

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*

Rooted cuttings



Mother plants



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

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Descriptive Phase

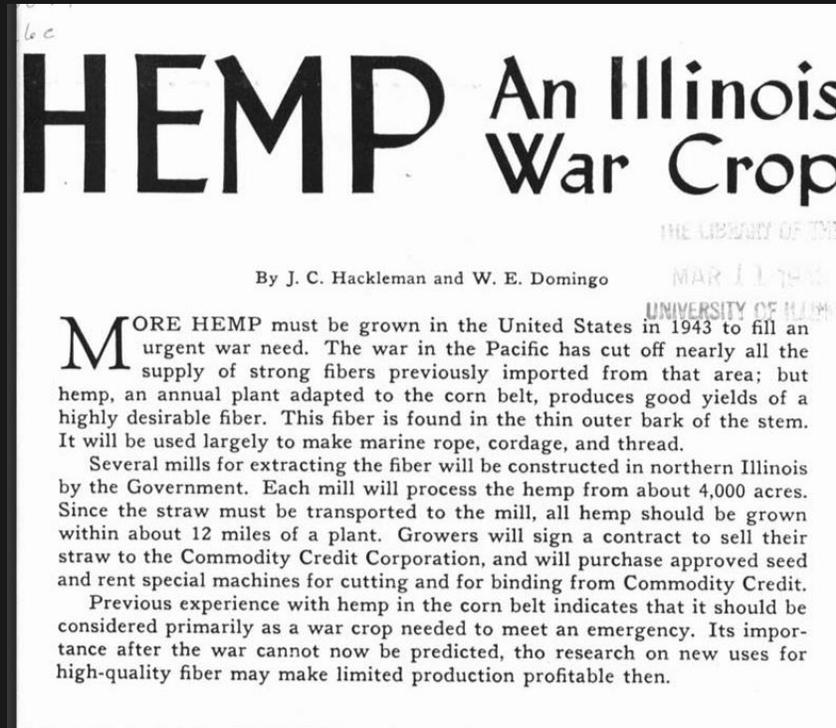
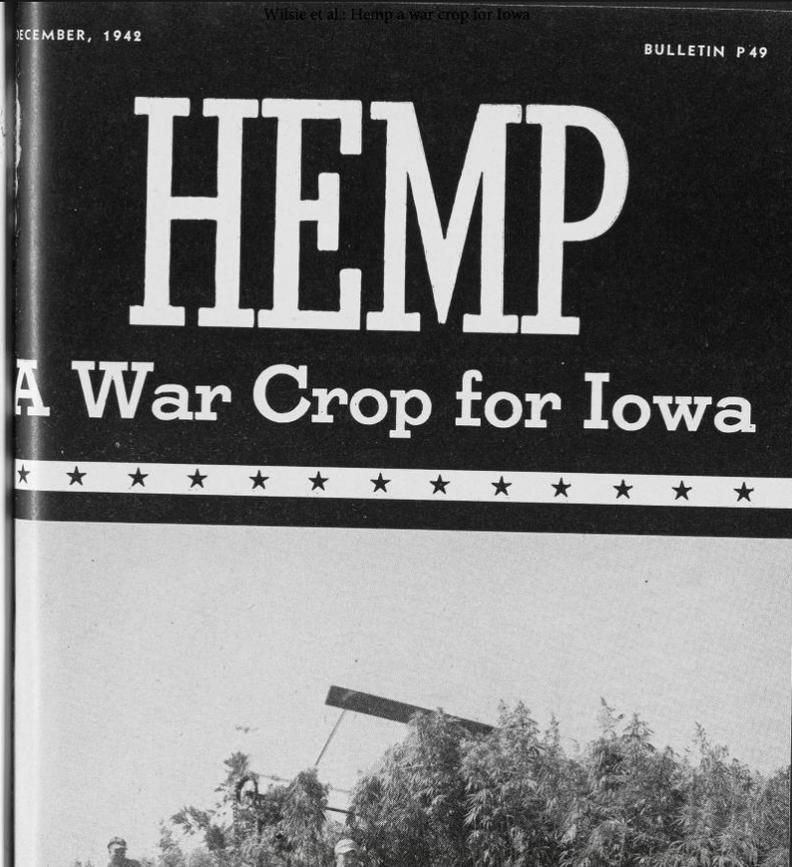


What kinds of arthropods will we find associated with North American hemp in this new era?



...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



The entomology details provided were cursory and appear to have little relevance to the present situation

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HEMP DISEASES AND PESTS

MANAGEMENT AND
BIOLOGICAL CONTROL

J.M. McPartland, R.C. Clarke
and D.P. Watson

KOPPERT
BIOLOGICAL SYSTEMS

Gw Pharmaceuticals Ltd
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CABI Publishing

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

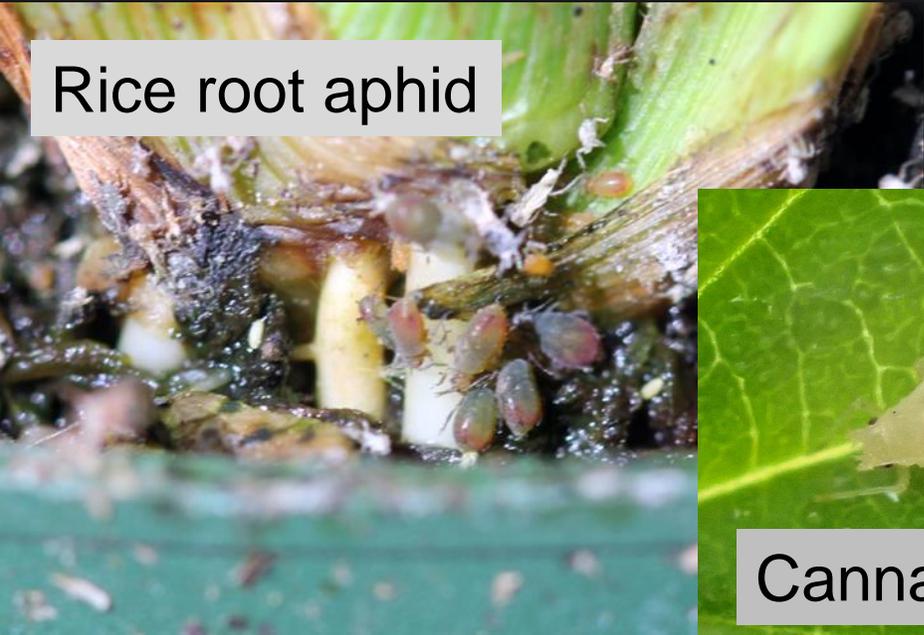


Hemp russet mite



Fungus gnats

Photograph courtesy of Karl Hillig



Rice root aphid



Cannabis aphid



Onion thrips



Twospotted spider mite
Tetranychus urticae



Photograph courtesy of Karl Hillig

Hemp russet mite

Aculops cannabicola



Photograph courtesy of Karl Hillig



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



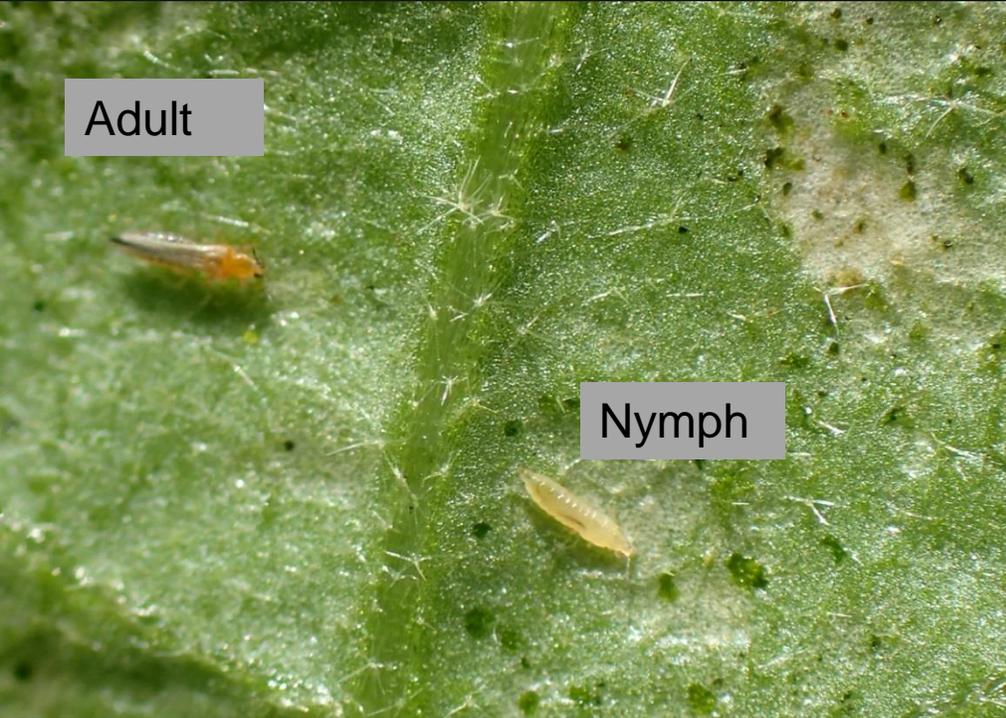
Wingless forms at base of plant



Cannabis Aphid

Phorodon cannabis





Adult

Nymph



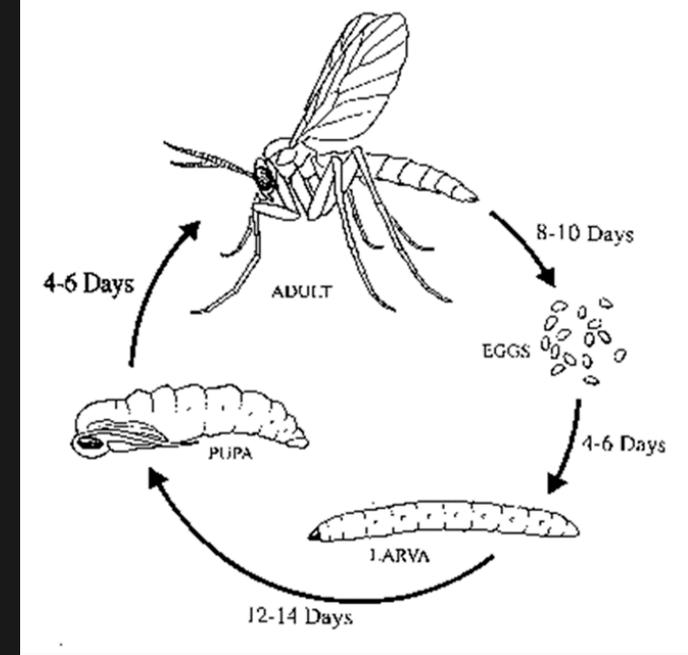
Extensive leaf injury by onion thrips

Onion Thrips

Thrips tabaci



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.”



Syrphid flies



Green lacewings



A robust complex of natural enemies can be expected to be found in hemp when it is grown outdoors

Collops beetles



Damsel bugs



The most common lady beetles found in hemp fields



Convergent lady beetle



Multicolored Asian lady beetle



Sevenspotted lady beetle



Also common were
Hippodamia parenthesis,
Olla c-nigrum, and
Coccinella novemnotata

Adults



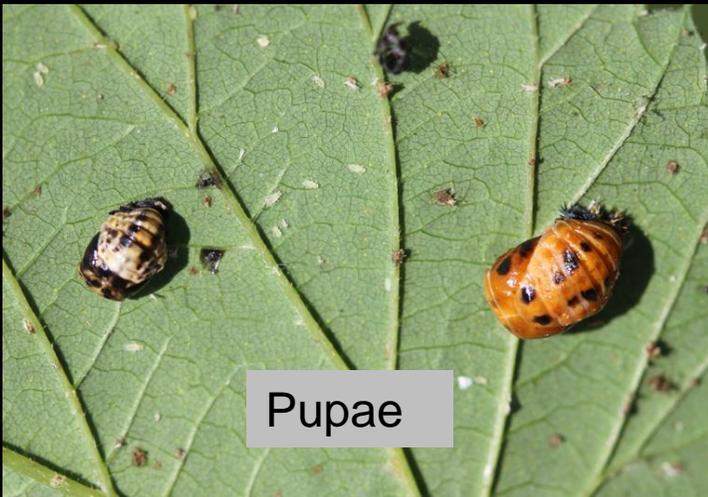
Eggs



Larvae



Pupae



Lady Beetle Life Stages



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

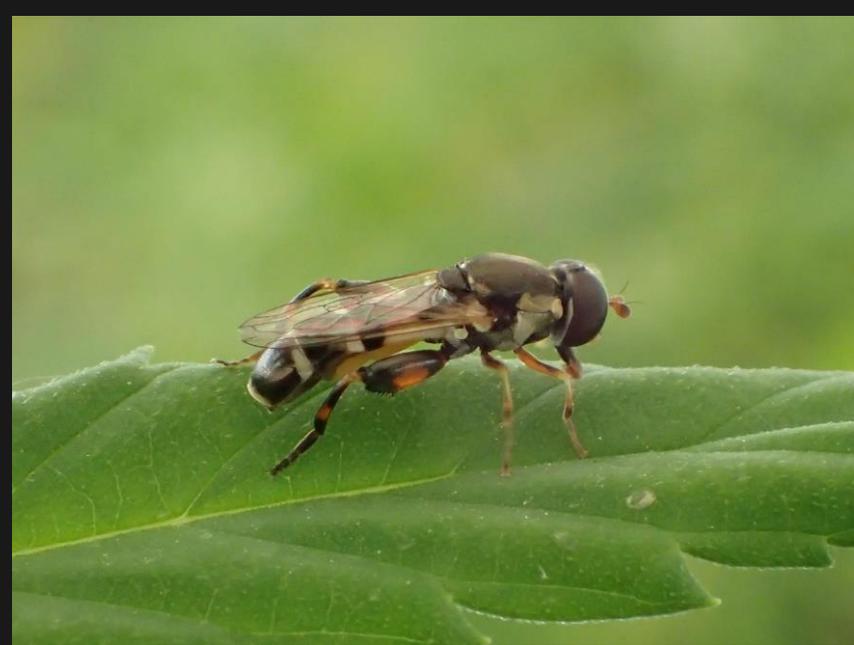


Three species of **Green Lacewings** have been observed in hemp fields



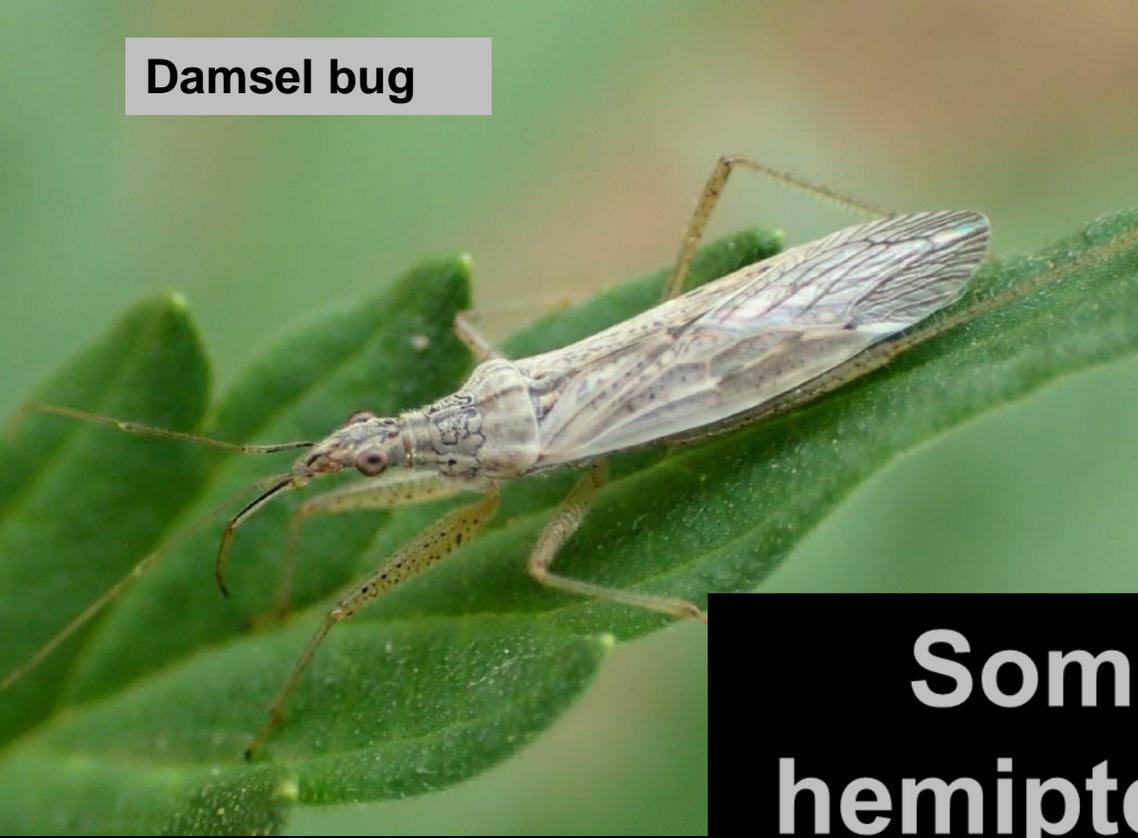
Chrysopa oculata,
Chrysoperla floribunda,
Chrysoperla nigricornis

Flower flies

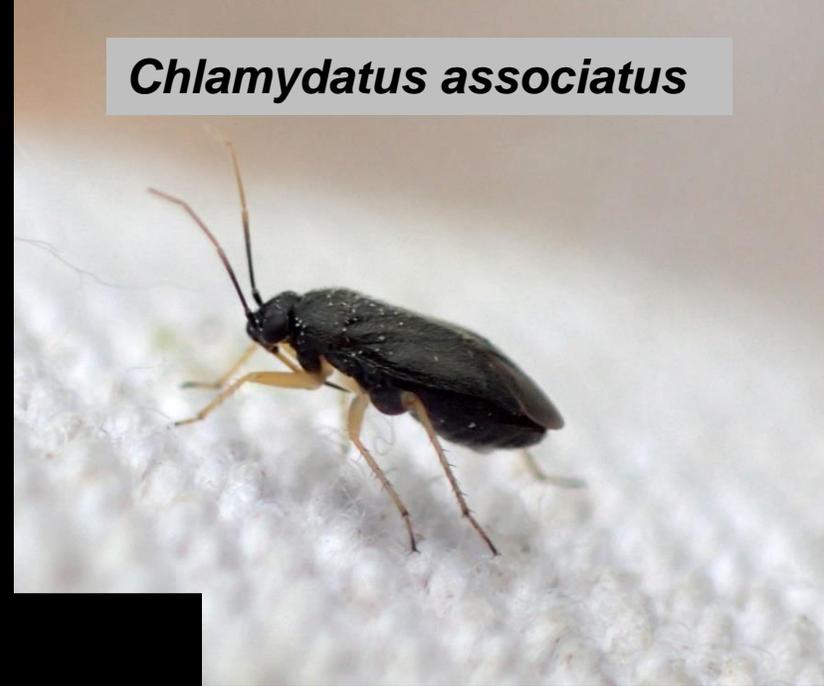


....and other families of predatory flies

Damsel bug



Chlamydatus associatus



**Some generalist
hemipteran predators**

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



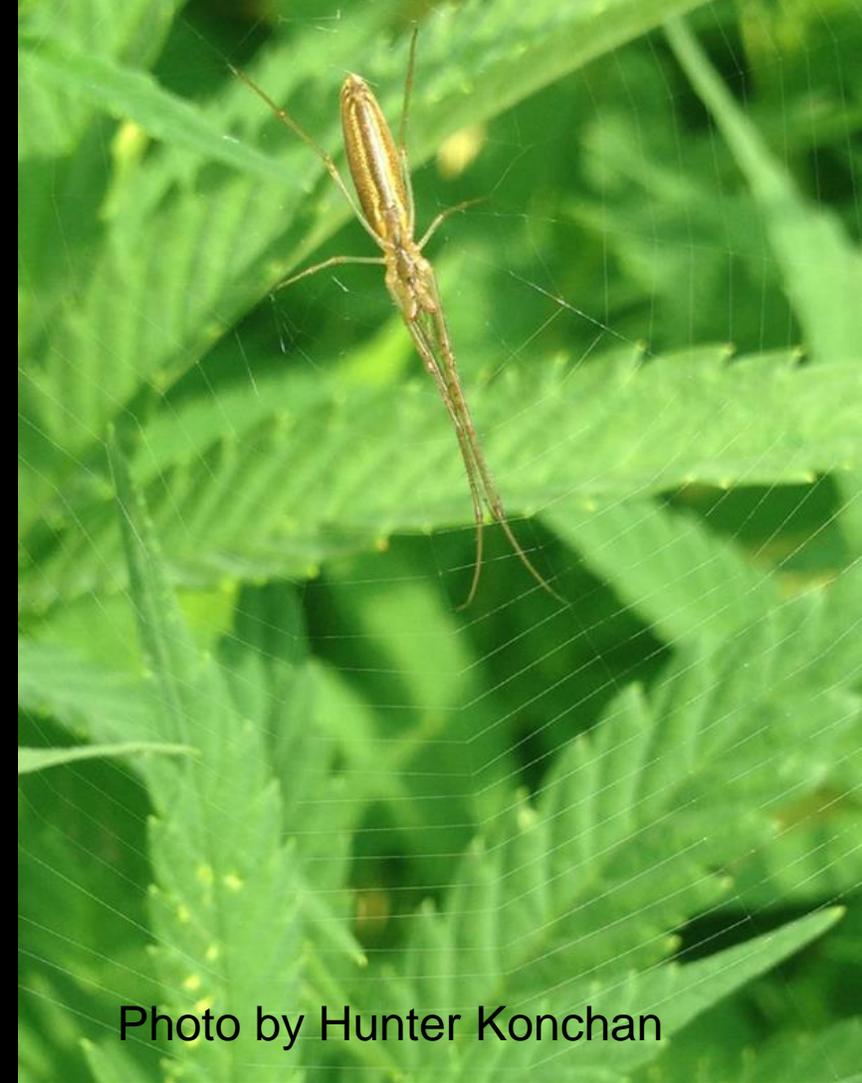


Photo by Hunter Konchan



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

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



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?

Lady beetles and other
Coleopteran predators



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

Green lacewings



Syrphid flies



Spiders and other
arachnid predators



Predatory Hemiptera



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?



Zygogramma disrupta –
a leaf beetle of ragweed



What is a hemp insect?

Western corn rootworm



Argus tortoise beetles
pupating on hemp



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



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?



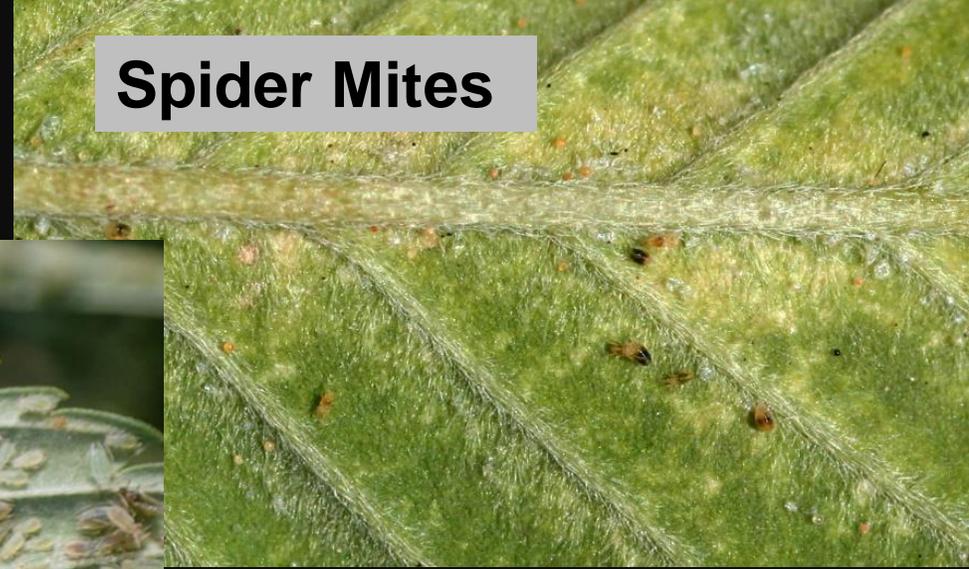
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Insect/Mites with Sucking Mouthparts that Feed on Leaves



Leafhoppers



Spider Mites



Aphids



Thrips



Russet Mites

There are some fluid feeding insects that occur on the leaves



Aphids

Plus some treehoppers, planthoppers, and spittlebugs



Leafhoppers

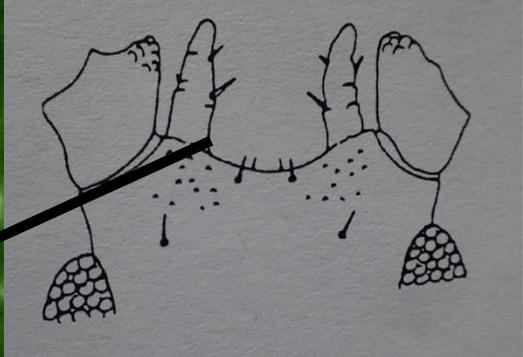




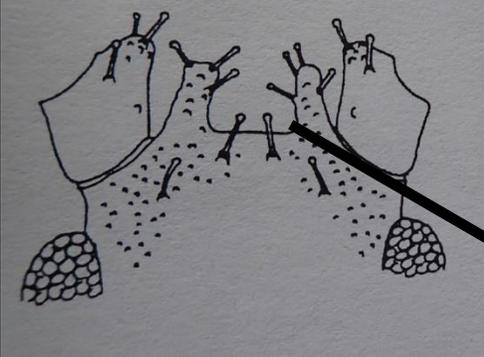
Most surprising
insect associated
with the crop?

Cannabis Aphid
Phorodon cannabis





Hop aphid
Phorodon hamuli



Cannabis aphid
Phorodon cannabis

Cannabis aphid is newly describe from North America – *but is very widely distributed in the U.S. and Canada*



Insecta Mundi

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

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

Abstract

Phorodon cannabis Passerini (Hemiptera: Aphididae: Macrosiphini) is reported for the first time as a pest of *Cannabis* L. crops in North America. The insect 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 persifoliae* Shinji is transferred to *Hyalopterus* Koch as a *nomen dubium*.

Insects with sucking mouthparts that feed on leaves



Leafhoppers

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

Possible newly identified insect-
vectored pathogen of hemp – **beet
curly top virus**



Beet curly top virus is transmitted to plants
by the beetle leafhopper (*Circulifer tenellus*)



Photograph courtesy of Karl Hillig

Hemp russet mite

Aculops cannabicola



Photograph courtesy of Karl Hillig

Defoliators



Caterpillars



Grasshoppers



Beetles

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



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



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**

Photograph from the website of the Canadian Hemp Trade Alliance

Stem/Stalk Boring Insects

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



Green June beetle

Physiphora demandata



Bumble flower beetle



Photograph by Leah Black

Hemipteran seed/flower feeders



Miridae



Pentatomidae



Lygaeidae



Rhopalidae

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??



Chewing Insects that Damage Buds



A particular issue of
crops grown for
CBD production

Corn earworm



Key Insect Pests Emerging in Colorado Hemp Production

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