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UNDERSTANDING HOST PHYSIOLOGY FOR EARLY DETECTION OF FOLIAR DISEASES IN FLORICULTURE CROPS

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Floriculture involves the cultivation of flowering and ornamental plants for commercial and aesthetic purposes. With growing global demand for flowers, maintaining plant health has become increasingly important. Among the major challenges in this field are foliar diseases that affect leaves, the primary photosynthetic organs, leading to reduced growth, flower production, and visual appeal. Traditional disease detection often relies on visible symptoms, which appear only after significant physiological damage has occurred. Hence, there is a pressing need for early detection methods rooted in the understanding of plant physiological responses to disease onset.

Major Foliar Diseases in Flower Crops

Common foliar pathogens affecting floricultural crops include

Disease Name	Causal Organism (Scientific Name)	Commonly Affected Flower Crops
Powdery Mildew	*Erysiphe cichoracearum*, *Podosphaera spp.*	Rose, Marigold, Chrysanthemum
Leaf Spot	*Alternaria alternata*, *Cercospora spp.*	Gerbera, Dahlia, Zinnia

Anthracnose	*Colletotrichum gloeosporioides, C. capsici*	Hibiscus, Gladiolus, Chrysanthemum
Rust	*Puccinia spp., Uromyces spp.*	Marigold, Snapdragon, Carnation
Downy Mildew	*Peronospora spp., Plasmopara spp.*	Petunia, Impatiens, Aster
Botrytis Blight (Grey Mould)	*Botrytis cinerea*	Rose, Geranium, Begonia
Bacterial Leaf Spot	*Xanthomonas campestris, Pseudomonas spp.*	Carnation, Gerbera, Chrysanthemum
Septoria Leaf Spot	*Septoria spp.*	Carnation, Aster
Stemphylium Leaf Spot	*Stemphylium solani*	Cotton (ornamental cultivars), Marigold
Cercospora Leaf Spot	*Cercospora carotae, C. gossypina*	Gerbera, Dahlia, Carnation

Physiological Responses to Pathogen Infection

Plants exhibit various physiological changes upon pathogen invasion, even before symptoms become visible. These include:

- ✓ Reduction in chlorophyll content: Decreases photosynthesis and causes chlorosis.
- ✓ Altered stomatal behaviour: Affects transpiration and gas exchange.
- ✓ Elevated reactive oxygen species (ROS): Trigger plant defence mechanisms.
- ✓ Hormonal imbalances: Particularly involving salicylic acid, Jasmonic acid, and ethylene.

Monitoring these physiological parameters can provide an early indication of stress, aiding in the pre-symptomatic detection of foliar diseases.

Physiological Indicators for Disease Monitoring

Parameter	Physiological Change	Detection Method
Photosynthetic Rate	Decline due to chloroplast damage or stomatal closure	Chlorophyll fluorescence, gas exchange tools
Stomatal Conductance	Irregular transpiration patterns	Pyrometry, thermal imaging
ROS Accumulation	Elevated oxidative stress markers (e.g., H_2O_2, MDA)	Biochemical assays, biosensors
Leaf Pigment Shifts	Altered chlorophyll, carotenoid, and anthocyanin levels	Hyperspectral imaging, pigment quantification
VOC Emissions	Pathogen-induced changes in volatile profiles	GC-MS, electronic nose
Leaf Water Potential	Disruption due to vascular blockage or necrosis	Pressure chamber, remote sensing

Integrating Technology with Plant Physiology

- ✓ Hyperspectral imaging: Detects delicate spectral changes linked to stress.
- ✓ Drones with multispectral cameras: Survey large fields to identify affected zones.
- ✓ IoT-based sensors: Measure microclimate, chlorophyll index, and other physiological traits.
- ✓ Machine learning models: Predict disease onset using physiological data patterns.

Application of Integrating Technology in Floriculture Crops

Floricultural crops are particularly sensitive to foliar diseases due to their aesthetic value and market timing.

- **Roses**: Early detection of powdery mildew via stomatal conductance and VOC profiling.
- **Gerbera & Carnation**: Leaf spot and blight monitored through pigment degradation and ROS markers.
- **Orchids**: Viral infections detected via hyperspectral shifts and water potential changes.
- **Chrysanthemums**: Rust and bacterial blight diagnosed using fluorescence and VOC sensors.

Conclusion

Understanding host physiology provides a valuable framework for the timely detection of foliar diseases in floriculture. By monitoring key physiological changes and integrating them with smart sensing technologies, growers can achieve better disease control, reduce losses, and ensure sustainable flower production. As precision floriculture continues to evolve, physiology-driven disease surveillance will be central to modern crop protection strategies.

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