Insect Pest Management Needs Identified in Colorado Hemp Production

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What type of crop is hemp?

Hemp (broad sense)

Cultivars of *Cannabis* with low levels* of psychoactive compounds (THC).

* The magic number is 0.3% by dry weight. Don’t ask why.

There are at least 3 kinds of hemp crops from an Insect Management Perspective

- Hemp grown seed and/or fiber
  - Outdoor culture
- Hemp grown for CBD production
  - Outdoor culture
- Indoor culture of any Cannabis crop

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 pollen can be extremely attractive to many kinds of bees

Colton O'Brien and Dr. Arathi Seshadri just published a paper on the use of hemp pollen by bees

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

Hemp Grown for CBD (and other non-psychoactive compounds)

Often all-female plants
Male flowers, pollen absent

Plants often sticky near harvest

Plant is often harvested at immature stage

There are at least 3 kinds of hemp crops from an Insect Management Perspective

- Hemp grown seed and/or fiber
  - Outdoor culture
- Hemp grown for CBD production
  - Outdoor culture
- Indoor culture of any Cannabis crop

Stages in Developing Insect Pest Management Systems for Industrial Hemp

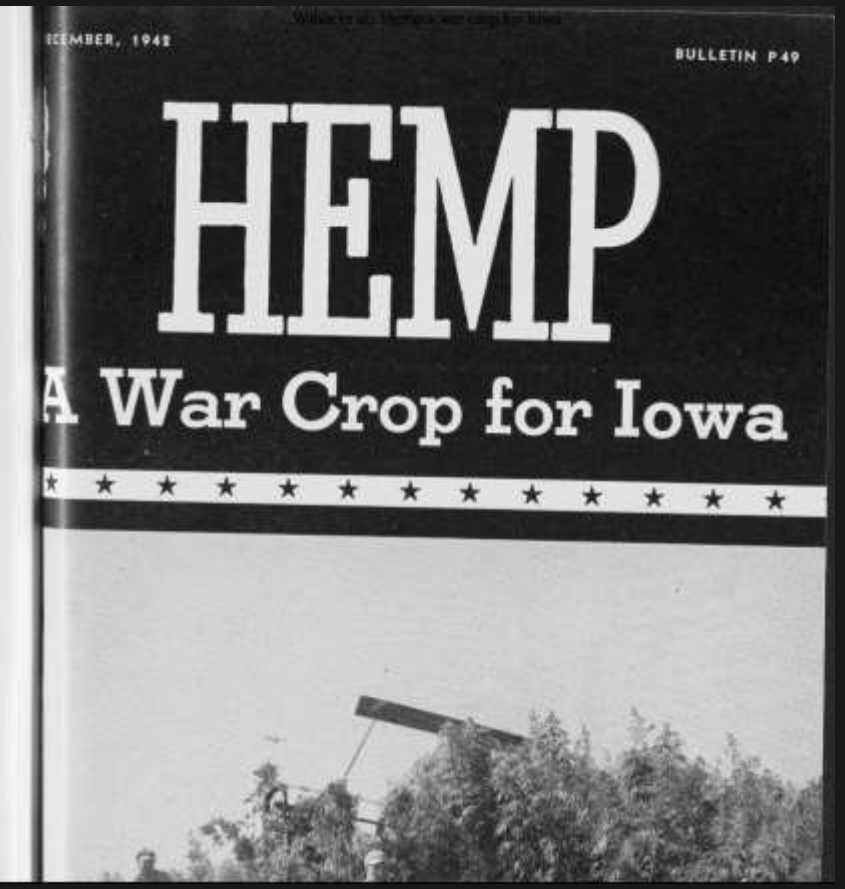
- Descriptive Stage
- Development Stage
- Implementation Stages

Descriptive Phase

What kinds of arthropods will we find associated with North American hemp in this new era?

…and what is their association with the crop?

The only university–derived resources that give any mention of hemp insects in the United States date to the **World War II period**



HEMP An Illinois War Crop

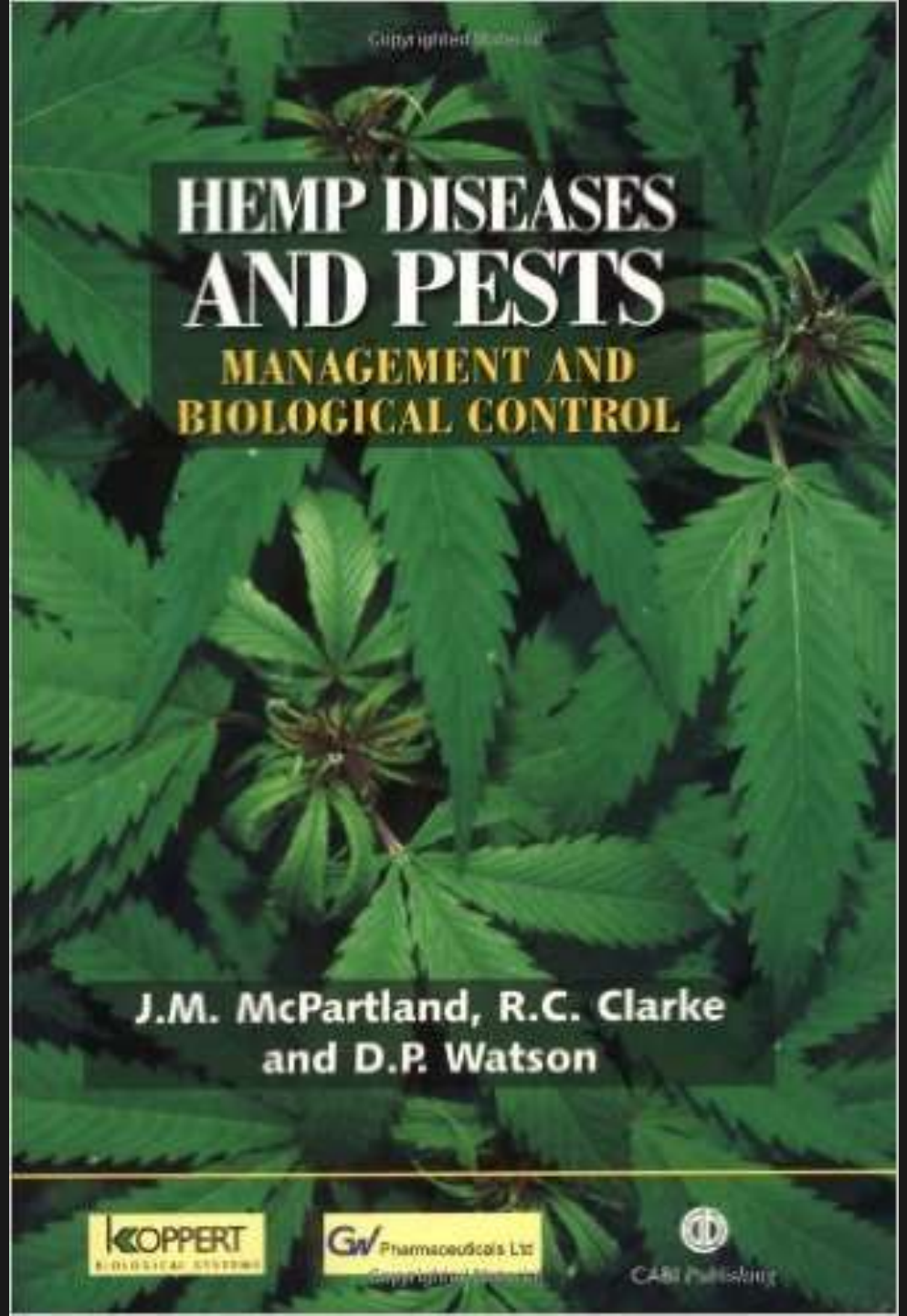
By J. C. Hackleman and W. E. Domingo

MORE HEMP must be grown in the United States in 1943 to fill an urgent war need. The war in the Pacific has cut off nearly all the supply of strong fibers previously imported from that area; but hemp, an annual plant adapted to the corn belt, produces good yields of a highly desirable fiber. This fiber is found in the thin outer bark of the stem. It will be used largely to make marine rope, cordage, and thread.

Several mills for extracting the fiber will be constructed in northern Illinois by the Government. Each mill will process the hemp from about 4,000 acres. Since the straw must be transported to the mill, all hemp should be grown within about 12 miles of a plant. Growers will sign a contract to sell their straw to the Commodity Credit Corporation, and will purchase approved seed and rent special machines for cutting and for binding from Commodity Credit.

Previous experience with hemp in the corn belt indicates that it should be considered primarily as a war crop needed to meet an emergency. Its importance after the war cannot now be predicted, tho research on new uses for high-quality fiber may make limited production profitable then.

The entomology details provided were cursory and appear to have no relevance to the present situation



This book has very well summarized the information known about hemp pests, worldwide, prior to 2000.

There are very few references from North America sources.

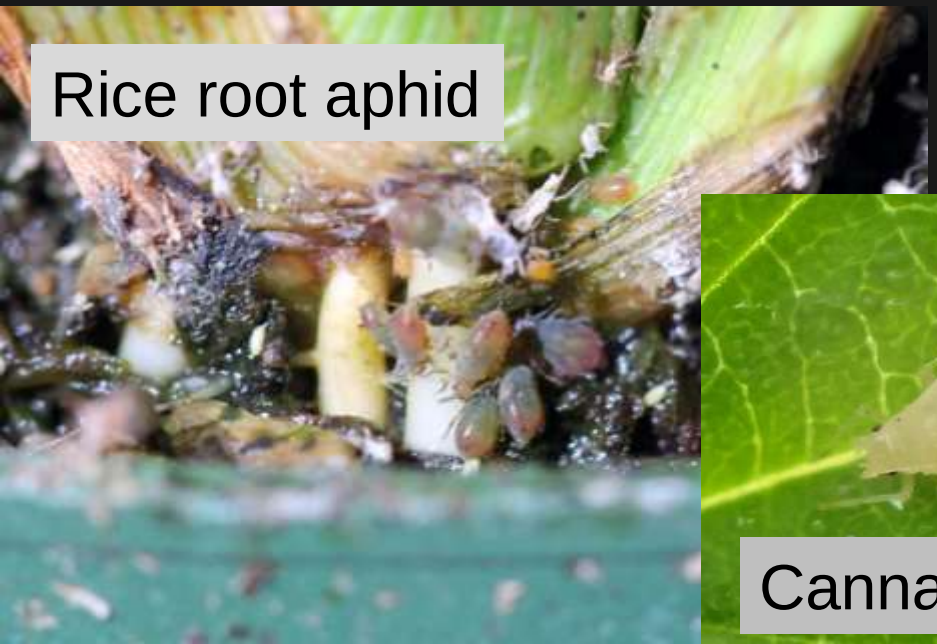
Key Arthropod Pests of Indoor Grown Cannabis in Colorado


Twospotted spider mite


Hemp russet mite

Photograph courtesy of Karl Hillig


Fungus gnats

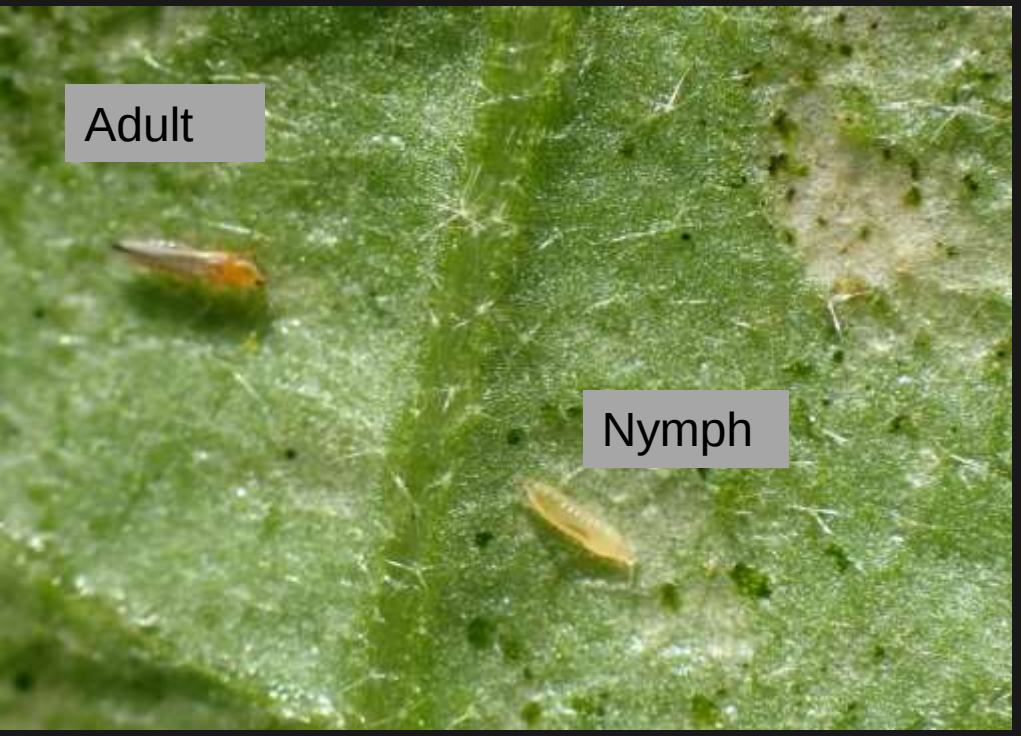

Rice root aphid


Cannabis aphid


Onion thrips

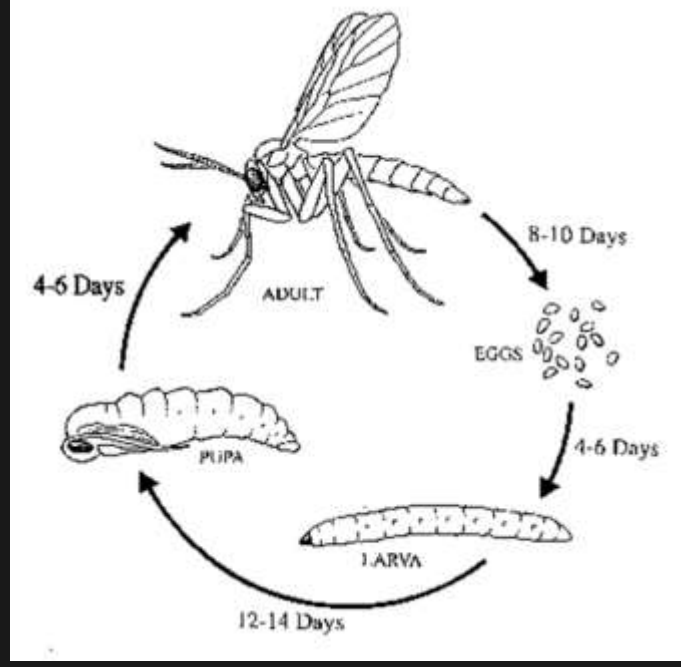
Twospotted spider mite

Tetranychus urticae



Onion Thrips

Thrips tabaci



Darkwinged fungus gnats

***Bradysia* spp.**

Photograph courtesy of Karl Hillig

Hemp russet mite

Aculops cannabicola

Photograph courtesy of Karl Hillig

…..also broad mite (Polyphagotarssenums latus)!

Massed aphids in roots of rice.
Photograph by Emily Luna.

Rice Root Aphid

Rhopalosiphum rufiabdominalis

Colonizing roots of hydroponically cultured cannabis

Winged forms caught on leaves

Wingless forms at base of plant

Cannabis Aphid

Phorodon cannabis

This is what I said in Extension programs last winter 2018:

"Pests problems associated with outdoor grown hemp *will likely have little overlap* with those affecting it when the plant is grown in confined conditions. This is largely due to greater effects of natural controls in outdoor settings."

Hemp may support a diverse and robust complement of natural enemy species

This is what I had been saying in Extension programs:

"Pests problems associated with outdoor grown hemp *will likely have little overlap* with those affecting it when the plant is grown in confined conditions. This is largely due to greater effects of natural controls in outdoor settings."

Two hemp pests that can occur in high population on both indoor and outdoor hemp production

Photograph courtesy of Karl Hillig

Descriptive Phase

What kinds of arthropods will we find associated with North American hemp in this new era?

…and what is their association with the crop?

Herbivores associated with Hemp

- Foliage feeding species
- Stem/Stalk borers
- Root feeders
- Species feeding on flowers/developing seed
- Insects that damage flower buds

What is a Hemp Insect?

What is a hemp insect?

Zygogramma disrupta – a leaf beetle of ragweed

Western corn rootworm

Physiphora demandata – a commonly seen fly that develops on decaying OM

Argus tortoise beetles pupating on hemp

Diamondback moth

An Unusual Insect Event in Hemp - 2018

A Lace Bug

***Gargaphia* sp.**

A field of young hemp in southeastern Colorado was massively infested by a lace bug in early June. Adults of a *Gargaphia* sp. were found on essentially every plant.

Large numbers of eggs were laid on the plants

Some plant injury was observed on the lower leaves

What happened?

Nothing. Eggs hatched but no nymphs developed.

A few adults were found on the plants for weeks.

The field as it was being readied for first harvest in September

What kinds of arthropods will we find feeding on hemp plants in this new era?

Insect/Mites with Sucking Mouthparts that Feed on Leaves

There are some hemipterans that extract fluids from the phloem (and less commonly the xylem or mesophyll)

Plus some treehoppers, planthoppers, and spittlebugs

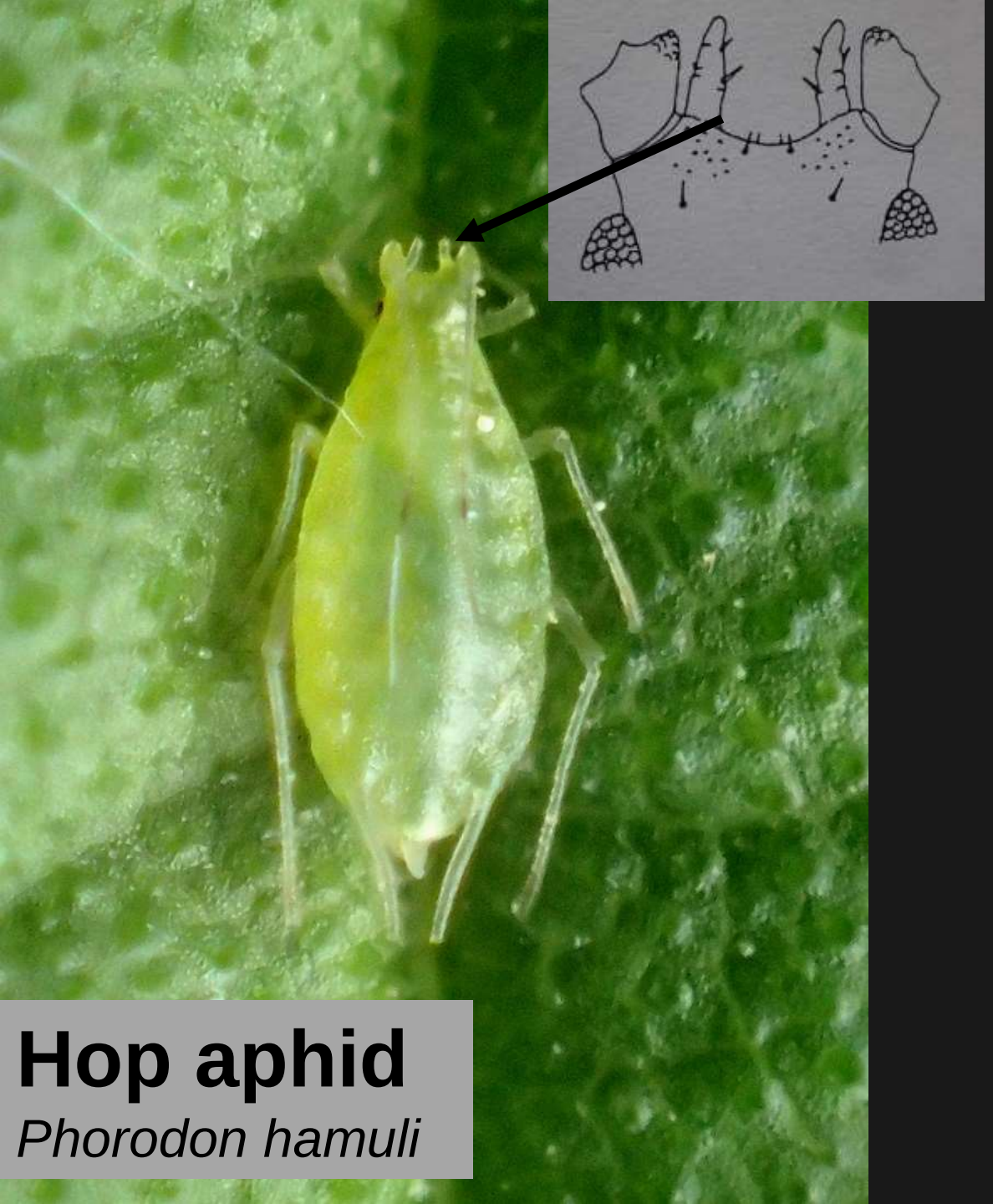
Leafhoppers

Aphids

Most surprising insect associated with the crop?

Cannabis Aphid

Phorodon cannabis


Hop aphid
Phorodon hamuli


Cannabis aphid
Phorodon cannabis

Leafhoppers

Damage potential of Colorado species to crop:
Negligible, at most

Photograph courtesy of Karl Hillig

Hemp russet mite

Aculops cannabicola

This is most important as a pest of developing flower buds on CBD cultivars

Defoliators

Caterpillars

Beetles

Grasshoppers

Various caterpillars chew leaves of the plant (defoliators)


Yellowstriped armyworm


Yellow woollybear


Beet webworm


Thistle caterpillar


Beet armyworm


Zebra caterpillar

Two late season “woollybear” caterpillars are common

Saltmarsh caterpillar

Yellow woollybear

Zebra caterpillar

Often the most conspicuous caterpillar on hemp

Mostly feeding on flowers?

Leaf Feeding Beetles

Palestriped flea beetle

Southern corn rootworm adult and damage

Western black flea beetle

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 will be important *in some areas*

European corn borer

Ostrinia nubilalis

Photograph from the website of the Canadian Hemp Trade Alliance

Photographs courtesy of Frank Peairs

An insect that surprised me a lot when found in Colorado

Eurasian hemp borer

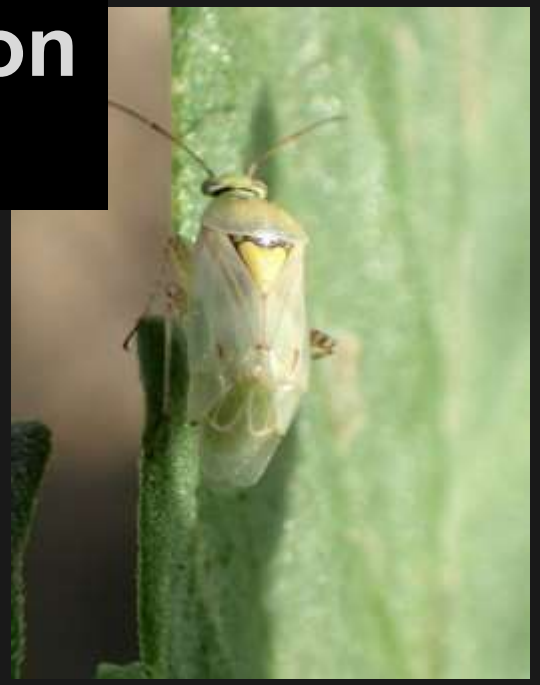
Grapholita dilineana

This is most important to flower buds and developing seeds

Hemipteran seed/flower feeders

Some of these could be important for hemp crops grown for seed

Several hemipterans (“true bugs”) feed on flowers and developing seeds of hemp



Stink bugs (4 species)

Lygus bugs (2-3 species)

Hemipteran seed feeders

False chinch bugs

Hyaline grass bug

Species of interest where there is continuous culture of seed-producing crops?

Seed Feeding Bugs and Hemp

- Feeding concentrated on flowers and developing seed
- Potential damage
  - Aborted seed, damaged seed
- Significant damage??

Potential Pest Management Problem:

If we do have significant seed feeding insect pests on hemp…..

….how can they be managed without harming pollinators?

Chewing Insects that Damage Buds

A particular issue of crops grown for CBD production

Key Pests Emerging in Colorado Hemp Production


Corn earworm


Eurasian hemp borer


Cannabis aphid


Hemp russet mite

Cannabis Aphid

Phorodon cannabis

Cannabis Aphid

- *Cannabis* spp. are the only plants on which cannabis aphid can feed and develop (we think)

Sexual forms of cannabis aphid and eggs

Late September
on a hemp leaf

Note: This photo, and about 200 other photos involving hemp and hemp insects, are posted for public use at Bugwood/IPMImages.org

How will cannabis aphid survive between seasons in a place with hard freezing winters?

… mostly on indoor crops?

Volunteer hemp

Cannabis aphids were collected from volunteer hemp sampled in midMay

Photograph courtesy of Karl Hillig

Hemp russet mite

Aculops cannabicola

Photograph courtesy of Karl Hillig

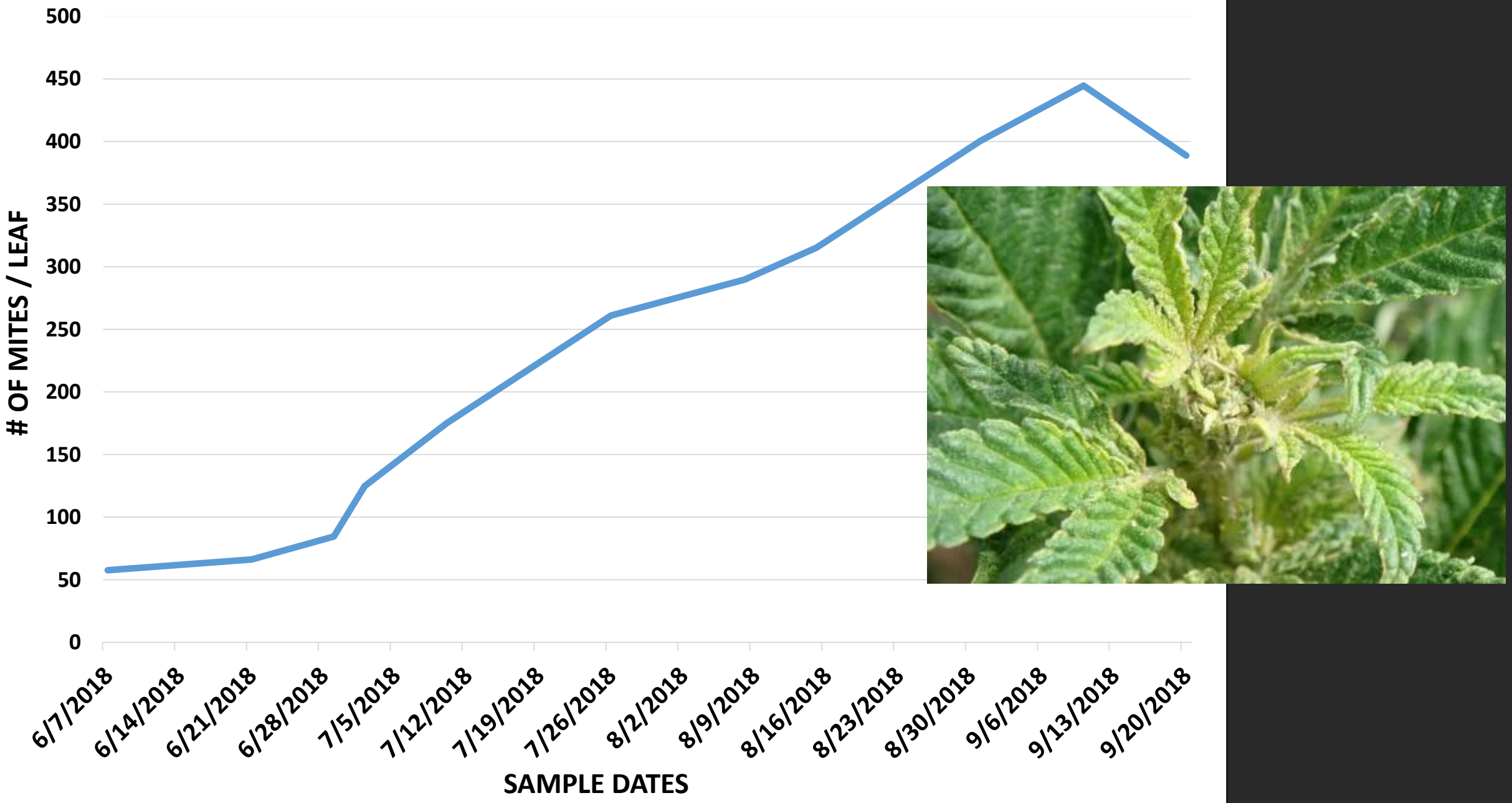
Is an upward leaf curl a symptom of hemp russet mite injury?

Yes – and no. Some cultivars seems to produce an upward leaf curl in response to hemp russet mites. Some do not.

Some genotypes normally produce upward leaf curling in the absence of mites.

Symptoms of hemp russet mite infestation on developing buds of hemp

HEMP RUSSET MITES # / LEAF



What is eating hemp russet mites in the field?

Minute pirate bugs were the only species regularly observed that could credibly be considered a hemp russet mite predator

Eurasian Hemp Borer

Grapholita delineana

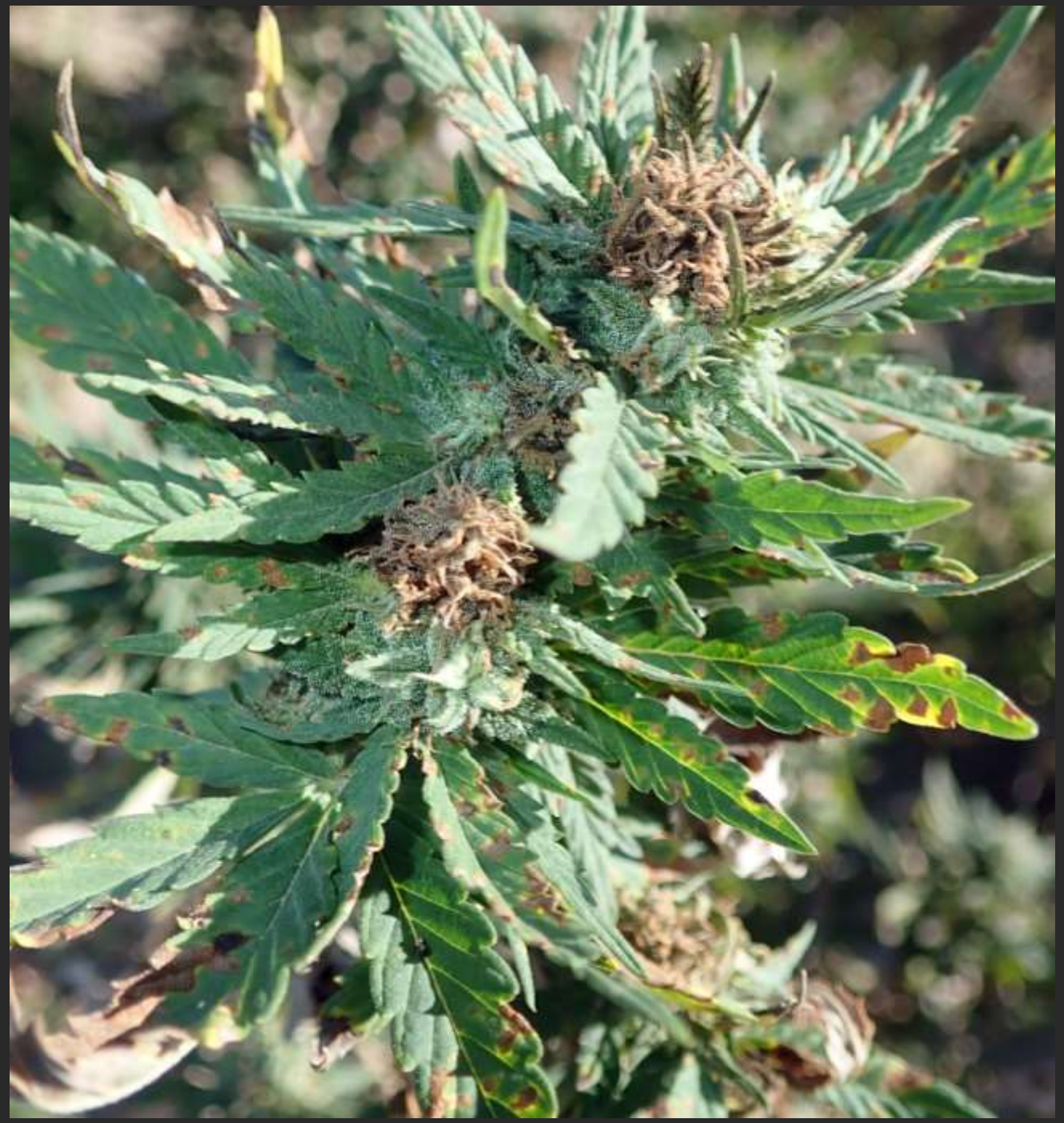
Adults were found in fields from 5 of the 6 eastern Colorado counties visited in 2018

These constitute a known range extension to the west of 600+ miles

Volunteer hemp examined June 18 were infested with larvae in late stages of development

The last stage larva changes from cream colored to pinkish, as do some other *Grapholita* species

Exterior symptom of stalk tunneling – leaf flagging



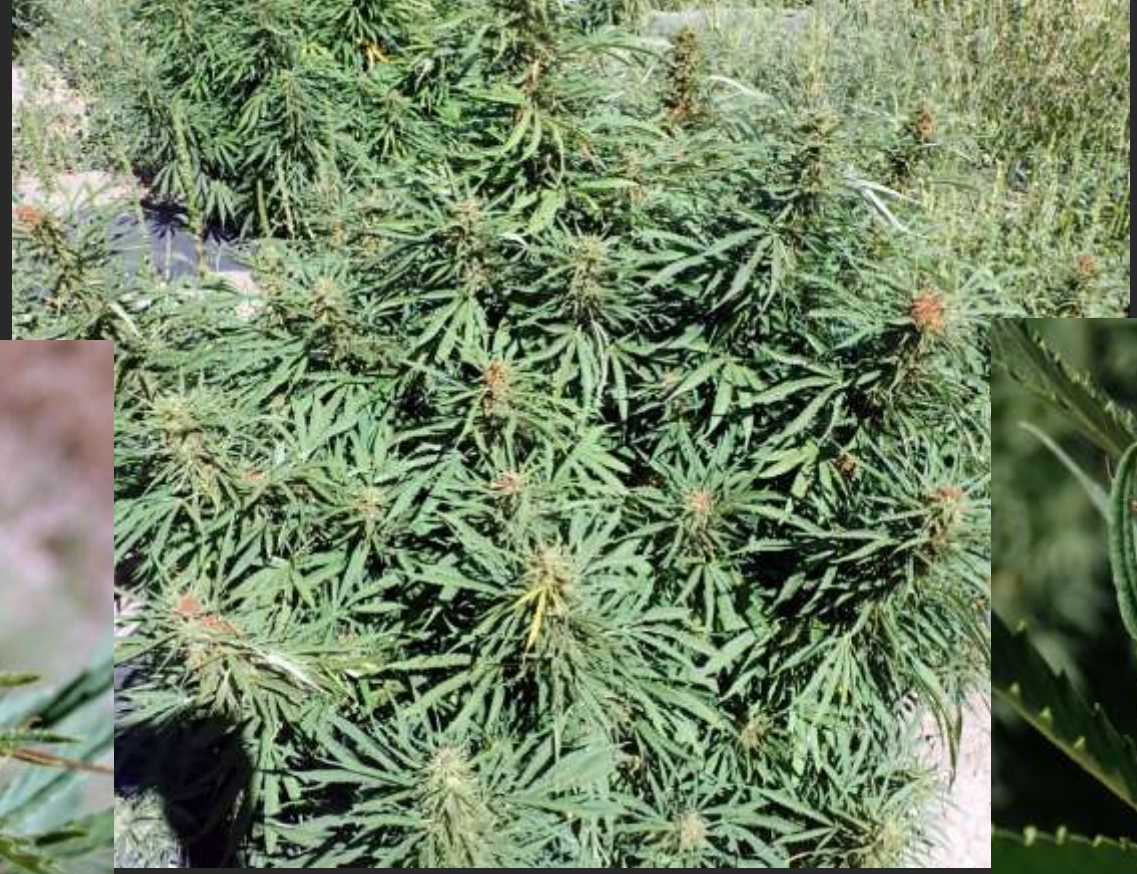
Serious damage to buds was observed in one field located in northeastern Colorado

Most significant potential pest of the crop in Colorado?

Corn earworm

Helicoverpa zea

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

At what plant growth stage is hemp attractive (and not attractive) to corn earworm?

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

A 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. Potential damage to fiber or seed producing cultivars is likely to be minimal. Populations of this insect vary greatly from season to season in Colorado. This insect will usually move into hemp in late summer with peak injury occurring after plants begin to flower during late August and September.

Corn earworm feeding in the top of a hemp plant

Melissa Schreiner

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 in 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.

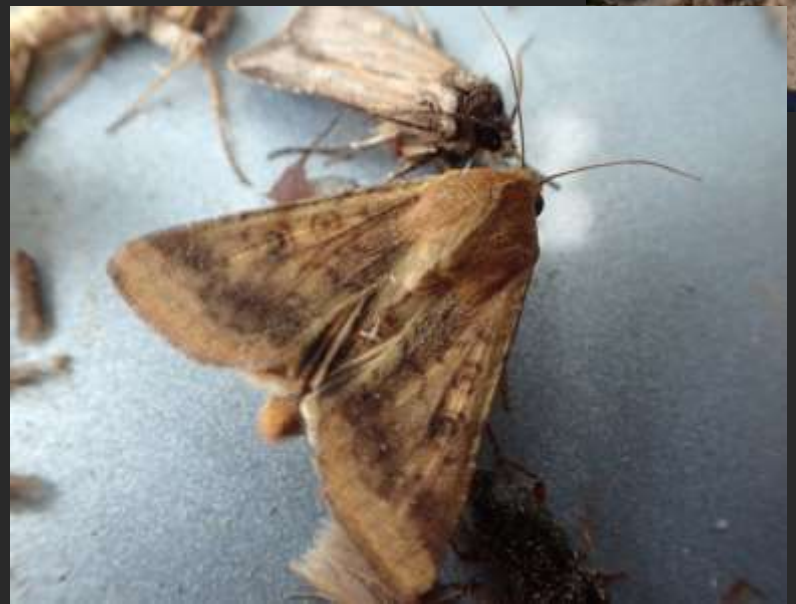
Light traps will capture a wide variety of insects, mostly various kinds of moths and beetles. Traps

Present proposed IPM program for corn earworm in hemp in CO

An IPM Implementation Phase effort

This is program, minimally adapted for hemp, derived from sweet corn IPM

Pheromone traps can be used to monitor corn earworm in hemp production



Insecticides that are allowed to be used on hemp that are recommended to control corn earworm

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

***Helicoverpa* Nuclear Polyhedrosis Virus**

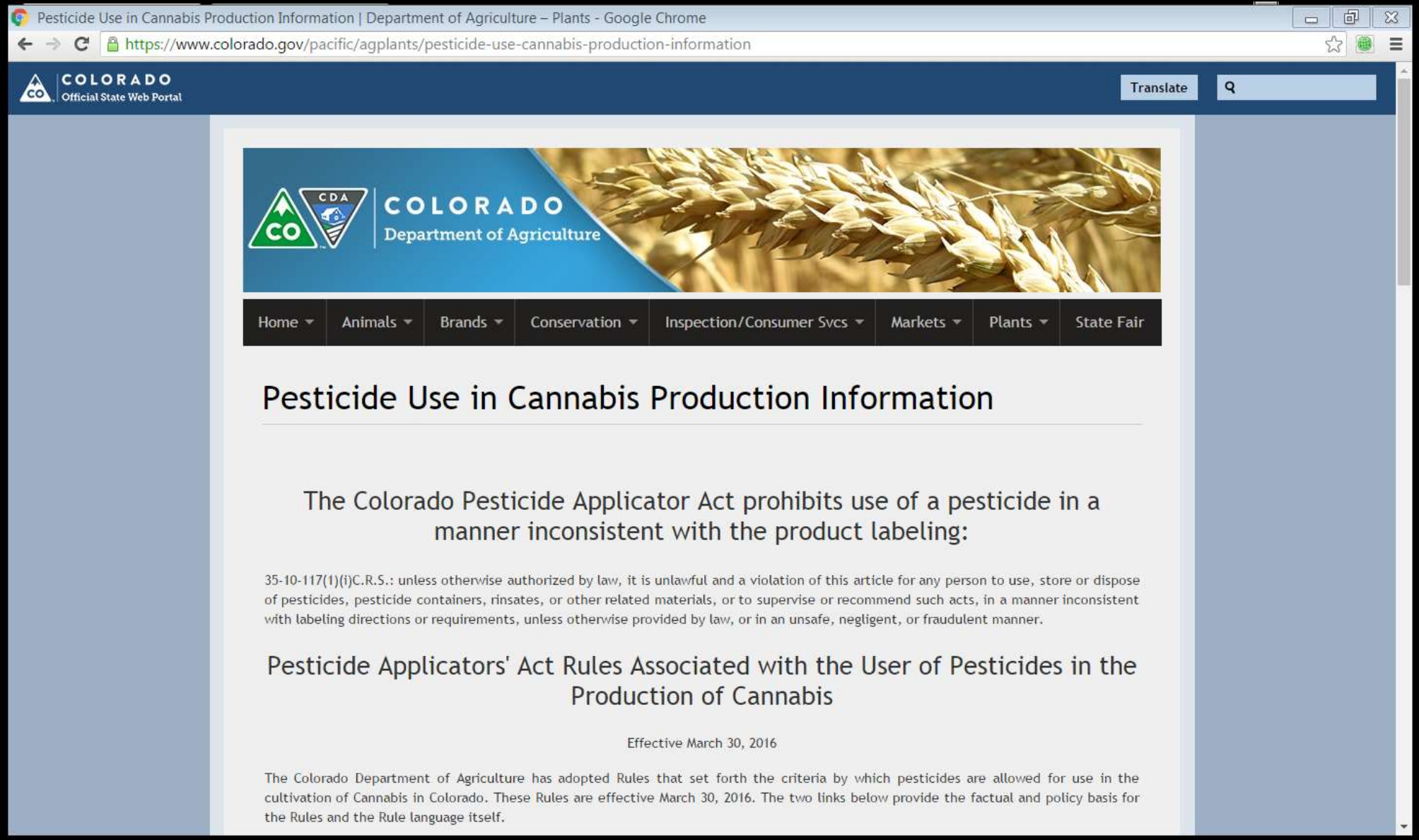
2018 Corn Earworm Monitoring Program

- Traps were provided to 7 growers (8 counties)
- In two sites (SE Colorado) high trap captures were noted in September
- At least 3 growers treated for corn earworm in 2018

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.

Colorado follows the "Washington Finesse" Model



Pesticide Use in Cannabis Production Information | Department of Agriculture – Plants - Google Chrome

https://www.colorado.gov/pacific/agplants/pesticide-use-cannabis-production-information

COLORADO Official State Web Portal

Translate

COLORADO Department of Agriculture

Home | Animals | Brands | Conservation | Inspection/Consumer Svcs | Markets | Plants | State Fair

Pesticide Use in Cannabis Production Information

The Colorado Pesticide Applicator Act prohibits use of a pesticide in a manner inconsistent with the product labeling:

35-10-117(1)(i)C.R.S.: unless otherwise authorized by law, it is unlawful and a violation of this article for any person to use, store or dispose of pesticides, pesticide containers, rinsates, or other related materials, or to supervise or recommend such acts, in a manner inconsistent with labeling directions or requirements, unless otherwise provided by law, or in an unsafe, negligent, or fraudulent manner.

Pesticide Applicators' Act Rules Associated with the User of Pesticides in the Production of Cannabis

Effective March 30, 2016

The Colorado Department of Agriculture has adopted Rules that set forth the criteria by which pesticides are allowed for use in the cultivation of Cannabis in Colorado. These Rules are effective March 30, 2016. The two links below provide the factual and policy basis for the Rules and the Rule language itself.

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

Colorado product name	Company	EPA Number	Active Ingredients	Percent	Commercial	Personal use	Hemp	Comments	Pesticide Type
#1 Fungus Bully (concentrate)	Stills LLC	25(b)	Sodium Lauryl Sulfate Corn Oil Citric Acid	8.000% 3.680% 1.120%	Yes	Yes	Yes		Fungicide
#1 Pest Bully	Stills LLC	25(b)	Castor Oil Garlic Oil Corn Oil	8.000% 4.000% 4.000%	Yes	Yes	Yes		Insecticide
420 Drench Bully	Stills LLC	25(b)	Sodium Lauryl Sulfate Castor Oil Corn Oil	16.000% 8.000% 4.000%	Yes	Yes	Yes		Fungicide, Insecticide
420 Fungus Bully (concentrate)	Stills LLC	25(b)	Sodium Lauryl Sulfate Corn Oil Citric Acid	8.000% 3.680% 1.120%	Yes	Yes	Yes		Fungicide
420 Pest Bully Concentrate	Stills LLC	25(b)	Castor Oil Garlic Oil Corn Oil	8.000% 4.000% 4.000%	Yes	Yes	Yes		Insecticide
420 Pest Bully Powder	Stills LLC	25(b)	Garlic White Pepper Citric Acid	0.250% 0.120% 0.080%	Yes	Yes	Yes		Insecticide
420 Pest Bully Ready-to-Use	Stills LLC	25(b)	Castor Oil Garlic Oil Corn Oil	0.500% 0.250% 0.250%	Yes	Yes	Yes		Insecticide
70% Neem Oil (Monterey)	Lawn and Garden Products, Inc	70051-2-64705	Clarified Hydrophobic Extract of Neem Oil	70.000%	No	Yes	No		Fungicide, Insecticide
86 Mites & Mold Ready to Use	NorCal Plant Nutrients LLC	25(b)	Rosemary Oil Lemon Grass Oil Cinnamon Oil Cottonseed Oil	0.300% 0.100% 0.100% 0.100%	Yes	Yes	Yes		Fungicide, Miticide
86 Mites + Mold Concentrate	NorCal Plant Nutrients LLC	25(b)	Rosemary Oil Lemon Grass Oil Cinnamon Oil Cottonseed Oil	1.200% 0.600% 0.500% 0.300%	Yes	Yes	Yes		Fungicide, Miticide

Wednesday, June 29, 2016

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Colorado product name	Company	EPA Number	Active Ingredients	Percent	Commercial	Personal use	Hemp	Comments	Pesticide Type
Agri-Fos Systemic Fungicide	Lawn and Garden Products, Inc	71962-1-64705	Phosphorous Acid, Mono- and Di-Potassium Salts of	45.800%	Yes	Yes	Yes	Use allowed prior to final transplant.	Fungicide
Agri-Fos Systemic Fungicide	Liquid Fertilizer Pty. Ltd.	71962-1	Phosphorous Acid, Mono- and Di-Potassium Salts of	45.800%	Yes	Yes	Yes	Use only allowed prior to final transplant, unless grown in recirculating hydroponics systems.	Fungicide
Agri-Fos Systemic Fungicide Plus	Liquid Fertilizer Pty. Ltd.	71962-2	Phosphorous Acid, Mono- and Di-Potassium Salts of	60.560%	Yes	No	Yes	Use allowed prior to final transplant.	Fungicide
AllPer-Plus Concentrate	AllPer-Plus	25(b)	Geranium Oil Rosemary Oil Clove Oil	0.380% 0.330% 0.330%	Yes	Yes	Yes		Insecticide
AllPer-Plus Ready to Use	AllPer-Plus	25(b)	Geranium Oil Rosemary Oil Clove Oil	0.190% 0.130% 0.190%	Yes	Yes	Yes		Insecticide
Alude Systemic Fungicide	Cleary Chemical Corporation	71962-1-1001	Phosphorous Acid, Mono- and Di-Potassium Salts of	45.800%	Yes	Yes	Yes	Use allowed prior to final transplant.	Fungicide

CANNABIS

PESTICIDES THAT ARE **LEGAL** TO USE

Protecting workers, the public, and the environment
California Cannabis Cultivation

Guidance on allowable pesticide uses in California seems to be structured differently from CO, OR, and WA

The following are examples of pesticide active ingredients that are exempt from tolerance requirements and either exempt from registration requirements or have labels broad enough to include use on cannabis. This is not an exhaustive list of active ingredients that may fit the legal use criteria. The active ingredients are organized by the intended target.

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

You may wish to check out the **Hemp Insect Website** for periodic updates on this subject

COLORADO STATE UNIVERSITY | COLLEGE OF AGRICULTURAL SCIENCES

Hemp Insects

Home | Hemp Insect Factsheets | Hemp Insect Images | Regulations and Pesticide Use | Got Bugs? | Recommendations | Future Students | Commencement | Dire

Insect Management Considerations in Hemp Production

The Hemp Insect Website is designed to provide hemp producers a way to recognize and to better understand the insects, mites, and other "bugs" that are present when this crop is grown in North America.

The goals of the Hemp Insect Website are to:

(1) Provide description of all insects and mites observed in production of hemp;

(2) Provide information on the habits of all insects that are associated with hemp production.

At present the Hemp Insect Website does give particular attention to insects and mites that are present within the High Plains/Rocky Mountain area of the western United States. This is because, to date, the most extensive surveys of hemp insects have occurred in this region, mostly in Colorado from 2015 to the present. However, the goal of this website is to provide progressively more comprehensive treatment of insects associated with hemp production throughout North America. Submission of photos and inquiries about insects observed on hemp is encouraged from anywhere and the website should expand as the field of hemp insect pest management develops in the United States and Canada.

Note: This website is limited to insect issues involving hemp, defined as *Cannabis* grown for seed, fiber, or non-THC pharmaceutical products. *This is not a forum for marijuana.* Industrial

Acknowledgements

- **Melissa Schreiner**
- Andrew Miller
- Wendlin Burns

- Colorado Department of Agriculture
- Colorado Cultivars
- CW Hemp
- …and the many other CO hemp growers who have provided field access, assistance and encouragement

Western IPM Center

AGRICULTURAL EXPERIMENT STATION
COLORADO STATE UNIVERSITY

More obvious can be insects that chew leaves of the plant (defoliators)

Caterpillars

Beetles

Grasshoppers

Several lady beetles are common in hemp

Three species of Green Lacewings have been observed in hemp fields

Chrysopa oculata,
Chrysoperla floribunda,
Chrysoperla nigricornis

Flower flies

….and other families of predatory flies

Some generalist hemipteran predators

Damsel bug

Chlamydatus associatus

Spined assassin bug

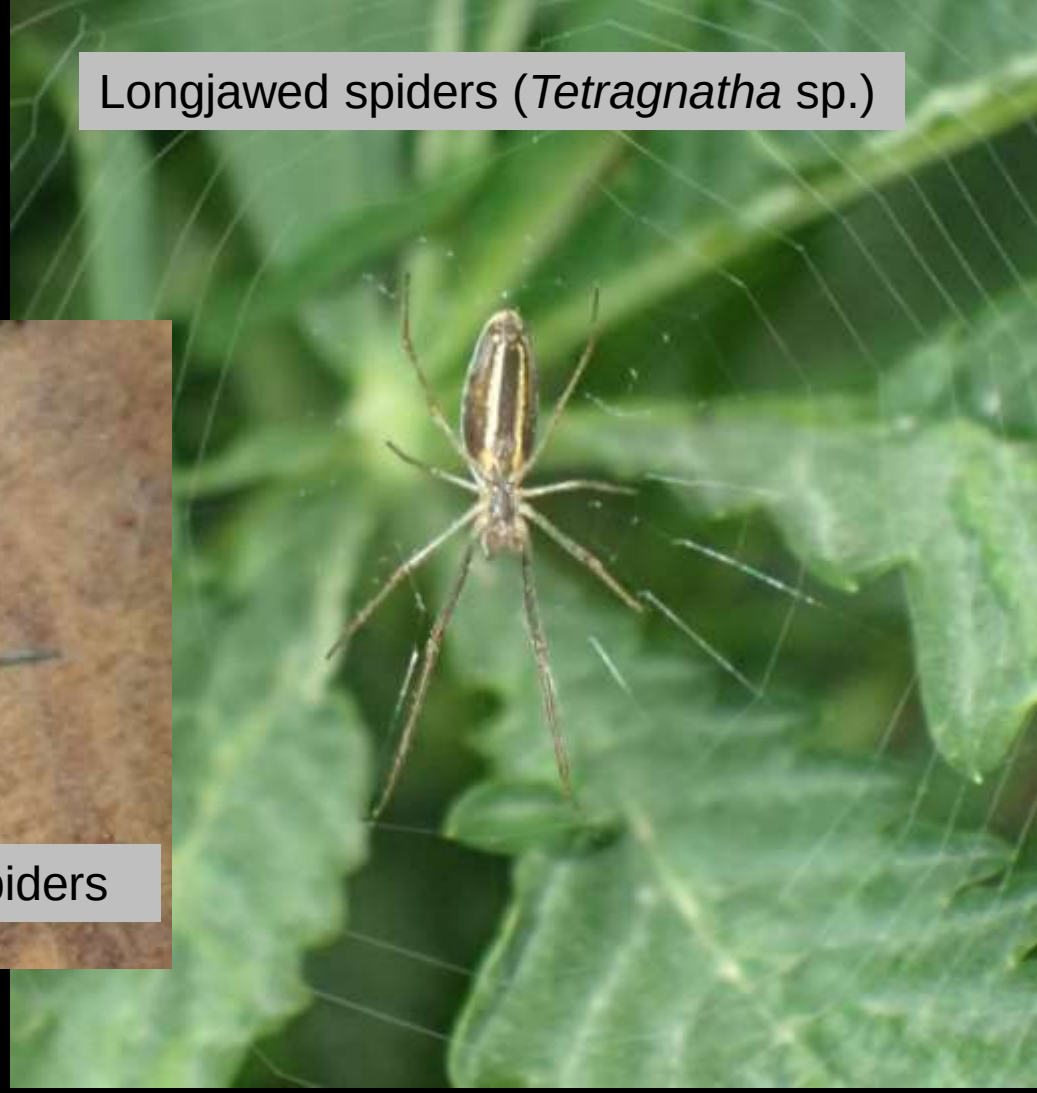
Minute pirate bugs

Damsel bug nymph (right) and lady beetle

Damsel Bug

Nabis alternatus

A very common insect in hemp fields and a generalist predator of many insects, including caterpillars



Spiders may often be very important natural enemies of insects associated with hemp

Several insects will be associated with ooze from wounds or infections of stems, stalks

Photograph by Leah Black

Some crops are being grown from seed and some for duo-purpose (CBD/seed)

These crops have lower concentrations of cannabinoids but produce much more biomass – and seed

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***

What is the potential value of hemp as a pollen resources for bees in agricultural regions?

Hemp may be a very heavily used by many kinds of bees as a pollen source late in the season

Honey bee

Many species of native solitary bees

Bumble bees

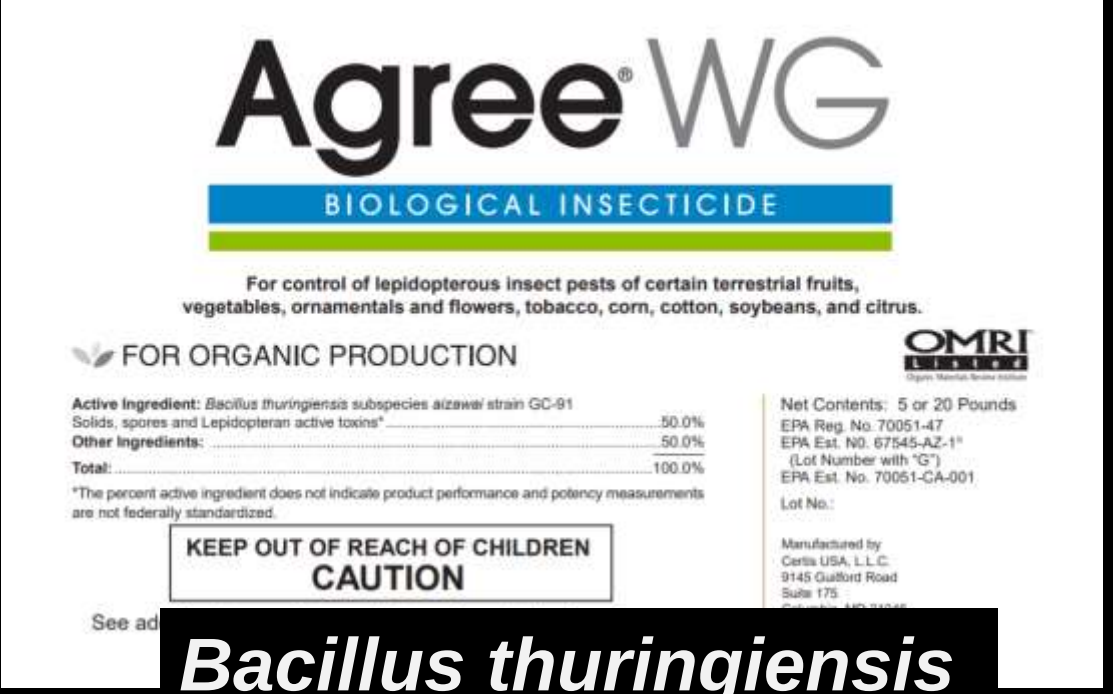
Hemp grown for seed production with pollen producing male plants/flowers – potentially excellent resource for many pollinators

Hemp grown for extractable compounds (e.g. CBD) without male plants – not a potential pollen source

Pollinator use may complicate controls if there are insects that are pests of the crop during flowering

Fortunately, the *Bacillus thuringiensis* (Bt) and HelicoVex products used for corn earworm ***are compatible with pollinators***

Colorado allowed insecticides that can be used to control corn earworm in hemp


Agree® WG

BIOLOGICAL INSECTICIDE

For control of lepidopterous insect pests of certain terrestrial fruits, vegetables, ornamentals and flowers, tobacco, corn, cotton, soybeans, and citrus.

FOR ORGANIC PRODUCTION

OMRI LISTED

Active Ingredient: *Bacillus thuringiensis* subspecies *aizawai* strain GC-91
Solids, spores and Lepidopteran active toxins* 50.0%
Other Ingredients: 50.0%
Total: 100.0%

*The percent active ingredient does not indicate product performance and potency measurements are not federally standardized.

KEEP OUT OF REACH OF CHILDREN
CAUTION

Net Contents: 5 or 20 Pounds
EPA Reg. No. 70051-47
EPA Est. N0. 67545-AZ-1
(Lot Number with "G")
EPA Est. No. 70051-CA-001
Lot No.:

Manufactured by
Certis USA, L.L.C.
9145 Guilford Road
Suite 175

See ad

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


Andermatt USA

where Nature leads Innovation

www.andermattusa.com

HELICOVEX®

Insecticidal Virus for Use in Greenhouses and Open Fields for the Control of the Corn earworm, the Tobacco budworm and the African cotton bollworm

FOR ORGANIC PRODUCTION

OMRI LISTED

Active Ingredient:*
Helicoverpa armigera nucleopolyhedrovirus strain BV-0003 ..... 0.60%
Other Ingredients: 99.40%
Total: **100.00%**
*Contains a minimum of 7.5×10^{12} viral occlusion bodies per liter.

KEEP OUT OF REACH OF CHILDREN
CAUTION

SEE SIDE/INSIDE PANEL FOR ADDITIONAL PRECAUTIONARY STATEMENTS AND FIRST AID

Net Contents:
Lot No.:
EPA Reg. No.: 69553-2
EPA Est. No.:

Manufactured by: Andermatt Biocontrol AG
Stahlermatten 6
6146 Grossdietwil
Switzerland

***Helicoverpa* Nuclear Polyhedrosis Virus**

The Pesticide Conundrum with Cannabis

- All registered pesticides can only be legally applied to sites (e.g., crops) on which they are labeled
- 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, *and***
  - **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
- 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*

Pesticide Use in Cannabis Production Information | Department of Agriculture – Plants - Google Chrome

https://www.colorado.gov/pacific/agplants/pesticide-use-cannabis-production-information

COLORADO Official State Web Portal

Translate

COLORADO Department of Agriculture

Home | Animals | Brands | Conservation | Inspection/Consumer Svcs | Markets | Plants | State Fair

Pesticide Use in Cannabis Production Information

The Colorado Pesticide Applicator Act prohibits use of a pesticide in a manner inconsistent with the product labeling:

35-10-117(1)(i)C.R.S.: unless otherwise authorized by law, it is unlawful and a violation of this article for any person to use, store or dispose of pesticides, pesticide containers, rinsates, or other related materials, or to supervise or recommend such acts, in a manner inconsistent with labeling directions or requirements, unless otherwise provided by law, or in an unsafe, negligent, or fraudulent manner.

Pesticide Applicators' Act Rules Associated with the User of Pesticides in the Production of Cannabis

Effective March 30, 2016

The Colorado Department of Agriculture has adopted Rules that set forth the criteria by which pesticides are allowed for use in the cultivation of Cannabis in Colorado. These Rules are effective March 30, 2016. The two links below provide the factual and policy basis for the Rules and the Rule language itself.

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, *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**
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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

Such labels are rare

CROPS (including but not limited to)	APPLICATION	COMMENTS
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 Cotton, alfalfa, soybeans, peanuts, potatoes, corn, wheat, sweet potatoes, tobacco, sunflowers, sugar beets, sorghum, floriculture, and border plants	**Rate:** 1.0 – 2.5 fl. oz. per acre **Method:** Sprayer, Aircraft **Equipment:** Sprayer, Sprinkler Irrigation, Mist Sprayer	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.

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Website page to access what Colorado Department of Agriculture considers to be *not* *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

Colorado product name	Company	EPA Number	Active Ingredients	Percent	Commercial	Personal use	Hemp	Comments	Pesticide Type
#1 Fungus Bully (concentrate)	Stills LLC	25(b)	Sodium Lauryl Sulfate Corn Oil Citric Acid	8.000% 3.680% 1.120%	Yes	Yes	Yes		Fungicide
#1 Pest Bully	Stills LLC	25(b)	Castor Oil Garlic Oil Corn Oil	8.000% 4.000% 4.000%	Yes	Yes	Yes		Insecticide
420 Drench Bully	Stills LLC	25(b)	Sodium Lauryl Sulfate Castor Oil Corn Oil	16.000% 8.000% 4.000%	Yes	Yes	Yes		Fungicide, Insecticide
420 Fungus Bully (concentrate)	Stills LLC	25(b)	Sodium Lauryl Sulfate Corn Oil Citric Acid	8.000% 3.680% 1.120%	Yes	Yes	Yes		Fungicide
420 Pest Bully Concentrate	Stills LLC	25(b)	Castor Oil Garlic Oil Corn Oil	8.000% 4.000% 4.000%	Yes	Yes	Yes		Insecticide
420 Pest Bully Powder	Stills LLC	25(b)	Garlic White Pepper Citric Acid	0.250% 0.120% 0.080%	Yes	Yes	Yes		Insecticide
420 Pest Bully Ready-to-Use	Stills LLC	25(b)	Castor Oil Garlic Oil Corn Oil	0.500% 0.250% 0.250%	Yes	Yes	Yes		Insecticide
70% Neem Oil (Monterey)	Lawn and Garden Products, Inc	70051-2-64705	Clarified Hydrophobic Extract of Neem Oil	70.000%	No	Yes	No		Fungicide, Insecticide
86 Mites & Mold Ready to Use	NorCal Plant Nutrients LLC	25(b)	Rosemary Oil Lemon Grass Oil Cinnamon Oil Cottonseed Oil	0.300% 0.100% 0.100% 0.100%	Yes	Yes	Yes		Fungicide, Miticide
86 Mites + Mold Concentrate	NorCal Plant Nutrients LLC	25(b)	Rosemary Oil Lemon Grass Oil Cinnamon Oil Cottonseed Oil	1.200% 0.600% 0.500% 0.300%	Yes	Yes	Yes		Fungicide, Miticide

Wednesday, June 29, 2016

Page 1 of 22

Colorado product name	Company	EPA Number	Active Ingredients	Percent	Commercial	Personal use	Hemp	Comments	Pesticide Type
Agri-Fos Systemic Fungicide	Lawn and Garden Products, Inc	71962-1-64705	Phosphorous Acid, Mono- and Di-Potassium Salts of	45.800%	Yes	Yes	Yes	Use allowed prior to final transplant.	Fungicide
Agri-Fos Systemic Fungicide	Liquid Fertilizer Pty. Ltd.	71962-1	Phosphorous Acid, Mono- and Di-Potassium Salts of	45.800%	Yes	Yes	Yes	Use only allowed prior to final transplant, unless grown in recirculating hydroponics systems.	Fungicide
Agri-Fos Systemic Fungicide Plus	Liquid Fertilizer Pty. Ltd.	71962-2	Phosphorous Acid, Mono- and Di-Potassium Salts of	60.560%	Yes	No	Yes	Use allowed prior to final transplant.	Fungicide
AllPer-Plus Concentrate	AllPer-Plus	25(b)	Geranium Oil Rosemary Oil Clove Oil	0.380% 0.330% 0.330%	Yes	Yes	Yes		Insecticide
AllPer-Plus Ready to Use	AllPer-Plus	25(b)	Geranium Oil Rosemary Oil Clove Oil	0.190% 0.130% 0.190%	Yes	Yes	Yes		Insecticide
Alude Systemic Fungicide	Cleary Chemical Corporation	71962-1-1001	Phosphorous Acid, Mono- and Di-Potassium Salts of	45.800%	Yes	Yes	Yes	Use allowed prior to final transplant.	Fungicide

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?*

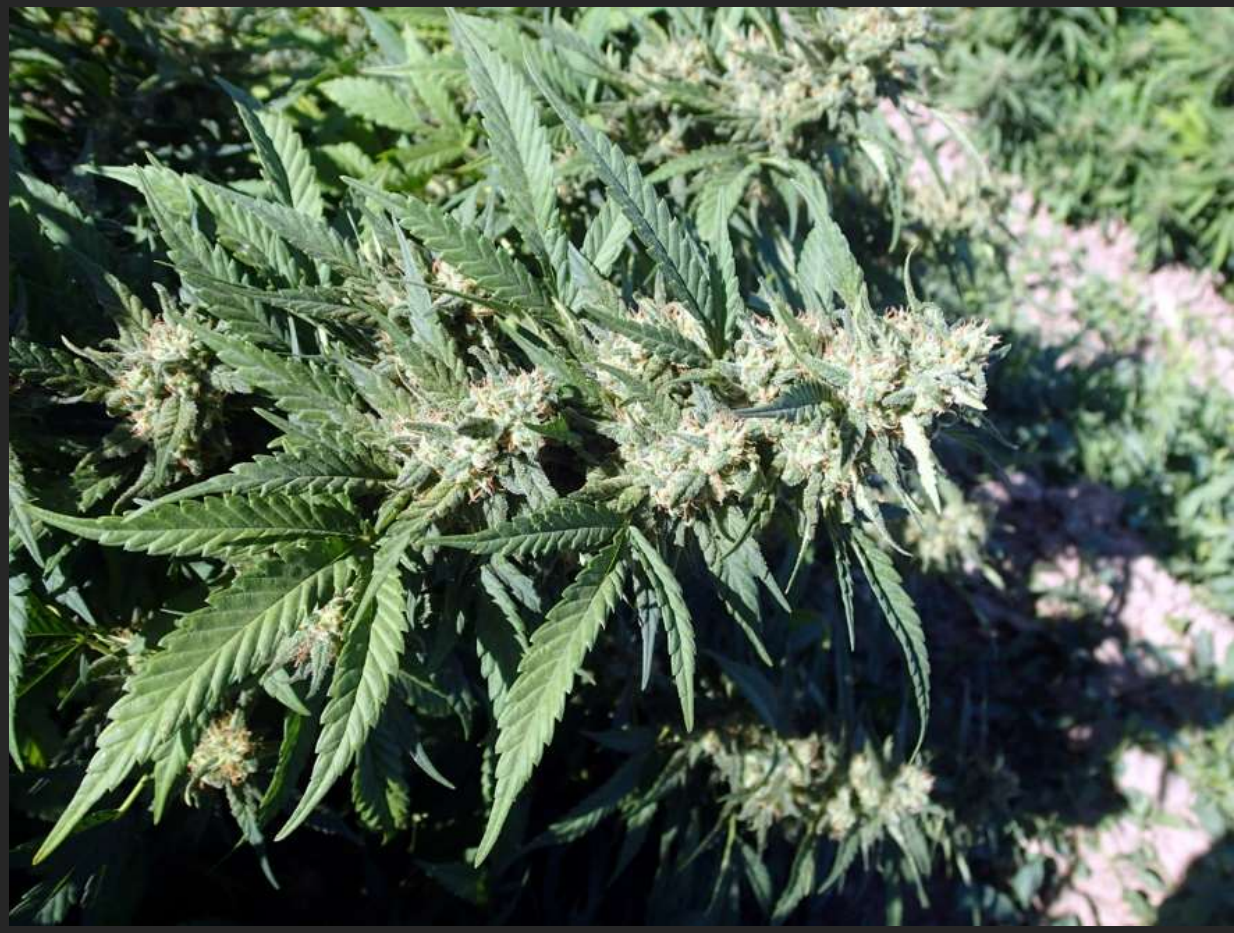
It will very likely vary by the type of hemp crop, and end use

Hemp Grown for Fiber and Seed

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?

Hemp Grown for CBD



This poses some more serious registration problems

Hemp Grown for CBD

This poses some obvious registration problems.

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

Hemp Grown for CBD

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.

You may wish to check out the **Colorado Hemp Insect Website** for periodic updates on this subject

COLORADO STATE UNIVERSITY | COLLEGE OF AGRICULTURAL SCIENCES

Hemp Insects

Home | Hemp Insect Factsheets | Hemp Insect Images | Regulations and Pesticide Use | Got Bugs? | Recommendations | Future Students | Commencement | Dire

Insect Management Considerations in Hemp Production

The Hemp Insect Website is designed to provide hemp producers a way to recognize and to better understand the insects, mites, and other "bugs" that are present when this crop is grown in North America.

The goals of the Hemp Insect Website are to:

(1) Provide description of all insects and mites observed in production of hemp;

(2) Provide information on the habits of all insects that are associated with hemp production.

At present the Hemp Insect Website does give particular attention to insects and mites that are present within the High Plains/Rocky Mountain area of the western United States. This is because, to date, the most extensive surveys of hemp insects have occurred in this region, mostly in Colorado from 2015 to the present. However, the goal of this website is to provide progressively more comprehensive treatment of insects associated with hemp production throughout North America. Submission of photos and inquiries about insects observed on hemp is encouraged from anywhere and the website should expand as the field of hemp insect pest management develops in the United States and Canada.

Note: This website is limited to insect issues involving hemp, defined as *Cannabis* grown for seed, fiber, or non-THC pharmaceutical products. *This is not a forum for marijuana.* Industrial

Defining and Responding to the Insect Pest Management Needs of a “New” Crop: Industrial Hemp

Questions?