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# Occurrence and Distribution of Common Diseases and Pests of U.S. Cannabis: A Survey

*Misbakhul Munir, Kimberly Leonberger, Magdalena Ricciardi, Henry Smith, and Nicole Gauthier*

## Introduction

Hemp (*Cannabis sativa*) is a recent addition to the U.S. agricultural and horticultural industries. Although it is often described as a pest-free crop, it remains susceptible to a considerable number of diseases and pests. Historical restrictions have slowed research and limited understanding of disease and pest occurrences and distributions. This study was intended to determine the distribution and occurrence of common diseases and arthropod pests. Resulting data will serve as a foundation for regional and national prioritization of research and regulatory activities.

## The Survey

The survey was intended for agronomy, horticulture, entomology, and pathology specialists who were qualified to confirm the identity of arthropod pests and/or pathogens. The survey was distributed to state and university diagnostic laboratories, research and industry specialists, and Extension programs across the 48 continental states between July 2021 and June 2022. States were sorted into five geographic regions, similar to those of the National Plant Diagnostic Network. Kentucky is located in the Southern Region.

A total of 163 valid responses were collected, and 148 were included in the final dataset. The largest percentage of respondents were from the South (41%), followed by the Northeast (21%), Great Plains (15.2%), North Central (12.4%), and West (10.4%).

## Disease Data

Disease distribution was variable across regions. All fungal diseases in the survey were reported in the Northeast and South, regions with the highest rainfall. Nationwide comparison among fungal diseases showed

**Figure 1.** Occurrence of (**A**) fungal and (**B**) oomycete, bacterial, nematode, and viral diseases across all states surveyed, represented as percentage of respondents who confirmed causal pathogens. Percent occurrence followed with the same letters are not significantly different.

that fungal diseases such as Botrytis bud rot, powdery mildew, Cercospora leaf spot, Fusarium damping-off, and Fusarium canker/basal rot were reported significantly more often than fungal diseases such as sooty mold, Exserohilum leaf spot, Stemphylium leaf spot, and Corynespora leaf spot. Fungal diseases, notably Cercospora leaf spot, Fusarium canker, powdery mildew, Botrytis bud rot, and Fusarium head blight, had the highest occurrences in both the Northeast and South. Warm season fungal diseases such as Southern blight were more prominent in the South, while cool season diseases such as white mold were more prominent in the Northeast. Fewer diseases were reported in the arid Great Plains and West. In the West, only 15 out of the 30 fungal diseases were reported. The Great Plains had fewer diseases than other regions, and none reported with more than 50% occurrence. Bacterial (Ralstonia) blight, specific to tropical and subtropical climates, was reported in the Great Plains and South. More viral diseases were reported in the Great Plains and West than in other regions. Hop latent viroid (HLVd) was reported in all regions, although it was more prominent in the West and Great Plains where more hops are grown. Beet curly top virus (BCTV) was reported in the West and Great Plains, where its vector, the beet leafhopper feeds primarily on native plants of arid regions. Oomycetes were consistently reported across regions. There were limited reports of nematodes overall.

**Arthropod Data**

Most arthropods in the survey were reported in all regions, except for beet leafhoppers, fire ants, oblique banded leafrollers, the darker spotted straw moths, and rice root aphid. Nationwide comparison among lepidopterans showed that corn earworm was reported significantly more often than yellowstriped armyworm, beet armyworm, oblique banded leafroller, and darker spotted straw moth. Corn earworm was the most reported lepidopteran in all regions. Three borer species were reported in all regions, though occurrence was higher in the Northeast where forest cover is more dense than other regions. Tarnished plant bug was the most reported bug in all regions. Cannabis aphid, specific to cannabis, was reported in all regions. Rice root aphid was not reported in the North Central region despite its

**Figure 2.** Occurrence of (**A**) lepidoptera, (**B**) borers, (**C**) bugs, (**D**) aphids, (**E**) beetles, (**F**) mites, and (**G**) other arthropods across all states surveyed, represented as percentage of respondents who confirmed arthropod pests. Percent occurrence followed with the same letters are not significantly different.

wide host range; fewer overall responses were received from North Central. All beetles were reported in all regions. Mites were reported in all regions, including the host-specific hemp russet mite. However, there were more reports of mites in the Northeast and South. Fire ants were reported in the West, Great Plains, and South, which include the warmer latitudes across the U.S. Beet leafhopper was limited to the arid western portion of the U.S. and was not reported in the central or eastern portion of the U.S.

**Conclusion**

Results from this survey present an overview of occurrence and distribution of common diseases and pests of cannabis in the U.S., as well as provide a foundation for future regional and national prioritization of research and regulatory activities. Focused research on pest and disease management is critical to building a sustainable cannabis industry.

**Table 1.** A summary of occurrence of arthropod pests across five regions across the continental U.S. Values indicate the percent of postive responses reported for the arthropod per region.

| Arthropod Pest | U.S. Region | | | | |
|---|---|---|---|---|---|
| | Great Plains | North Central | North-eastern | Southern | Western |
| Beet armyworm | 14 | 13 | 23 | 42 | 67 |
| Beet leafhopper | 43 | 0 | 0 | 0 | 100 |
| Brown marmorated stink bug | 38 | 43 | 43 | 67 | 57 |
| Cannabis aphid | 44 | 60 | 93 | 68 | 71 |
| Common stalk borer | 33 | 25 | 54 | 38 | 20 |
| Corn earworm | 63 | 56 | 82 | 92 | 86 |
| Darker spotted straw moth | 0 | 0 | 15 | 22 | 20 |
| Eurasian hemp borer | 29 | 25 | 29 | 40 | 33 |
| European corn borer | 38 | 40 | 100 | 35 | 33 |
| Fall armyworm | 14 | 38 | 38 | 72 | 57 |
| Fire ant | 25 | 0 | 0 | 63 | 50 |
| Flea beetle | 75 | 56 | 76 | 50 | 71 |
| Fourlined plant bug | 43 | 33 | 50 | 28 | 20 |
| Fungus gnat | 63 | 25 | 65 | 63 | 33 |
| Hemp russet mite | 29 | 14 | 53 | 74 | 43 |
| Japanese beetle | 43 | 63 | 94 | 60 | 33 |
| Oblique banded leafroller | 14 | 38 | 29 | 22 | 0 |
| Potato leafhopper | 71 | 50 | 81 | 57 | 86 |
| Red headed flea beetle | 14 | 50 | 44 | 33 | 20 |
| Red shouldered stinkbug | 14 | 13 | 31 | 42 | 43 |
| Rice root aphid | 38 | 0 | 38 | 33 | 29 |
| Spider mite | 88 | 63 | 94 | 73 | 71 |
| Tarnished plant bug | 67 | 60 | 100 | 68 | 71 |
| Thrips | 75 | 63 | 88 | 73 | 71 |
| Two-spotted spider mite | 88 | 50 | 83 | 76 | 71 |
| Yellow woolly bear | 38 | 56 | 57 | 40 | 17 |
| Yellowstriped armyworm | 14 | 13 | 53 | 70 | 40 |
| Whitefly | 50 | 50 | 63 | 70 | 43 |
| Unidentified aphid | 57 | 33 | 87 | 60 | 57 |
| Unidentified caterpillar | 57 | 57 | 76 | 50 | 33 |
| Unidentified grasshopper | 57 | 57 | 81 | 67 | 57 |
| Unidentified leaf miner | 43 | 33 | 75 | 59 | 57 |
| Unidentified stink bug | 43 | 29 | 53 | 50 | 57 |

**Table 2.** A summary of occurrence of diseases across five regions across the continental U.S. Values indicate the percent of postive responses reported for the disease per region.

| Disease | U.S. Region | | | | |
|---|---|---|---|---|---|
| | Great Plains | North Central | North-eastern | Southern | Western |
| Alternaria leaf blight, leaf spot | 38 | 63 | 67 | 50 | 60 |
| Anthracnose, Colletotrichum | 25 | 29 | 64 | 45 | 20 |
| Anthracnose, Gloeosporium | 38 | 0 | 43 | 30 | 0 |
| Ascochyta leaf spot | 25 | 17 | 42 | 30 | 0 |
| Bacterial leaf spot | 13 | 33 | 67 | 45 | 20 |
| Bacterial soft rot | 0 | 0 | 33 | 30 | 20 |
| Bacterial wilt, Ralstonia | 13 | 0 | 0 | 30 | 0 |
| Beet curly top virus | 56 | 17 | 8 | 23 | 86 |
| Botryosphaeria dieback/canker | 25 | 17 | 46 | 62 | 0 |
| Botrytis bud rot | 50 | 67 | 100 | 69 | 83 |
| Botrytis stem canker/rot | 25 | 33 | 85 | 48 | 0 |
| Cercospora leaf spot | 25 | 100 | 77 | 76 | 60 |
| Charcoal rot, Macrophomina | 25 | 33 | 25 | 45 | 0 |
| Cladosporium bud rot | 13 | 20 | 25 | 21 | 20 |
| Corynespora leaf spot | 0 | 0 | 25 | 21 | 0 |
| Downy mildew | 0 | 57 | 54 | 32 | 0 |
| Exserohilum leaf spot | 0 | 20 | 33 | 22 | 0 |
| Fusarium bud mold/head blight | 0 | 50 | 79 | 64 | 25 |
| Fusarium canker/basal rot | 14 | 80 | 77 | 70 | 50 |
| Fusarium damping off | 29 | 60 | 73 | 55 | 75 |
| Fusarium wilt | 14 | 71 | 82 | 47 | 75 |
| Bipolaris/zonate leaf spot | 14 | 57 | 93 | 78 | 0 |
| Hop latent viroid | 50 | 20 | 33 | 10 | 43 |
| Nematode, lance | 13 | 0 | 8 | 6 | 0 |
| Nematode, lesion | 13 | 0 | 8 | 6 | 0 |
| Nematode, ring | 0 | 0 | 9 | 6 | 20 |
| Nematode, root knot | 50 | 0 | 8 | 26 | 20 |
| Nematode, spiral | 13 | 0 | 17 | 6 | 20 |
| Nematode, stubby root | 38 | 0 | 17 | 6 | 0 |
| Nematode, stunt | 14 | 0 | 17 | 6 | 0 |
| Phoma blight/dieback | 13 | 60 | 25 | 22 | 20 |
| Phomopsis tip blight/canker | 13 | 33 | 23 | 17 | 0 |
| Phytophthora root rot | 38 | 17 | 67 | 38 | 40 |
| Phytophthora stem rot | 38 | 17 | 42 | 26 | 20 |
| Phytoplasma | 0 | 0 | 8 | 0 | 25 |
| Powdery mildew | 38 | 71 | 93 | 70 | 86 |
| Pythium wilt/damping off | 25 | 83 | 85 | 55 | 67 |
| Rhizoctonia damping off | 13 | 17 | 50 | 55 | 40 |
| Rhizoctonia stem canker | 13 | 20 | 42 | 55 | 40 |
| Rhizoctonia web/aerial blight | 29 | 17 | 25 | 35 | 0 |
| Rust | 29 | 38 | 38 | 21 | 0 |
| Septoria leaf spot | 14 | 75 | 100 | 39 | 0 |
| Sooty mold | 29 | 17 | 25 | 5 | 0 |

**Table 2** (cont'd). A summary of occurrence of diseases across five regions across the continental U.S. Values indicate the percent of postive responses reported for the disease per region.

| Disease | U.S. Region | | | | |
|---|---|---|---|---|---|
| | Great Plains | North Central | North-eastern | Southern | Western |
| Southern blight | 0 | 0 | 27 | 78 | 0 |
| Stemphylium leaf spot | 0 | 0 | 27 | 39 | 0 |
| Verticillium wilt | 0 | 50 | 45 | 11 | 25 |
| Virus (other) | 67 | 20 | 18 | 26 | 25 |
| White mold, Sclerotinia | 33 | 38 | 69 | 21 | 25 |
| Unidentified bud or head mold | 33 | 65 | 36 | 44 | 20 |
| Unidentified leaf spot | 33 | 50 | 58 | 35 | 0 |
| Unidentified root rot | 33 | 50 | 42 | 19 | 0 |
| Unidentified stem canker | 0 | 33 | 38 | 25 | 0 |

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**Complete research study can be found at**

Munir, M., Leonberger, K., Kesheimer, K., Bolt, M., Zuefle, M., Aronson, E., Ricciardi, M., Schluttenhofer, C., Joly, D., Smith, H., Coburn, J., Franco Da Cunha Lema Filho, J., Rondon, S., Smart, C., Collins, A., Garfinkel, A., Gauthier, N. 2023. Occurrence and distribution of common diseases of US cannabis: A survey. Plant Health Progress https://doi.org/10.1094/PHP-01-23-0004-S

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