



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

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## 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

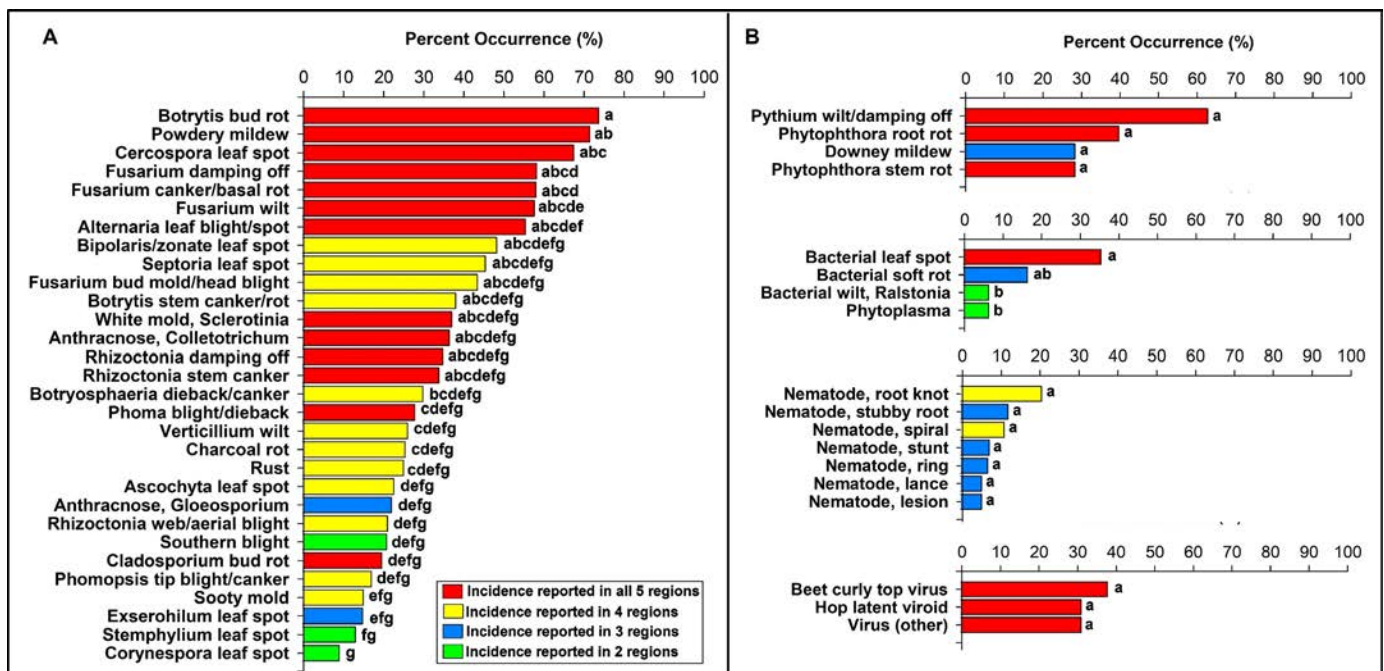
The survey was intended for agronomy, horticulture, entomology, and pathology specialists who were qualified to confirm the identity of arthropod pests and/or pathogens. The survey was distributed to state

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



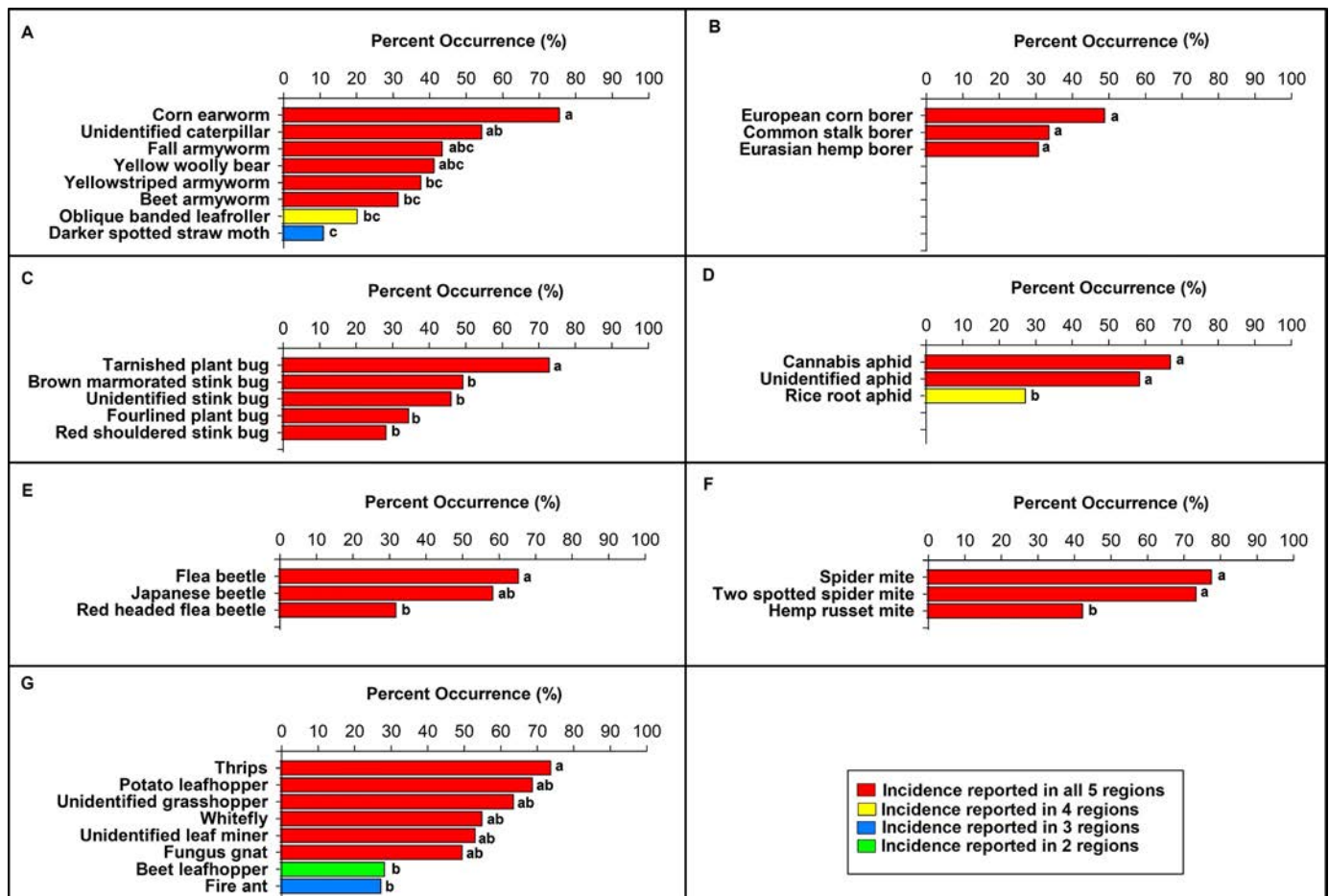
**FIGURE 1.** OCCURRENCE OF (A) FUNGAL AND (B) OOMYCETE, BACTERIAL, NEMATODE, AND VIRAL DISEASES ACROSS ALL STATES SURVEYED, REPRESENTED AS PERCENTAGE OF RESPONDENTS WHO CONFIRMED CAUSAL PATHOGENS. PERCENT OCCURRENCE FOLLOWED WITH THE SAME LETTERS ARE NOT SIGNIFICANTLY DIFFERENT.

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>