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 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 cannabinoids)

Often all-female plants
Male flowers, pollen absent

Plants often sticky near harvest

Plant is often harvested at immature stage

Harvesting CBD hemp near Milliken, CO
October 5, 2017
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.
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
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. The entomology details provided were cursory and appear to have little 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

- Twospotted spider mite
- Rice root aphid
- Cannabis aphid
- Fungus gnats
- Onion thrips
- Hemp russet mite

Photograph courtesy of Karl Hillig
Twospotted spider mite

*Tetranychus urticae*
Hemp russet mite

*Aculops cannabicolae*

Photograph courtesy of Karl Hillig
Rice root aphid
*Rhopalosiphum rufiabdominalis*

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

Colonizing roots of hydroponically cultured cannabis

Winged forms caught on leaves

Wingless forms at base of plant
Cannabis Aphid

*Phorodon cannabis*
Onion Thrips
*Thrips tabaci*

Adult

Nymph

Extensive leaf injury by onion thrips

Leaf injury and nymphs
Darkwinged fungus gnats
*Bradysia* spp.
This is what I said in Extension programs last winter:

“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.”
A robust complex of natural enemies can be expected to be found in hemp when it is grown outdoors.
Convergent lady beetle

The most common lady beetles found in hemp fields

Multicolored Asian lady beetle

Also common were Hippodamia parenthesis, Olla c-nigrum, and Coccinella novemnotata
Lady Beetle Life Stages

- Adults
- Eggs
- Larvae
- Pupae
Lady beetle laying a mass of eggs
Lady beetle larvae
Convergent lady beetle

Multicolored Asian lady beetle
Twospotted collops beetle is a pretty common insect in agricultural fields in the Arkansas Valley.
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
- Spined assassin bug
- Chlamydatus associatus
- Minute pirate bugs
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**

Photo by Hunter Konchan
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

Cannabis aphid

Hemp russet mite

Photograph courtesy of Karl Hillig
What kinds of arthropods will we find associated with North American hemp in this new era? …and what is their association with the crop?
Hemp may support a diverse and robust complement of natural enemy species.
Herbivores associated with Hemp

- Leaf feeding species (all crops)
- Stalk borers (all crops)
- Hemipteran seed feeders (seed crops)
- Insects that damage flower buds (CDB crops)
What is a Hemp Insect?
What is a hemp insect?

Zygo gramma disrupta – a leaf beetle of ragweed

Argus tortoise beetles pupating on hemp

Physi phora demandata – a commonly seen fly that develops on decaying OM

Western corn rootworm

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?
Herbivores associated with Hemp

• Leaf feeding species (all crops)
• Stalk borers (all crops)
• Hemipteran seed feeders (seed crops)
• Insects that damage flower buds (CDB crops)
Insect/Mites with Sucking Mouthparts that Feed on Leaves

- Leafhoppers
- Aphids
- Thrips
- Spider Mites
- Russet Mites
There are some fluid feeding insects that occur on the leaves. Plus some treehoppers, planthoppers, and spittlebugs.
Most surprising insect associated with the crop?

Cannabis Aphid

*Phorodon cannabis*
Hop aphid
Phorodon hamuli

Cannabis aphid
Phorodon cannabis
Cannabis aphid is newly described from North America – but is very widely distributed in the U.S. and Canada.

Phorodon cannabis Passerini (Hemiptera: Aphidae), a newly recognized pest in North America found on industrial hemp

Whitney S. Cranshaw, Susan E. Halbert, Colin Favret, Katie E. Britt, Gary L. Miller

Abstract

*Phorodon cannabis* Passerini (Hemiptera: Aphidae: Macrosiphini) is reported for the first time as a pest of *Cannabis L.* crops in North America. The pest has been confirmed from fields of industrial hemp in Colorado and Virginia and has been found present within greenhouses in at least several American states and one Canadian province. The generic position of the aphid species is discussed and other known members of the genus are ruled out. *Phorodon cannabis* is placed in genus *Phorodon* Passerini and subgenus (Diphorodon Börner). *Phorodon persicoiiae* Shinji is transferred to *Hyalopterus* Koch as a nomen dubium.
Leafhoppers

Insects with sucking mouthparts that feed on leaves

Damage potential of Colorado species to crop: Negligible, at most
Beet curly top virus is transmitted to plants by the beet leafhopper (*Circulifer tenellus*).
Hemp russet mite
*Aculops cannabicola*

Photograph courtesy of Karl Hillig
Defoliators

Caterpillars

Beetles

Grasshoppers
Various caterpillars chew leaves of the plant (defoliators)

Yellowstriped armyworm

Thistle caterpillar

Beet armyworm

Zebra caterpillar

Beet webworm

Yellow woollybear
Two late season “woollybear” caterpillars are common.
Leaf Feeding Beetles

Palestriped flea beetle

Western black flea beetle

Southern corn rootworm adult and damage
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.
Research questions: What is the relationship between leaf loss (defoliation) and yield? Do plant injuries affect production of important compounds produced by the crop (e.g. THC, CBD)?
European corn borer

Eurasian hemp borer

Stem/Stalk Boring Insects

Photograph from the website of the Canadian Hemp Trade Alliance
There are some stem boring species that will be important in some areas.

**European corn borer**

*Ostrinia nubilalis*

Photographs courtesy of Frank Peairs.

Photograph from the website of the Canadian Hemp Trade Alliance.
An insect that surprised me when found in Colorado

Eurasian hemp borer

*Grapholita dilineana*
Several insects will be associated with ooze from wounds or infections of stems, stalks.

Photograph by Leah Black

*Physiphora demandata*

*Bumble flower beetle*
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

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??
Chewing Insects that Damage Buds

A particular issue of crops grown for CBD production
Key Insect Pests Emerging in Colorado Hemp Production

- Corn earworm
- Eurasian hemp borer
- Cannabis aphid
- Hemp russet mite
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.