Insect Management Issue Identified in Colorado’s Hemp Crops

Whitney Cranshaw
Colorado State University
Hemp (broad sense)

Cultivars of *Cannabis* (e.g., *C. sativa*) with low levels* of psychoactive compounds (THC)

* The magic number is 0.3% by dry weight. Don’t ask why.
What type of crop is hemp?
Primary Cannabis Crop Products

• Psychoactive compounds (THC)
  – Marijuana
• CBD (cannabidiol) production
• Seed production
• Fiber production

Hemp being harvested in Kentucky for fiber (ca 1920)
Hemp Grown for Fiber and/or Seed

Produced by seeding

Plant populations are high
Hemp Grown for Fiber and Seed

Crop may be a mixture of separate female and male (dioecious) plants or may include monoecious plants.

Pollination (wind) is needed for seed production.
Hemp may be a very heavily used by many kinds of bees as a pollen source late in the season.

Many species of native solitary bees

Honey bee

Bumble bees
What is the potential value of hemp as a pollen resource for bees in arid agricultural regions?
Hemp Grown for CBD
Most hemp being grown for CBD presently uses transplanted clones. Parentage is often *C. indica* or *C. indica/C. sativa* hybrids. 

This usually involves a greenhouse/indoor production phase. Some live plants (mother plants, clones) are normally present year-round.
Hemp Grown for CBD (and other non-psychoactive cannabinoids)

Typically grown by transplants, with early season indoor production

In-field plant populations are often low
Some CBD crops are being grown from seed.

These crops have lower concentrations of cannabinoids but produce much more biomass.
Hemp Crops – Insect Management Perspective

• Hemp grown seed and/fiber
  – Outdoor culture

• Hemp grown for CBD production
  – Outdoor culture

• Indoor culture of any Cannabis crop
What kinds of arthropods will we find associated with hemp in this new era?
A robust complex of natural enemies can be expected to be found in hemp whenever it is grown outdoors.
Most obvious often are insects that chew leaves of the plant (defoliators)

- Caterpillars
- Beetles
- Grasshoppers
Various caterpillars chew leaves of the plant (defoliators)

Yellowstriped armyworm

Thistle caterpillar

Beet armyworm

Zebra caterpillar

Beet webworm

Yellow woollybear
Grasshoppers (at least three species)
Stem feeding seems to cause the most injury by grasshoppers.
Hemp response to hail injury can give some insight on how the crop may respond to grasshopper injuries.
There are some stem boring species that may be important.

**European corn borer**

*Ostrinia nubilalis*

**Eurasian hemp borer**

*Grapholita delineana*
There are some fluid feeding insects that occur on the leaves:

- Aphids
- Leafhoppers
- Plus some treehoppers, planthoppers, and spittlebugs
Several hemipterans (‘true bugs’) feed on flowers and developing seeds of hemp.
Insects that damage developing buds have caused particular injury to hemp crops in Colorado.
Cannabis Aphid

*Phorodon cannabis*

Key Pest of CO Hemp
Key Pest of CO Hemp

Hemp russet mite

*Aculops cannabicola*

Photograph courtesy of Karl Hillig
Symptoms of hemp russet mite infestation on developing buds of hemp
Eurasian Hemp Borer

*Grapholita delineana*
Death of developing buds is particularly damaging to CBD cultivars.
Most significant potential pest of the crop in Colorado?

Corn earworm

*Helicoverpa zea*
Corn earworm is known by several common names.
Corn earworm shows wide range in coloring and patterning on hemp (as with most crops)
Corn earworm tunnels into and can extensively damage developing buds of hemp.
In 2016 and 2018 corn earworm caused serious losses to CBD hemp in southeastern Colorado

One night’s light trap capture, September 8, 2016

Adults of the corn earworm
Present fact sheet on Corn Earworm at the Hemp Insect Website

Corn Earworm

The insect that has shown the most potential to damage hemp in Colorado is the corn earworm (Helicoverpa zea). This is one of the most widespread and commonly damaging insects in much of the United States, affecting both field crops and vegetable crops. Evidence of its importance is indicated by it having three accepted common names: corn earworm (when in corn), tomato fruitworm (when feeding on fruits of peppers, tomatoes, etc.), and bollworm (when feeding on cotton bolls).

In hemp the primary damage occurs when they tunnel into buds and developing seeds. Damage to hemp by corn earworm has potential to cause significant damage, particularly to crops grown for production of large buds to extract CBD or other pharmaceutical compounds.
Proposed Management Plan for Corn Earworm in Hemp

Background. Corn earworm (*Helicoverpa zea*) is a key pest of hemp grown in Colorado. Damage is caused by the larva (caterpillar) that tunnels through and destroys maturing buds. This insect is present every growing season in Colorado, where it may be found on a wide variety of crops and weed hosts. However, population size, and associated damage, can vary greatly from season to season and by location.

Traps (light, pheromone) can be used to capture the adult stage of this insect, a night flying moth. When used over a period of time these traps can provide information on changes in abundance of the insect, with high trap captures being associated periods of peak egg laying on plants.

The insecticides that have the most potential to control corn earworm - and are allowable by the Colorado Department of Agriculture for use on cannabis crops – are certain strains of the microbial insecticide *Bacillus thuringiensis* (Bt). These are best applied at times coinciding with periods of peak egg laying by the adult moths and subsequent egg hatch, which occurs a couple of days after eggs are laid.

Use of Traps for Monitoring Corn Earworm

Two types of traps can be used to capture the night flying moths of the corn earworm, light traps or pheromone traps.

Basic design of a light trap uses a light, preferably UV, to attract insects that fly at night. The insects then hit a vane and are funneled into a collecting container below. Usually a killing agent (often a dichlorvos Pest-Strip) is placed in the collecting container to minimize damage to the collected insects, particularly damage to the delicate wings of moths, which may be torn by “June bugs” and other other active insects that come to these traps.

Light traps will capture a wide variety of insects, mostly various kinds of moths and beetles. Traps should be in strategic locations along the farm to detect the number of insects that are of interest in this pest.
Outline of Corn Earworm Management Program in Hemp

• Establish a program to monitor flights of adult corn earworms using pheromone traps
  – This should begin by midsummer to establish baseline of adult captures
  – Traps should be checked twice a week and the number of new moths recorded
Pheromone trap used to monitor corn earworm
Outline of Corn Earworm Management Program in Hemp

• If very high numbers of moths are discovered during flowering, treatment should be considered
  – *Bacillus thuringiensis* var. *aizawi*
    • Agree WG, XenTari Biological Insecticide
  – *Helicoverpa NPV*
    • *HelicoVex*
Colorado allowed insecticides that can be used to control corn earworm in hemp.

**Bacillus thuringiensis** *(aizawi strain)*

**Helicoverpa Nuclear Polyhedrosis Virus**
The Pesticide Conundrum with Cannabis

- All registered pesticides cannot legally be applied to sites (e.g., crops) on which their use is contraindicated/inconsistent with the pesticide label.
- Presently, the agency overseeing pesticide labeling (EPA) does not recognize cannabis as a crop site.

*Are there pesticides that can be used on this crop now?*
Phases of Pesticide Use Regulation in Cannabis Production

• Phase I - "Wild West" Phase
• Phase II - State Finesse Phase
• Phase III - Normalization Phase
  – Cannabis is federally recognized as a crop
  – Cannabis is regulated as a normal crop
“Wild West Phase”

• All registered pesticides are illegal
• Pesticide regulation and enforcement is ignored by state and federal agencies
• Growers are unaware of pesticide laws or ignore them in the absence of direction
• All pest management information sources devolve to the internet and hearsay
2013 Washington State Finesse on the Subject of Pesticide Use on Cannabis

- Pesticides that require federal registration under Section 3 of FIFRA
  - Active ingredient is exempt from the requirements of food crop tolerance
  - Label has directions for use on unspecified food crops, including unspecified food crops grown as bedding plants
  - EPA and WSDA registration is required
- Section 25b minimum risk pesticides (exempt from federal registration)
“State Finesse Phase”

• Some pesticides are identified by State agencies as allowable in *Cannabis* production

• Somewhat uneasy alliance with Federal agencies as *Cannabis* remains unrecognized as crop category

• Pest management information sources are provided minimal support by state and local agencies
In Colorado, the Colorado Department of Agriculture maintains a website of *pesticides that may be applied to hemp grown within the state*. Not all states that allow hemp production have established guidelines regarding pesticides.
Criteria for Pesticides Allowed to be Used on Cannabis in Colorado

- Pesticides that require federal registration under Section 3 of FIFRA
  - Active ingredient is exempt from the requirements of food crop tolerance, \textit{and}
  - Label has directions for use on unspecified food crops, including unspecified food crops grown as bedding plants
  - EPA and CDA registration is required
  - Pesticide is registered on tobacco

- Section 25b minimum risk pesticides (exempt from most federal registration)
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Example of pesticide label with a very broadly described Crop Site

Labels written in this manner can be interpreted as allowing use on hemp

<table>
<thead>
<tr>
<th>CROPS (including but not limited to)</th>
<th>APPLICATION</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tomatoes, lettuce, cucumbers, peppers, sweet corn, broccoli, cauliflower, cabbage; peas, beans, beets, celery, onions, garlic, leek, asparagus, okra, eggplant strawberries, grapes, escarole ornamentals and flowers</td>
<td>Rate: 1.0 – 2.5 fl. oz. per acre</td>
<td>Repeat application as above every 6 – 8 sunny days (counting 2 partially sunny days as 1 sunny day) if monitoring indicates that reapplication is necessary. Lower rates (every 6 sunny days) may be used during vegetative stages of the crop or when tank mixed with other insecticides. When flowers, fruits or other harvested structures of the plant are present or when infestation becomes strong, use the higher rates. Sweet corn and corn: For very sunny regions (e.g., California), use 0.5 to 1.25 fl. oz./acre every 3 days; for less sunny regions, use 1 to 2.5 fl. oz./acre every 6 to 8 days. Cover the whole larval hatching period of the treated generation until harvest.</td>
</tr>
<tr>
<td>Cotton, alfalfa, soybeans, peanuts, potatoes, corn, wheat, sweet potatoes, tobacco, sunflowers, sugar beets, sorghum, floriculture, and border plants</td>
<td>Method: Sprayer, Aircraft</td>
<td></td>
</tr>
<tr>
<td>Equipment: Sprayer, Sprinkler Irrigation, Mist Sprayer</td>
<td></td>
<td></td>
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Such labels are rare
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• Section 25b minimum risk pesticides (exempt from most federal registration)
In Colorado, the Colorado Department of Agriculture maintains a website of pesticides that may be applied to hemp grown within the state.
Website page to access what Colorado Department of Agriculture considers to be *not allowable* (= allowable) for use on Cannabis in Colorado.

Pesticides Allowed for Use on Cannabis

Each time we update the Cannabis pesticides list or have industry news we will send out an email blast and you can [sign up here](#) to be included. As of March 30, 2016 all past lists will be removed from the CDA website and updates will be made only to the list of approved pesticides that may be used in accordance with Pesticide Applicators' Act Rule - Part 17.

The list developed by CDA is intended to assist Colorado Cannabis growers in identifying which pesticides can be used legally in accordance with the Pesticide Applicators' Act and its Rules in the production of Cannabis (marijuana and industrial hemp). It is not an endorsement or recommendation to use these products in the production of Cannabis in Colorado. These products have not been tested to determine their health effects if used on Cannabis that will be consumed and thus the health risks to consumers is unknown. By including products on this list, therefore, CDA make no assurances of their safety or effectiveness when used on Cannabis and is not responsible or liable for any such use.

To view or download the current list, click the link below:

- Pesticides allowed for use in Cannabis production in accordance with the PAA Rule: Effective June 29th, 2016
  - PDF
  - Excel
- This link provides a list of products that have been removed from the list of pesticides that may be used on Cannabis. These products were either removed from the list prior to the effective date of the rule or were removed as a result of them not meeting the rule criteria as of March 30th, 2016.
  - Excel
- Selected Examples of pesticides that cannot be used in marijuana production January 13 2016
  - PDF

Products added since the last update are now highlighted in red on the PDF version of the file. The Excel version has the date that each product was added and can be sorted or filtered by name, date, active ingredient, etc.
A page listing the current products that are allowed for use on all Cannabis (including hemp) grown in Colorado.

Most all of the CDA allowable pesticides are also allowed in production of Certified Organic crops.
California appears to be handling the pesticides issue a bit differently.

CANNABIS
PESTICIDES THAT ARE LEGAL TO USE

Protecting workers, the public, and the environment from adverse effects of pesticide use in cannabis cultivation is critical to the mission of the California Department of Pesticide Regulation (DPR). DPR and the County Agricultural Commissioners (CAC) enforce the use and sale of pesticides under Divisions 6 and 7 of the California Food and Agricultural Code.

Always read the label prior to using any pesticide.

PRODUCTS THAT CAN BE LEGALLY APPLIED TO CANNABIS IN CALIFORNIA

A pesticide product can legally be applied to cannabis under state law if the active
Apparently pesticide uses in California on hemp and other Cannabis crops is based on the active ingredient only. Individual registered products that are allowable do not seem to be defined.

### Insecticides and Miticides

- Azadirachtin
- *Bacillus thuringiensis* sub. *kurstaki*
- *Bacillus thuringiensis* sub. *israelensis*
- *Beauveria bassiana*
- *Burkholderia* spp. strain A396
- Capsaicin
- Cinnamon and cinnamon oil
- Citric acid
- Garlic and garlic oil
- Geraniol
- Horticultural oils (petroleum oil)
- Insecticidal soaps (potassium salts of fatty acids)

- Iron phosphate
- *Isaria fumosorosea*
- Neem oil
- Potassium bicarbonate
- Potassium sorbate
- Rosemary oil
- Sesame and sesame oil
- Sodium bicarbonate
- Soybean oil
- Sulfur
- Thyme oil
When hemp “grows up” as a crop, addressed by federal laws and regulations as are all other crops - how will the pesticides issues work out?

It will very likely vary by the type of hemp crop, and end use.
For seeds, perhaps this would be considered under Crop Group 20 (Oilseeds, such as sunflower, cotton seed and canola/rape seed)

*For a strictly fiber grown crop?*
This poses some more serious registration problems
This poses some obvious registration problems.

This produces an extracted product that is consumed by humans, and in different manners (e.g., ingested, inhaled)
This poses some obvious registration problems.

This produces a product that is applied to humans, and in different manners.

Extraction methods used will affect potential for residues, and these must be studied.
Sometime check out the Hemp Insect Website

(Presently we are doing a makeover)
Defining the Insect Pest Management Needs of a “New” Crop: Industrial Hemp

Questions?