

PESTS LOSE

when climate wins

Smart environmental control
in tomato and cannabis
greenhouses

BY VIKRANT DHAWAN AND MOHYUDDIN MIRZA

Greenhouse tomato and cannabis production in Canada has grown rapidly over the past decade, driven by advances in controlled-environment agriculture (CEA) and the demand for premium produce and regulated cannabis. While greenhouses protect crops from unpredictable Canadian weather, they also create a finely tuned ecosystem where climate becomes the primary force determining whether plants thrive or whether pests and pathogens take hold.

Across the country — from humid British Columbia to the dry Prairie provinces and variable climates in Ontario and Quebec — the greenhouse microclimate governs the spread, survival, and intensity of insects, mites, and diseases.

This article explores how climate shapes major greenhouse pests and diseases in tomatoes and cannabis, and outlines effective, climate-based IPM strategies for growers.

HOW CLIMATE SHAPES PEST AND DISEASE ECOLOGY

Temperature dictates how fast pests reproduce and how aggressively pathogens spread.

- **Spider mites** complete a life cycle in under a week at temperatures above 28°C.
- **Thrips and aphids** multiply faster in warm, nutrient-rich environments.
- **Fungal pathogens**, including powdery mildew and leaf spots, favour moderate temperatures (18–25°C).
- Heat waves or uncontrolled canopy temperatures often accelerate pest metabolism, requiring earlier releases of biological controls or more frequent scouting.
- **Humidity & vapour pressure deficit (VPD)**
- Humidity is the single largest environmental factor influencing disease outbreaks.
- **High humidity (>75–80%)** increases risks of powdery mildew, botrytis, and leaf spot diseases.
- **Low humidity (<50–55%)** favours spider mite population booms.
- **Sudden humidity spikes at night** create condensation on leaves—an instant trigger for mildew germination.

Maintaining a stable VPD (rather than relying on relative humidity alone) helps prevent both fungal disease and moisture-stress-driven pest outbreaks.

Poor airflow encourages:

- humid pockets
- temperature stratification
- mold development
- reduced performance of biological control agents



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ABOVE

Powdery mildew on cannabis plants. When infection reaches this stage, photosynthesis is significantly reduced.



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Dense cannabis canopies and mature tomato vines require strategic pruning and strong horizontal and vertical airflow to avoid hidden microclimates where pests and pathogens flourish.

KEY PESTS & DISEASES INFLUENCED BY CLIMATE

Below are the most significant climate-responsive pests and diseases in Canadian greenhouse production of tomatoes and cannabis.

Powdery mildew — highly climate-sensitive

Powdery mildew consistently affects both crops:

- *Golovinomyces* spp. in cannabis
- *Oidium lycopersic* in tomatoes

It is worth mentioning that powdery mildew is a disease of low and high relative humidity. Under relative humidity below 50 per cent, the fungus produces more spores which then need free water to germinate and spread and cause new infections. This free water comes from condensation when day to night temperature drops rapidly and under high relative humidity conditions dew is formed on leaf surfaces.

Ideal conditions for powdery mildew

Climate Factor	Range That Promotes Disease
Relative Humidity	55–85%
Leaf Wetness	Dry surfaces
Temperature	18–26°C
Airflow	Low or stagnant

The disease becomes especially common in spring and fall, when greenhouses reduce ventilation to conserve heat and outdoor humidity is high.

Cannabis tends to be more vulnerable because its dense foliage and floral structures trap humidity, creating ideal microclimates for infection.

Spider mites

The two-spotted spider mite (*Tetranychus urticae*) thrives under:

- 25–32°C temperatures
- RH < 50%
- plant stress from heat or drought

Cannabis flowering rooms and tomato vines near high-intensity lighting often become hotspots for mite activity if climate is not stabilized.

Thrips

Favoured by:

- warm temperatures
- low humidity
- flowering plants

Thrips damage cannabis flowers and transmit viruses in tomatoes.

Whiteflies

Common in:

- warm, high-light greenhouses
- low-airflow environments

Growers in B.C., Ontario, and the Prairies report persistent whitefly issues when ventilation is inadequate.

Fungus gnats & shore flies

Favoured by:

- wet substrates
- algae growth
- cool, damp propagation zones

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TABLE 1: Climate triggers for major pests & diseases

Pest / Disease	Triggering Temperature	Triggering Humidity	Climate Impact
Powdery Mildew	18–26°C	55–85%	Germinates after condensation; thrives in still air
Spider Mites	25–32°C	< 50%	Reproduces rapidly in hot spots
Thrips	20–30°C	< 60%	Prefer dry, warm flowers
Whiteflies	22–28°C	Moderate	Thrive in low-airflow, warm areas
Fungus Gnats	15–24°C	Wet media	Activity increases in overwatered zones
Botrytis	17–23°C	> 80%	Needs cool, humid nights or wet tissue
Root Diseases	< 20°C root zone	High moisture	Triggered by saturated substrate
Aphids	18–25°C	Moderate-high	Favour lush, soft foliage

TABLE 2: Best climate-based IPM solutions

Issue	Climate Solution	Practical Actions
Powdery Mildew (PM)	Reduce nighttime RH to 55–60%	Increase airflow, run dehumidifiers before lights-off, avoid dawn condensation. Use of hydrogen peroxide in misting system along with air purifiers can also be helpful in controlling the spread of PM
Spider Mites	Maintain RH 55–65%	Improve airflow under lights, eliminate heat pockets, introduce predatory mites i.e. Phytoseiulus persimilis. Complement these measures with strict sanitation protocols and rigorous quality checks on all incoming plant material and outdoor agents to prevent the introduction and spread of spider mites.
Thrips	Raise RH 55–70%	Use airflow fans, remove debris, install insect mesh on vents
Whiteflies	Prevent Heat accumulation	Vent early morning, ensure propagation room hygiene

TABLE 3: IPM recommendations for tomatoes & cannabis

Category	Tomato-Specific IPM	Cannabis-Specific IPM
Climate Control	Keep RH < 80%; avoid leaf wetness	RH 55–65% in flowering; stabilize VPD
Canopy Management	Prune lower leaves ; open clusters	Defoliate lower canopy; increase vertical air movement
Sanitation	Clean gutters & prune waste	Remove leaf litter daily; sterilize tools
Monitoring	Scout leaves every 3 days	Scout both lights-on & off; inspect undersides
Biological Control	Encarsia, Swirskii, Persimilis	Californicus, Persimilis, Aphidius, BT-i drenches
Preventive Measures	Manage humidity	Avoid condensation; stabilize day-night transitions

Aphids

Favoured by:

- moderate temperatures
- humid conditions
- soft, lush plant growth

Populations expand rapidly because aphids reproduce without mating.

CLIMATE-DRIVEN DISEASES BEYOND POWDERY MILDEW

Botrytis (Grey Mold)

One of the most destructive greenhouse diseases both affecting plants and post harvest products.

Favoured by:

- nighttime RH (> 80–85 %)
- condensation
- poor airflow
- damaged plant tissue

Cannabis buds and tomato fruit clusters are particularly susceptible.

Root diseases — Pythium, Fusarium, Phytophthora

Triggered by:

- saturated growing media
- cold root zones (<18–20°C)
- low oxygen
- contaminated irrigation systems

Leaf Spot Diseases

Including Cladosporium and Alternaria.

Favoured by:

- warm, humid environments
- dense canopies
- poor ventilation

BEST CLIMATE-BASED IPM TECHNIQUES

This section highlights IPM practices specifically tied to climate management, presented in tables 1 to 3 (located above).

Through our professional experiences managing controlled-environment crops, one consistent pattern emerges: Growers who invest in climate stability experience significantly fewer pest outbreaks, cleaner harvests, lower chemical inputs, and more predictable cycles.

A climate-driven IPM approach, supported by pruning, sanitation, biological controls, and real-time monitoring, is the most reliable foundation for healthy, high-performance greenhouse production. When climate control becomes proactive rather than reactive, growers don't just reduce pest pressure—they create an environment where pests struggle to survive in the first place.

SUGGESTIONS

The drive to achieve high productivity and premium quality in greenhouse tomato and cannabis production while preventing disease, insect, and pest outbreaks remains one of the greatest challenges for growers managing controlled environments. However, based on our combined experience in Canadian greenhouse operations, we recommend the following strategies:

- Designing **climate zones based on crop stage**, not just room layout.
- Prioritizing **nighttime humidity and temperature stability**, the most overlooked disease trigger.
- Imparting **hydrogen peroxide in irrigation systems** to control the fungal formation in growing media and flush irrigation lines with hydrogen peroxide for proper sanitization.

- Spraying a cannabis crop in early into the flowering stage with **Health Canada-approved mineral based oils, insecticidal soaps and Potassium bicarbonate** can also be very helpful in controlling aphids, thrips and powdery mildew in greenhouse cannabis production.
- Integrating **vertical airflow fans** in cannabis, where microclimates form within inches.
- Implementing **ive climate dashboards** accessible to growers and IPM technicians.
- Proper implemented **sanitation protocols and rigorous quality checkson** all incoming plant material and outdoor agents to prevent the introduction and spread of these diseases, insects and pests.
- Adopting **preventive biological control programs** early in the cycle.
- Reassessing **plant density** regularly to avoid high-humidity pockets.
- Building a **year-round climate calendar** tailored to regional weather patterns.

These practices consistently strengthen crop resilience, improve product quality, and reduce production risks.

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