

Arthropod pests of hemp

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Questions?

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Ph.D. in Entomology from
Virginia Tech

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Research: arthropod pest
management in hemp and
cannabis



Arthropods associated with hemp

- Pest species



- Beneficial species



- Occasional feeders



- Transient species

- Just passing through

- Attracted to other species more than hemp



Corn earworm

Scientific name: *Helicoverpa zea*

Range: EVERYWHERE

Generalist / specialist

Indoor / outdoor

Likelihood of encounter: certain



Matt Bertone



Corn earworm

Scientific name: *Helicoverpa zea*

Range: EVERYWHERE

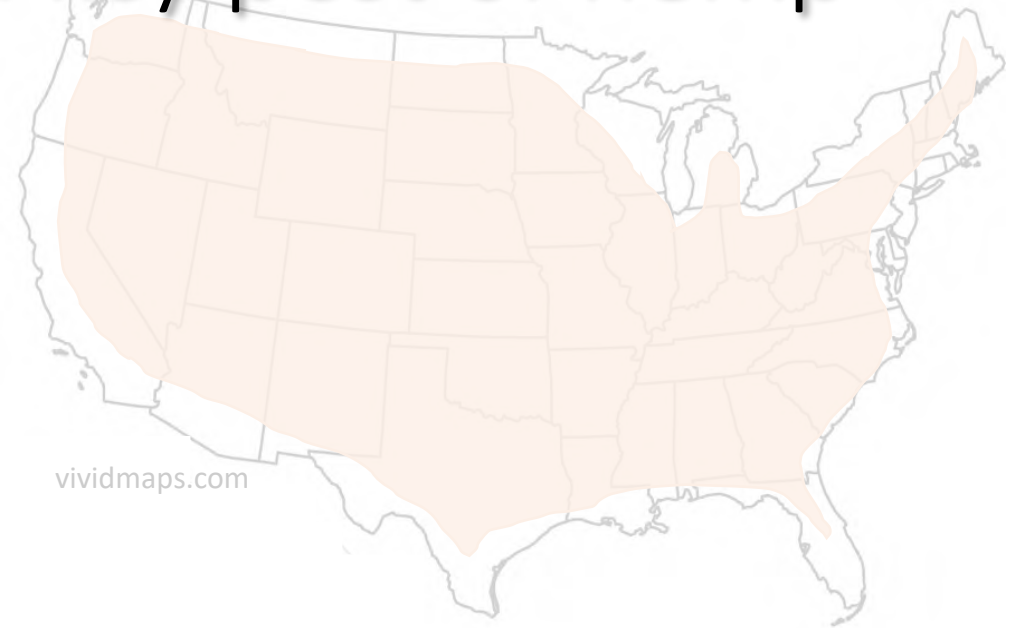


Corn earworm is a key pest of hemp

Generalist / specialist

Indoor / outdoor

Likelihood of encounter: certain





Matt Bertone

Corn earworm, *Helicoverpa zea*



Mike Parrish, Virginia Cooperative Extension

Adult female



Eggs – super tiny!

Corn earworm, *Helicoverpa zea*



Corn earworm, *Helicoverpa zea*



Vary in size

Corn earworm, *Helicoverpa zea*



Vary in size, coloration

Corn earworm, *Helicoverpa zea*



Vary in size, coloration, and location



Larval coloration can vary



Attracted to and feed from inflorescences

Corn earworm, *Helicoverpa zea*



Can nestle in plants (hard to see)

Corn earworm, *Helicoverpa zea*



Can nestle in plants (hard to see) and chew various parts of the plant

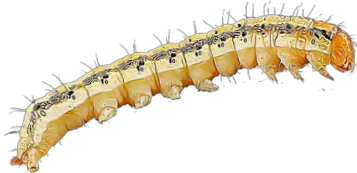


Chewing can
damage stem
integrity

Feeding injury → bud rot



Feeding injury → bud rot



→ feeding wounds → pathogens → rot



Rot can be present throughout bud material



Frass (🦿) can be an additional contaminant



Field research



Journal of Integrated Pest Management, (2021) 12(1): 34; 1–11
<https://doi.org/10.1093/jipm/pmab030>
Issues



ENTOMOLOGICAL
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Pest Management Needs and Limitations for Corn Earworm (*Lepidoptera: Noctuidae*), an Emergent Key Pest of Hemp in the United States

Kadie E. Britt,^{1,2,20} Thomas P. Kuhar,³ Whitney Cranshaw,⁴ Christopher T. McCullough,⁵
Sally V. Taylor,⁶ Benjamin R. Arends,⁷ Hannah Burrack,⁸ Melissa Pulkoski,⁸
David Owens,⁹ Tigist A. Tolosa,¹⁰ Simon Zebelo,¹⁰ Katelyn A. Kesheimer,¹¹
Olufemi S. Ajayi,¹² Michelle Samuel-Foo,¹² Jeffrey A. Davis,¹³ Nathan Arey,¹³
Hélène Doughty,¹⁴ Joanne Jones,¹⁵ Marguerite Bolt,^{16,17} Bradley J. Fritz,¹⁸
Jerome F. Grant,¹⁹ Julian Cosner,¹⁹ and Melissa Schreiner⁴



Field research

No significant relationship between trap catch and larval abundance at any site



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Field research

No significant relationship between trap catch and larval abundance at any site

Pheromone trap catch is likely not a reliable predictor of larval presence in hemp



Journal of Integrated Pest Management, (2021) 12(1): 34; 1–11
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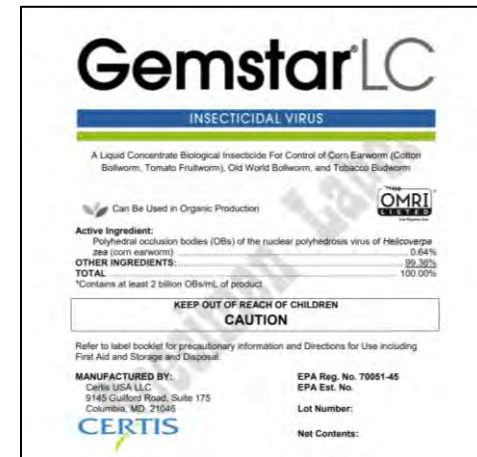


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Corn earworm management


- *Helicoverpa zea* nucleopolyhedrovirus
 - Timing is incredibly important
 - Greater efficacy on SMALL caterpillars
 - Safe for non-targets



Arthropod Management Tests, 46(1), 2021, 1–2
doi: 10.1093/amt/tsab108
Section F: Field & Cereal Crops



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OXFORD

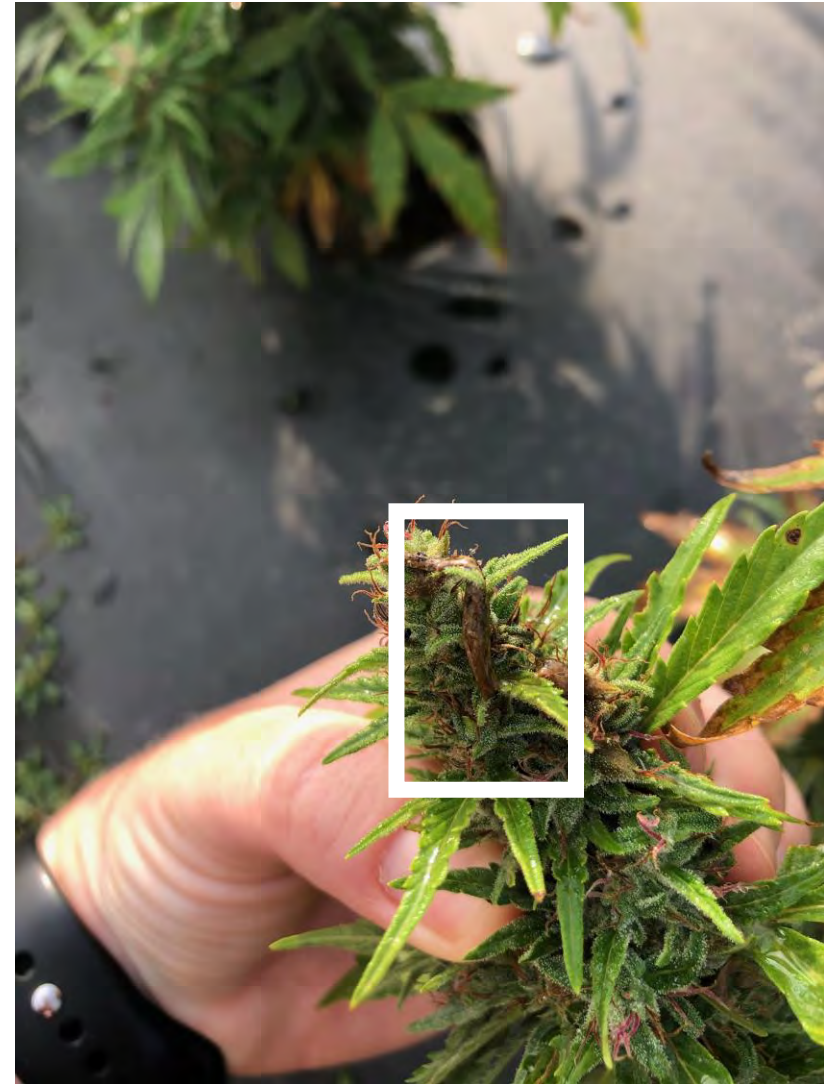
HEMP: *Cannabis sativa* Lamarck, 'Sweeten'

Evaluation of Biological Insecticides to Manage Corn Earworm in CBD Hemp, 2020

Kadie E. Britt,^{1,•} T. David Reed,² and Thomas P. Kuhar^{1,3,•}



Virus-infected larvae



Virus-infected larvae



- Dying larvae migrate to top of plant
- Upon death, larval body breaks down, viral particles disperse through field

Conclusions

- Corn earworm will remain a damaging pest in hemp for the foreseeable future.

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- Of the legal/allowable options, NPV insecticides may offer the highest level of corn earworm larval suppression.

Conclusions

- Corn earworm will remain a damaging pest in hemp for the foreseeable future.
- The best option for management at this time is to scout and initiate control measures at first appearance of larvae.
- Of the legal/allowable options, NPV insecticides may offer the highest level of corn earworm larval suppression.
- **More research is needed!** Timing, number of applications, etc.

Cannabis aphid

Scientific name: *Phorodon cannabis*

Range: EVERYWHERE

Generalist / specialist

Indoor / outdoor

Likelihood of encounter: probable



Matt Bertone



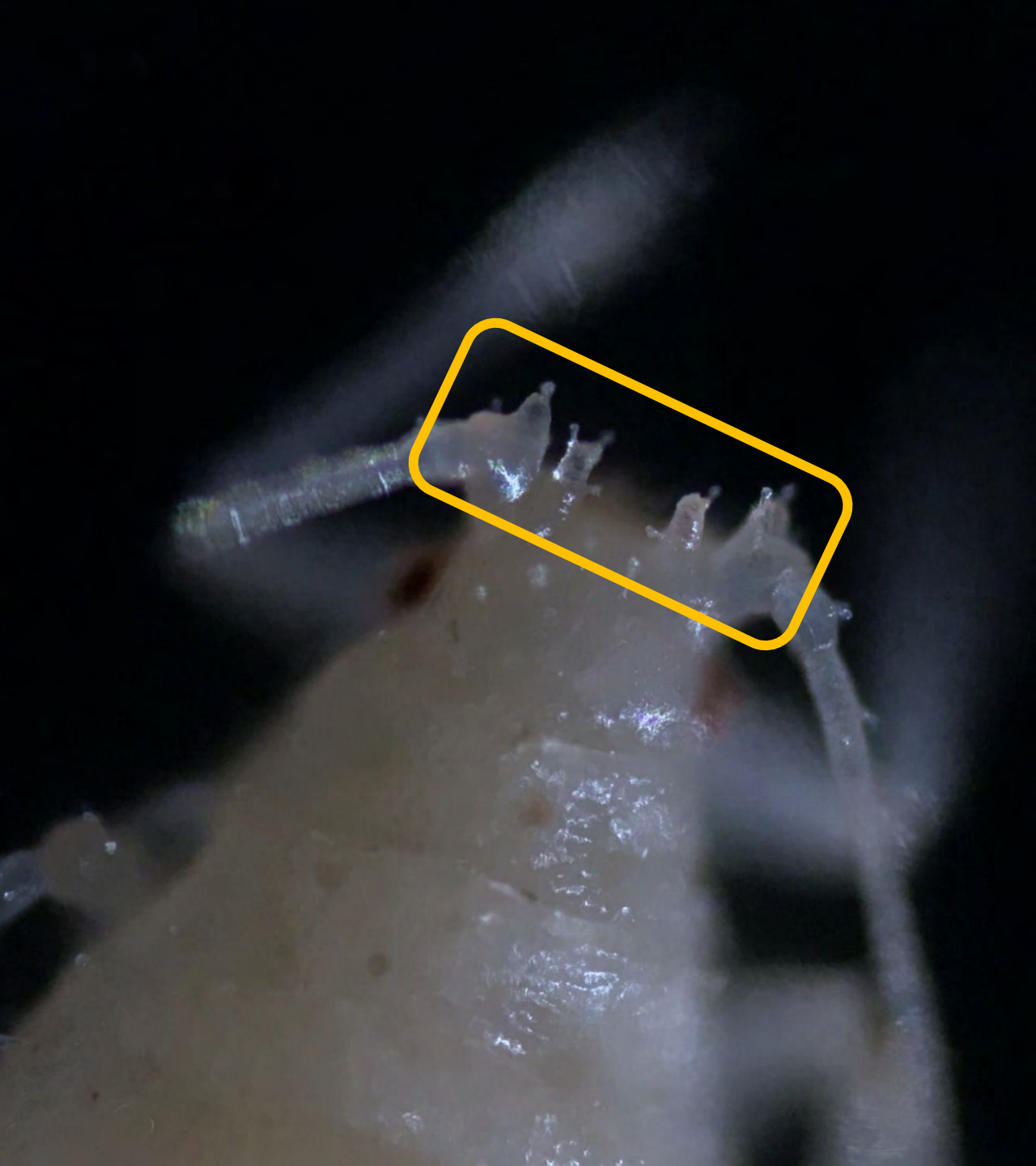
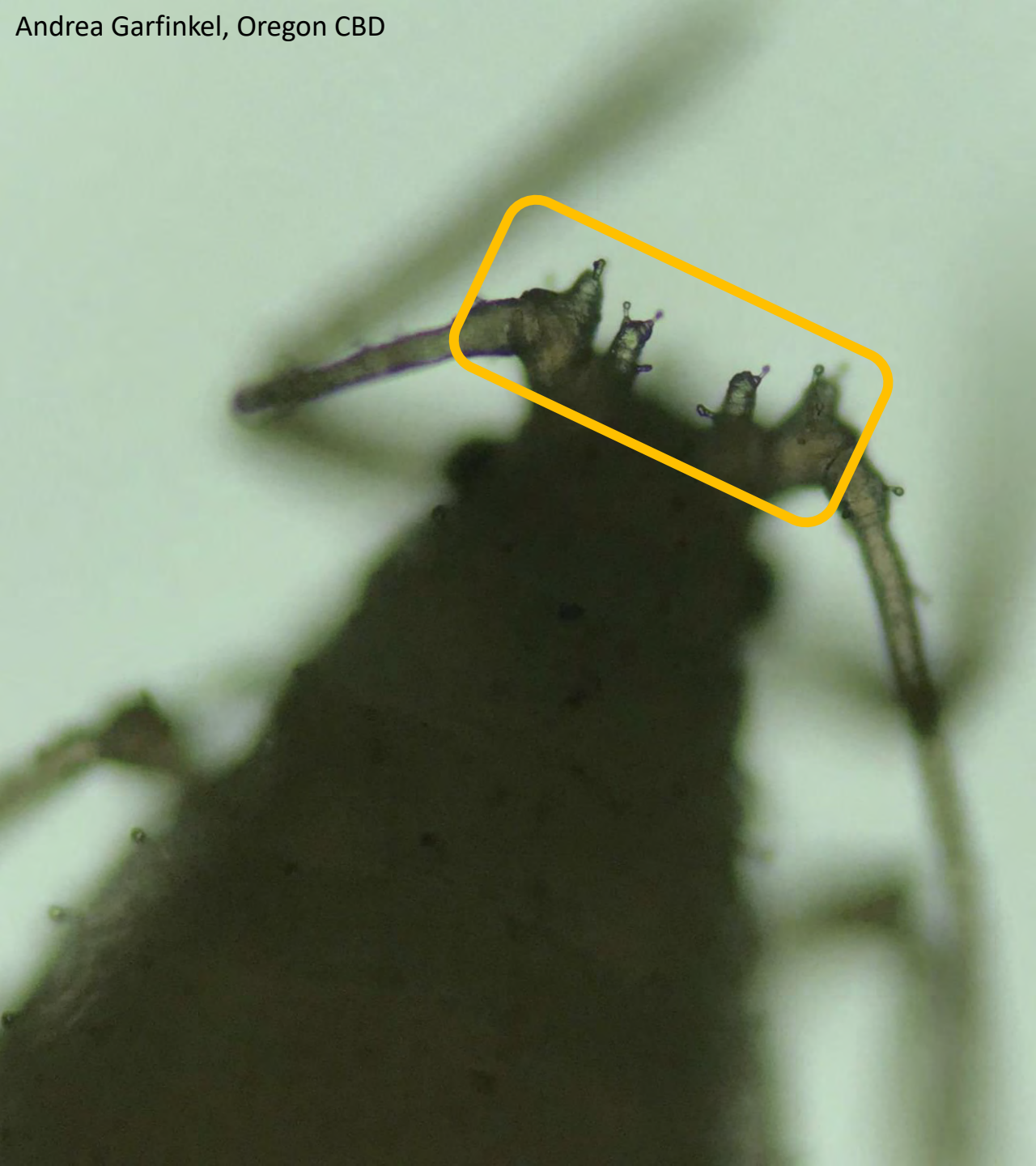
vividmaps.com

Cannabis aphid, *Phorodon cannabis*



Matt Bertone

Cannabis sativa is the only plant species on which cannabis aphid can feed and develop





Asexual reproduction is typical for cannabis aphid (and other aphids). Female gives live birth to identical offspring.

Reproductive (winged) forms can develop as well.



Females can produce
several offspring per
day



Outdoor populations are highest in late season.

With asexual production, populations can increase quickly.



Cannabis aphid can be found all throughout the plant
(leaves, stems, bud material)



Sooty mold formation (black substance) is common due to honeydew. Aphid exoskeletons (cast skins) can stick to leaves.



© MATT BERTONE 2017



Aphid damage on
Viburnum

University of Maryland
Extension

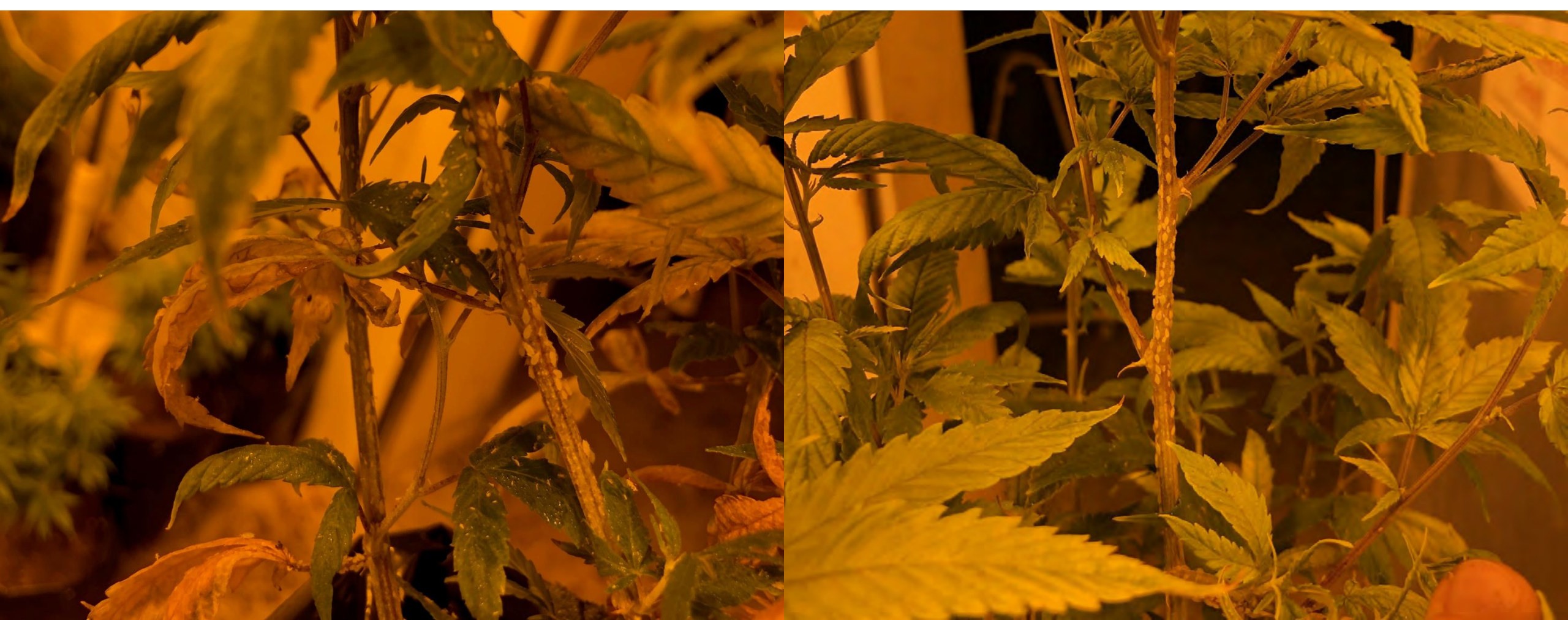
Yellowing, leaf curling, and wilting are typical symptoms resulting from aphid infestations in other plants. This is not always common with cannabis aphid.





With asexual production, populations can increase quickly.

Plants can be full of aphids and still retain vigor.



With asexual production, populations can increase quickly.

Plants can be full of aphids and still retain vigor.



Removal of plant material outdoors is important. Cannabis aphid can likely sustain populations between seasons.



Natural enemies can aid management

Cannabis aphid management strategies

- Always scout
- Outdoors
 - Remove crop debris at season end
 - Natural enemies will aid management
- Indoor
 - Inspect plants/plant material prior to introduction
 - Natural enemies
- Insecticides:
 - Soaps, neem, azadirachtin, other biologicals
 - Pyrethrins – last resort



Twospotted spider mite

Scientific name: *Tetranychus urticae*

Range: EVERYWHERE

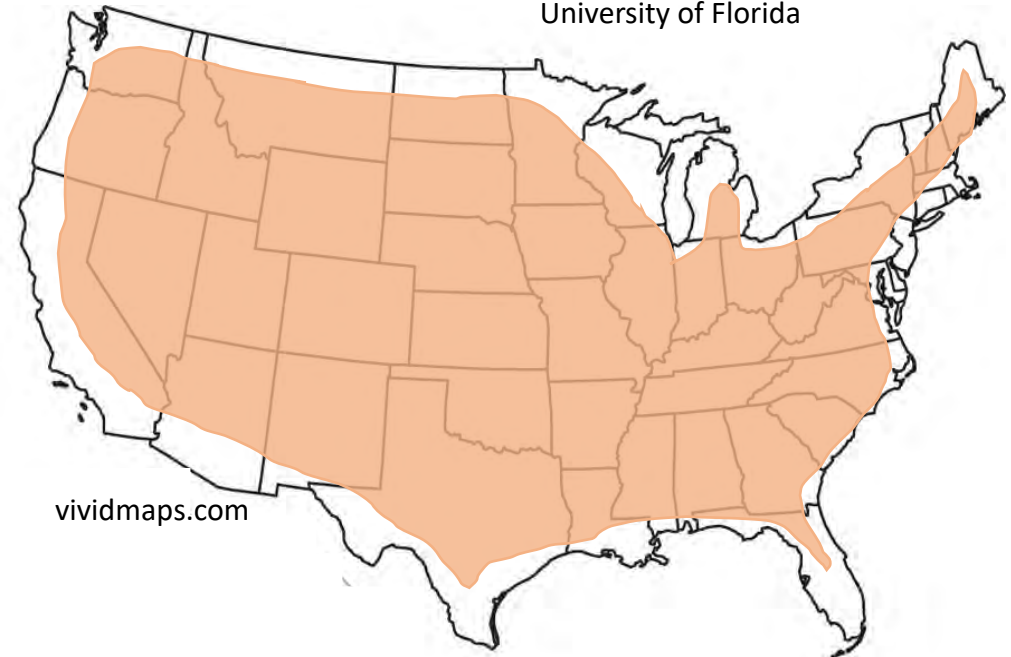
Generalist / specialist

Indoor / outdoor

Likelihood of encounter: possible



University of Florida



Twospotted spider mite is a common indoor pest.

It is less frequently encountered outdoors, but can be more common in drier, arid climates.





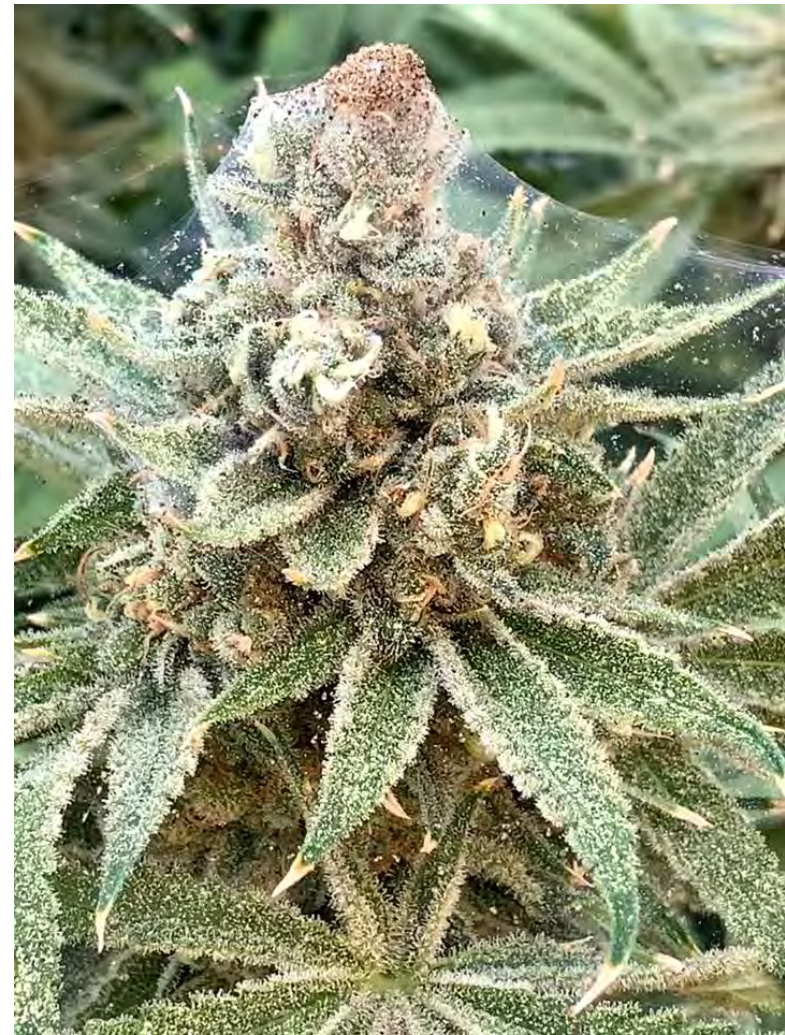
Twospotted spider mites have needle-like piercing-sucking mouthparts.

Stippling on leaves is common due to twospotted spider mite feeding.



Felix Vasquez

Webbing is common where populations are dense

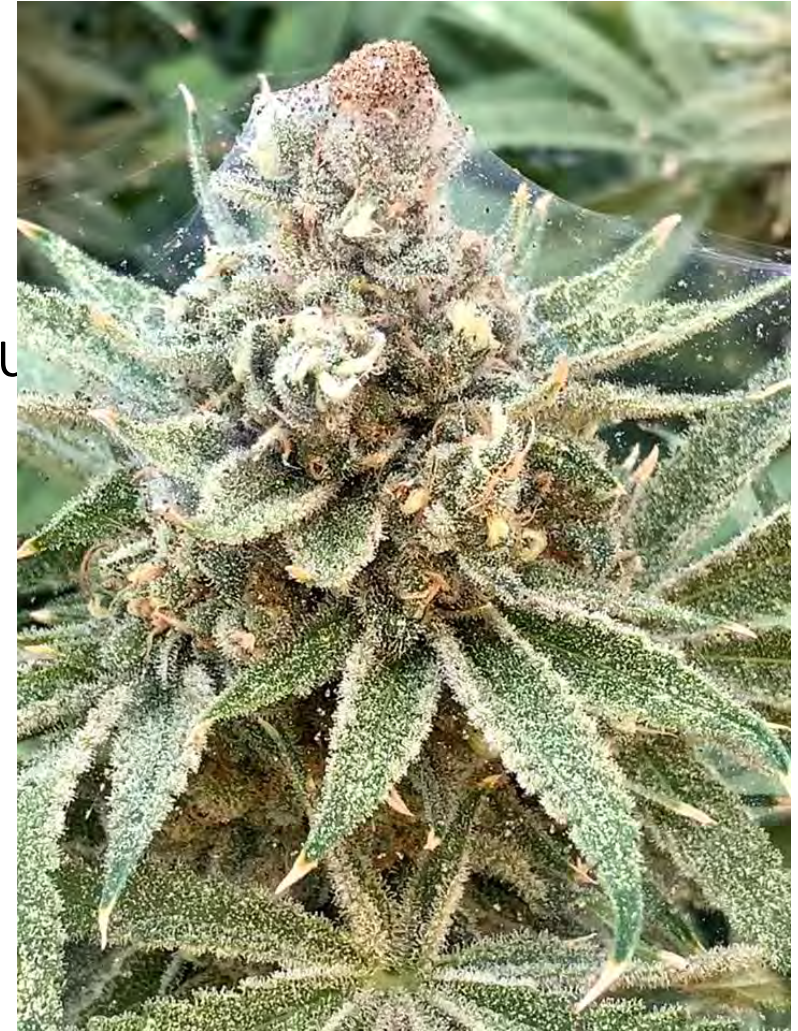


Felix Vasquez

Webbing is common where populations are dense

Twospotted spider mite management strategies

- Always scout
- Indoor
 - Inspect plants/plant material prior to introduction
 - Natural enemies
 - *Phytoseiulus persimilis*
 - Other species of predatory mites
 - *Orius insidiosus* (minute pirate bugs)
- Pesticides:
 - Insecticidal soaps
 - Oils



Felix Vasquez

Hemp russet mite

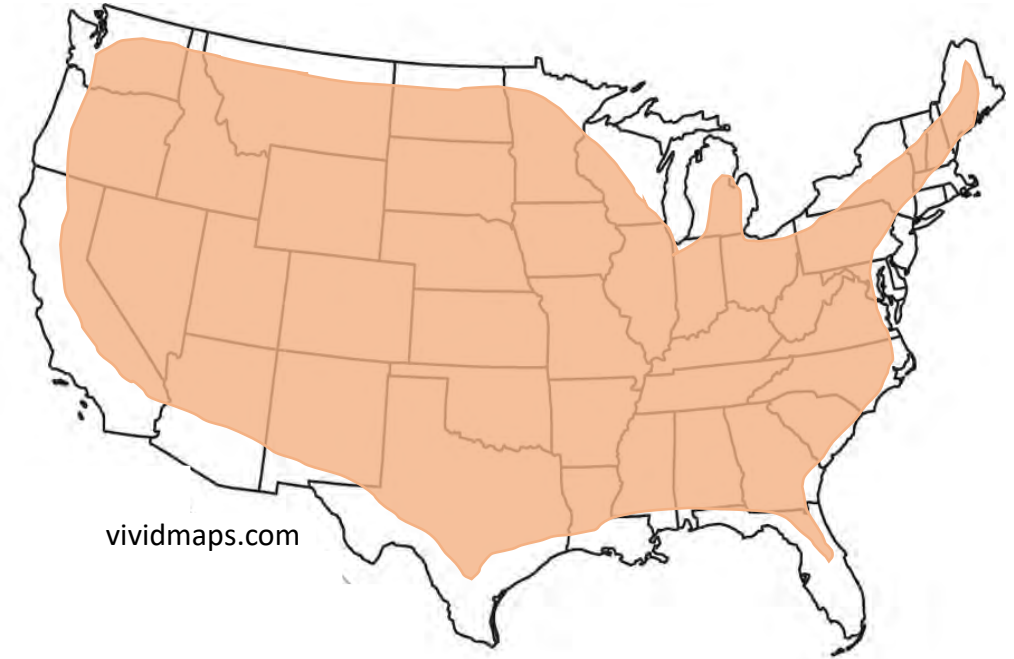
Scientific name: *Aculops cannabicola*

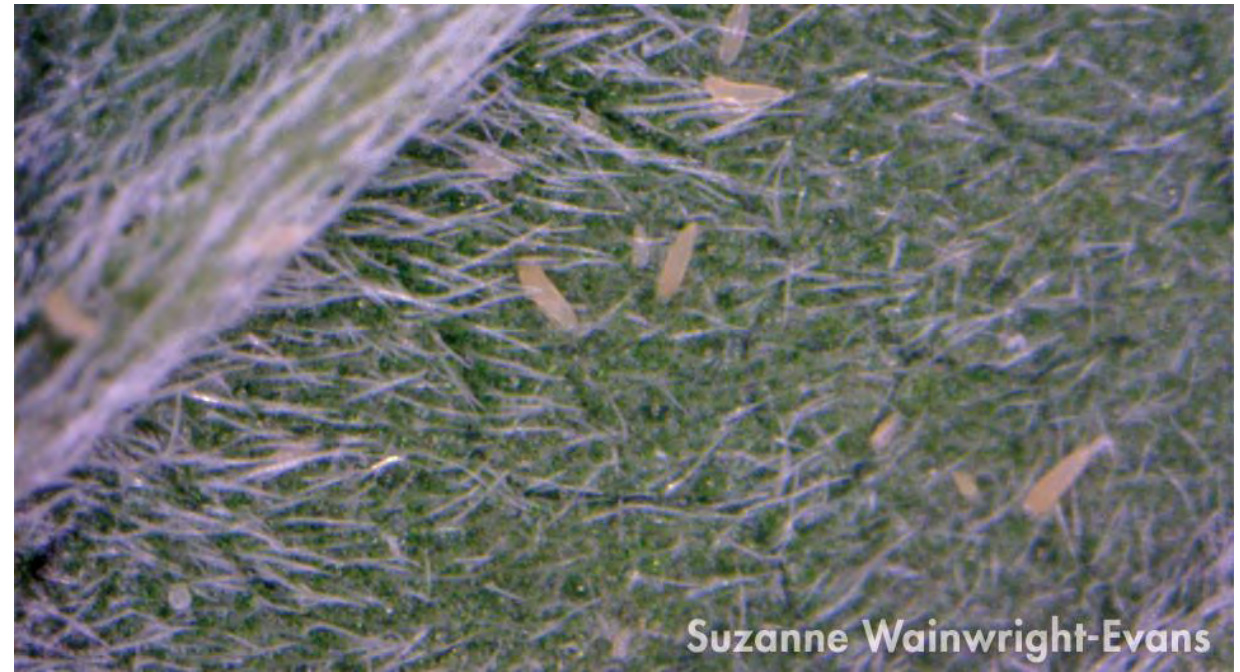
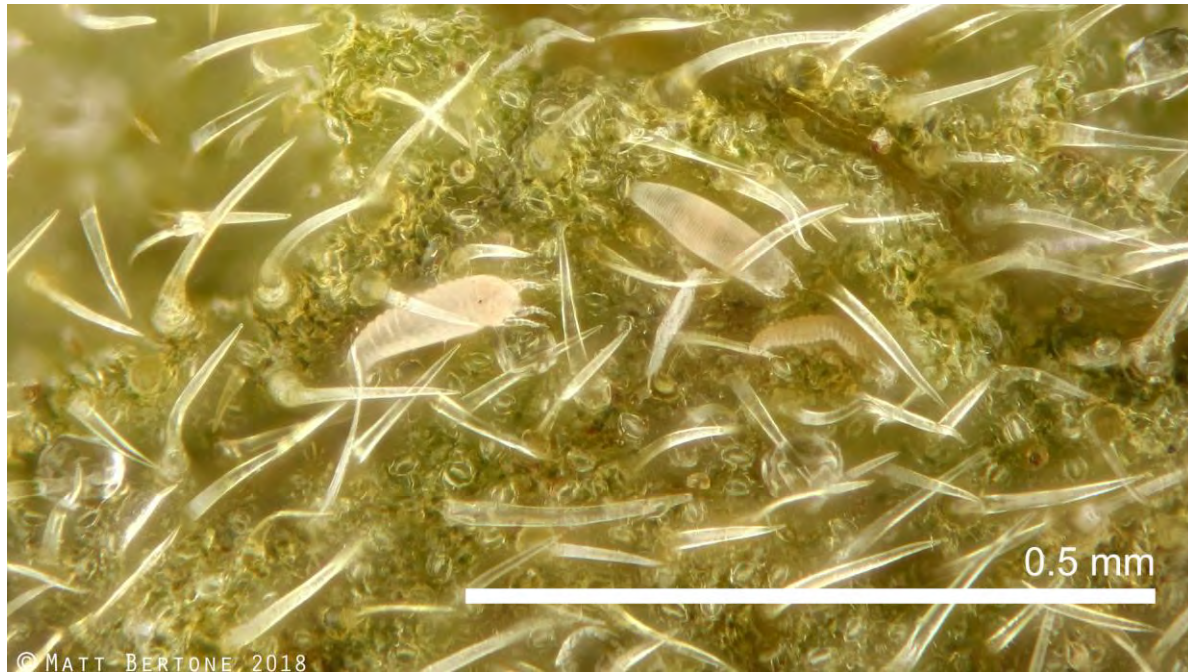
Range: Everywhere (?)

Generalist / specialist

Indoor / outdoor

Likelihood of encounter: possible





Mites are VERY SMALL

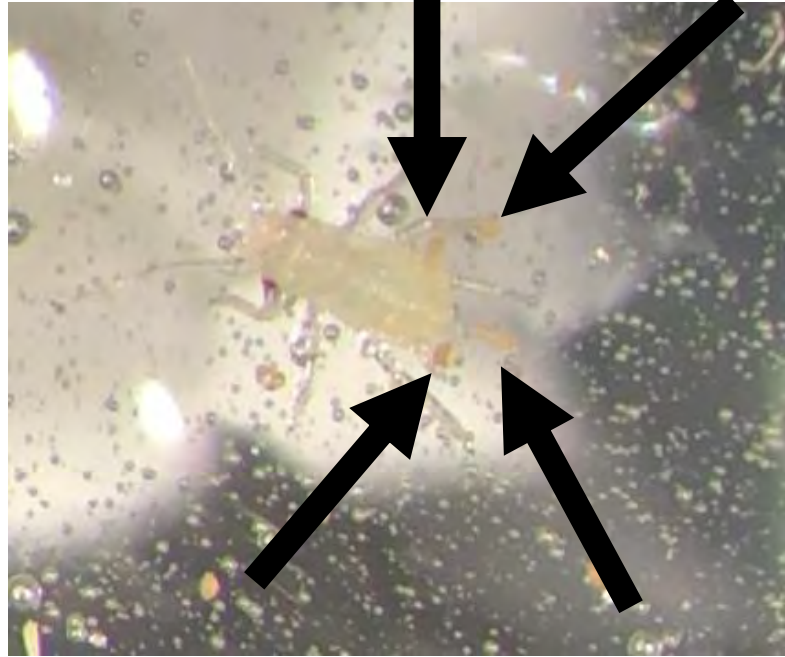
Cannot be seen with the naked eye

Microscopy (or a very strong hand lens) is needed to confirm presence



Whitney Cranshaw

Mites are VERY SMALL



Russet mites are super tiny!

Hemp russet mite, *Aculops cannabicola*



Mites infest developing buds

Feeding can reduce size and quality of future buds

Whitney Cranshaw



Whitney Cranshaw

Plant tissue has a dirty or grey appearance when russet mites have fed



Russet mite feeding injury
can lead to decreased
bud density



Hemp russet mite is a problem indoors and outdoors.

Issues can arise from infested transplants.



David Dycus

With lots of mites, plant material
can look dirty or dusty.



Karl Hillig



Karl Hillig

The dusty appearance is an abundance of mites



Hemp russet mite injury? Maybe.

Some cultivars produce leaf curl in response to hemp russet mite feeding.

Leaf curling can sometimes occur, but this is not always a symptom.

Microscopy should be used to confirm presence of mites.





Leaf curling can sometimes occur, but this is not always a symptom

Hemp russet mite management strategies

- Always scout
- Indoor
 - Inspect plants/plant material prior to introduction
 - Natural enemies
 - ?
- Pesticides:
 - Oils
 - Sulfur



Karl Hillig

Beet leafhopper

Scientific name: *Circulifer tenellus*

Range: Western United States

Generalist / specialist

Indoor / outdoor

Risk level: Very likely, if in the west



UC IPM





Beet leafhopper transmits beet curly top virus



Nachappa et al. 2020 Outlooks Pest Manag







Lots of leafhoppers found in hemp!



Victoria Morelos

Britt et al. 2022. First year survey of arthropods in California hemp.



Marguerite Bolt

Leafhoppers can cause yellowing, stunting, and distortion.



Marguerite Bolt

Leafhoppers can cause yellowing, stunting, and distortion.



Marguerite Bolt



Beet leafhopper/leafhopper management strategies

- ???
- No resistant cultivars are known at this time
- No seed treatments exist for hemp
- Pesticides?
 - Leafhoppers feed quickly, transmit virus quickly
 - Would currently available insecticide options aid management?



Rice root aphid

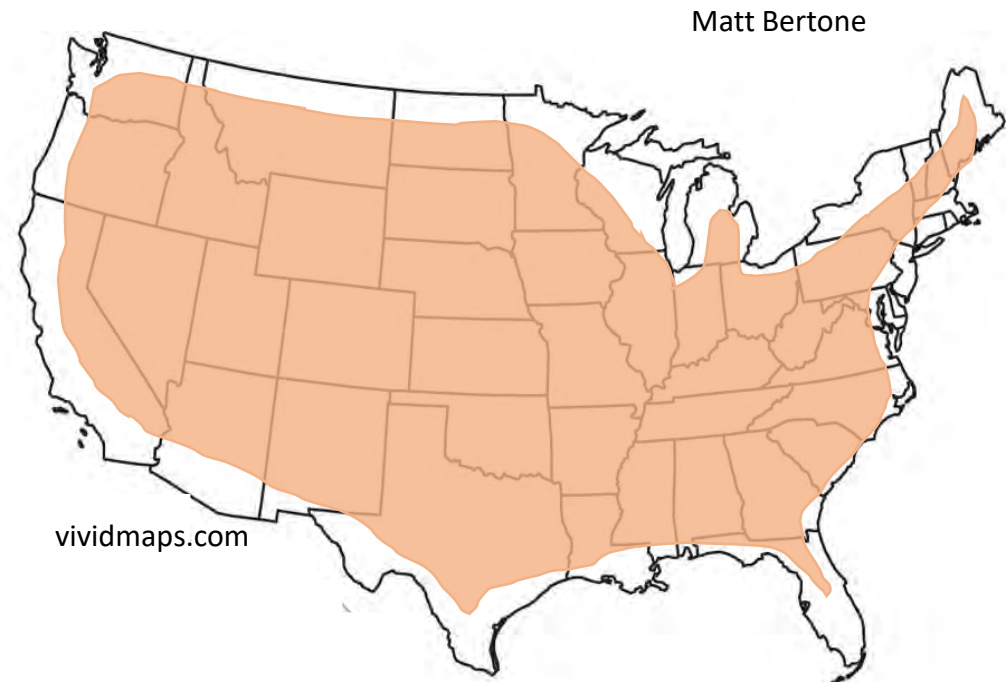
Scientific name: *Rhopalosiphum rufiabdominalis*

Range: Everywhere

Generalist / specialist

Indoor / outdoor

Risk level: moderate



Rice root aphid



Madison Cartwright, Whitney Cranshaw, Suzanne Wainwright-Evans



Felix Vasquez



Felix Vasquez

Rice root aphid management strategies

- Scout, when possible
 - More challenging with a root pest
- Insecticides
 - Azadirachtin soil drench
 - Very dependent on local and state regulations



Madison Cartwright, Whitney Cranshaw, Suzanne Wainwright-Evans

Chewing insects



Yellowstriped armyworm, *Spodoptera ornithogalli*

And many other caterpillars that chew leaves
(cutworms, armyworms, woollybears)



Grasshoppers



Whitney Cranshaw



Whitney Cranshaw

Grasshoppers



Whitney Cranshaw



5569069
Whitney Cranshaw

Northern, Southern, Western Corn Rootworm



Northern corn rootworm



Southern corn rootworm



Western corn rootworm



Flea beetles



Whitney Cranshaw

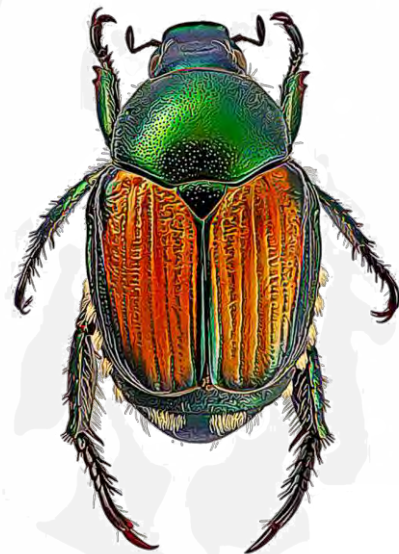


5596868

Scarab Beetles



May beetle



Japanese beetle



June beetle

John Fike



Even with considerable defoliation, yield loss and/or negative impacts to plants have not been observed



Piercing-sucking insects



Other aphids



Potato aphid
UC IPM



Green peach aphid
UC IPM



Melon (cotton) aphid
UC IPM

Matt Bertone



Stink bugs



Brown marmorated stink bug
Halyomorpha halys



Green stink bug
Chinavia hilaris



Rice stink bug
Oebalus pugnax



Twice stabbed stink bug
Cosmopepla lintneriana



Lygus bugs



Pale legume bug
Lygus elisis



Tarnished plant bug
Lygus lineolaris



Western tarnished plant bug
Lygus hesperus

False chinch bug, *Nysius raphanus*



Whitney Cranshaw

Whiteflies



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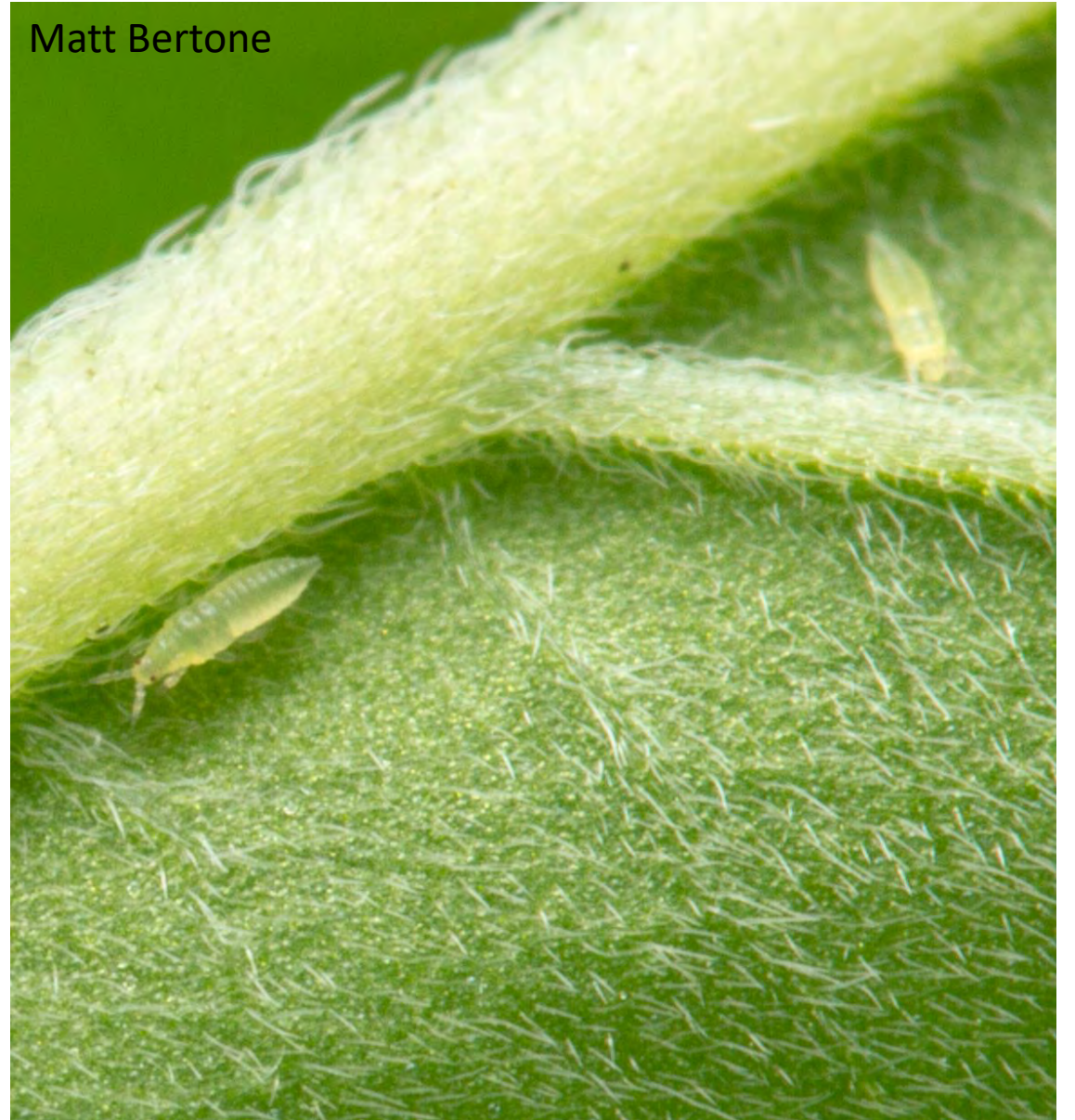
Whitney Cranshaw

Thrips

Matt Bertone



Matt Bertone

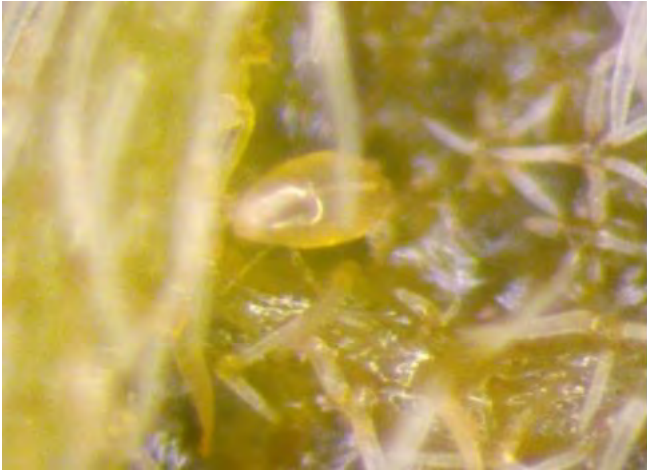




Matt Bertone



Broad mite, *Polyphagotarsonemus latus*



Karla Adesso

Broad mite?



Root pests



Fungus gnats



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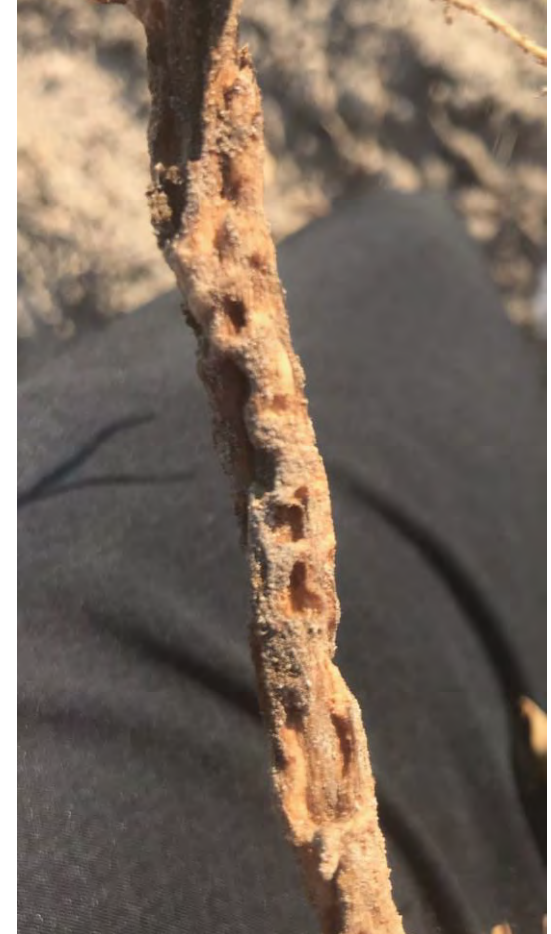


Fire ants



Katelyn Kesheimer

Fire ants



Katelyn Kesheimer, Taylor Clarke

Termites



David Reed

Wireworms



David Reed

Leaf miners



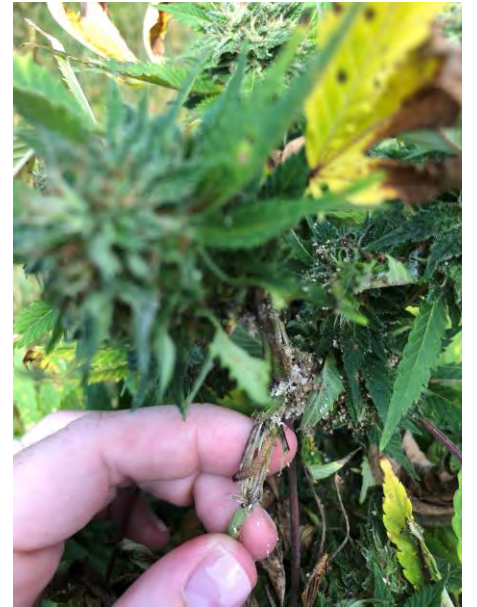


Eurasian hemp borer,
Grapholita delineana



Whitney Cranshaw

European
corn borer,
*Ostrinia
nubilalis*





Pesticides are federally regulated

- Pesticides: chemicals used to destroy, prevent, or control pests
 - “Pesticide” can mean a fungicide, herbicide, insecticide, rodenticide, etc.
- EPA regulates all chemical use on crops in the United States
- Only a handful of pesticide labels have hemp listed
 - Updated in December 2019
- Up to individual states to decide what pesticides can be applied to hemp



Pesticide use

- It is the responsibility of the producer to make sure the pesticide can be used legally
 - Follow all label directions as they pertain to PPE and WPS
- Do not use hemp pesticide lists from other states
- Before applying any chemical, work with your processor to verify its acceptability
 - Different processors/end users may have a different set of requirements for chemical use (ex. No chemicals, OMRI listed only, etc)
 - Verify the requirements before applying

A pesticide can be applied to cannabis in California IF the active ingredients found in the product are:

1. Exempt from residue tolerance requirements and from registration

OR

2. Exempt from residue tolerance requirements AND use of the product is not legally in conflict with the label

https://www.cdpr.ca.gov/docs/cannabis/can_use_pesticide.pdf

A pesticide can be applied to hemp in California IF:

1. The product is registered for use on **hemp**
2. The active ingredients found in the product are:
 - a) Exempt from residue tolerance requirements AND registration

OR

- b) Exempt from residue tolerance requirements AND use of the product is not legally in conflict with the label

https://www.cdpr.ca.gov/docs/cannabis/hemp_pesticide_guidance.pdf

Sil-MATRIX[®] LC

FUNGICIDE/MITICIDE/INSECTICIDE

For use on vegetables, fruits, nuts, vine crops, field crops, ornamentals and turf for control of fungal diseases, and control of spider mites, aphids and whiteflies.



CAN BE USED IN ORGANIC PRODUCTION



ACTIVE INGREDIENT:

Potassium silicate29%

OTHER INGREDIENTS:71%

TOTAL:100%

KEEP OUT OF REACH OF CHILDREN

CAUTION

Refer to inside of label booklet for additional precautionary information and Directions for Use.

MANUFACTURED BY:

Certis USA LLC
9145 Guilford Road, Suite 175
Columbia, MD 21046

CERTIS

EPA Reg. No. 70051-127
EPA Est. No. 70051-CA-1

Lot Number:

Item Code:

Package Code:

Net Contents: _____

CROP GROUP 13-07: BERRY AND SMALL FRUIT

Blackberry, blueberry; gooseberry; grape; loganberry; raspberry; strawberry

CROP GROUP 14-12: TREE NUTS

Almond; beechnut; Brazil nut; butternut; cashew; chestnut; chinquapin; hazelnut (filbert); hickory nut; macadamia nut; pecan; pistachio; walnut

CROP GROUP 15: CEREAL GRAINS

Corn; barley; millet; oats; popcorn; rice; rye; sorghum; wheat; wild rice

CROP GROUP 20: OILSEED

Jojoba; sesame; sunflower

CROP GROUP 22: STALK, STEM AND LEAF PETIOLE VEGETABLE GROUP

Asparagus; Celery; Fennel; Rhubarb

MISCELLANEOUS CROPS

Artichoke; Coffee; cotton; hops; ornamental; tea; tobacco; turf grass; grass grown for seed

OTHER CROPS

Hemp

TURF & ORNAMENTALS

(Including broadleaf shrubs and trees, flowering plants and bulbs, and foliage plants.)

IMPORTANT NOTE: Plant sensitivities to Sil-MATRIX® LC have been found to be acceptable for plants listed on this label; however, it is impossible to know sensitivities under all conditions and phytotoxicity may occur. Due to the large number of species and varieties of ornamentals and nursery plants, it is impossible to test every one for sensitivity to Sil-MATRIX® LC. Neither the manufacturer nor seller endorses use upon species not listed on the label, nor has it been determined that this product can be safely used on ornamental or nursery plants not listed on this

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Overall conclusions

- MANY species observed in hemp
 - Some pests
 - Some beneficials
 - Lots of transitory species
- Some management strategies
 - More will exist as more research occurs

Economic thresholds

1. Economic market: unstable, still developing
2. Research: ongoing



Developing Insect Pest Management Systems for Hemp in the United States: A Work in Progress

Whitney Cranshaw,^{1,5} Melissa Schreiner,¹ Kadie Britt,² Thomas P. Kuhar,^{2,*} John McPartland,³ and Jerome Grant⁴

¹Department of Bioagricultural Sciences and Pest Management, Colorado State University, Fort Collins, CO 80523, ²Department of Entomology, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061, ³Family Medicine Department, University of Vermont College of Medicine, University of Vermont, Burlington, VT 05405, ⁴Department of Entomology and Plant Pathology, University of Tennessee, Knoxville, TN 37996, and ⁵Corresponding author, e-mail: whitney.cranshaw@colostate.edu

Subject Editor: Carlos Bogran

Received 9 April 2019; Editorial decision 2 July 2019

Abstract

Hemp (*Cannabis sativa* L.) is now being grown within the United States over a much broader geographic area and for different uses than during its last period of significant production that ended after World War II. Within the past 3 yr, a large number of arthropod species have been documented to feed on hemp in the United States. Among key pest species, corn earworm, *Helicoverpa zea* (Boddie) (Lepidoptera: Noctuidae), has demonstrated greatest potential for crop injury, being particularly damaging to flower buds. Hemp russet mite, *Aculops cannibicola* (Farkas), and cannabis aphid, *Phorodon cannabis* Passerini, are the two species observed most damaging among those that suck plant fluids. Eurasian hemp borer, *Grapholita delineana* Walker, is widely present east of the Rocky Mountains and appears to have potential to significantly damage both flower buds and developing seeds. Numerous species of caterpillars, grasshoppers, and beetles chew hemp foliage; the severity of these defoliation injuries appears to be minimal, but needs further study. Similarly, numerous seed feeding hemipterans, most notably stink bugs and Lygus bugs, are regularly found in the crop but injury potential remains unclear. Some preliminary efforts have been made to develop integrated pest management strategies for these insects, particularly for corn earworm. Future research can be expected to rapidly resolve many of the data gaps that presently restrict advancing pest management on the crop. However, a major confounding issue involves the use of pesticides on hemp. Federal

Hemp Insect Fact Sheets

Insects that Chew on Leaves

[Beet Webworm](#)



[Beet Armyworm](#)



[Cotton Square Borer/Gray Hairstreak](#)



Insects/Mites associated with Buds/Flowers/Seeds

[Lygus Bugs](#)



[Hyaline Grass Bug](#)



[Red-shouldered Stink Bug](#)

