats during echolocation of prey. Since bats are an important predator of night flying moths, rapid evasive movements are a means of protection.

How can I control miller moths?

Before miller moths are flying try to seal any obvious openings, particularly around windows and doors. Also reduce lighting at night in and around the home during flights. This includes turning off all unnecessary lights or substituting non-attractive yellow lights.

Once in the home, the best way to remove the moths is to swat or vacuum them or to attract them to traps. An easy trap to make is to suspend a light bulb over a bucket partially filled with soapy water. (Always use a grounded plug and extreme caution when using any electrical device near water!) Some wetting agent, such as soap or detergent must be added or many moths will escape, the water beading readily off the scales of their wings and body. Moths attracted to the light often will fall into the water and be killed. Jingling keys or some other noise that induces evasive flight behaviors can sometimes dramatically speed the capture rate when using the soapy water trap.

Insecticides have little or no place in controlling millers. The moths are not very susceptible to insecticides. Furthermore, any moths killed will be rapidly replaced by new moths migrating into the area nightly.

Updated April 17, 2013