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Environmental Relation to Disease Development

(*Rakesh Kumar)
Swami Keshwanand Rajasthan Agricultural University, Bikaner, Rajasthan
* brorrk@gmail.com

It has been estimated that more than 50% of all plant diseases caused by improper environment, nutritional, or physical conditions. Such diseases are distinguished from those caused by infectious organisms or viruses and are referred to by term such as non-infectious, abiotic, or physiogenic. Organisms that cause diseases in plants are called pathogens. Perhaps the term physiogens should be used for those conditions of the physical environment that cause disease and the process of development of such diseases is physiogenesis as distinguished from pathogenesis.

Environment can influence the host or the pathogen or both. The interaction of host and pathogen and the severity of symptoms are influenced by environment. Important environmental factors that influence disease development are temperature, moisture, light pH and aeration.

Numerous plant disease problems can arise in greenhouse situations. These diseases can cause extensive damage if allowed to develop unchecked. Since plant diseases are strongly affected by temperature and humidity, the best way to combat disease is to manipulate the greenhouse environment. Unlike the weather outdoors, we can control the greenhouse environment.

Predisposition

Walker (1950) defined predisposition as the effect of one or more environmental factors, which makes a plant vulnerable to attack by a pathogen. It is a process, which antedates penetration and infection.

Temperature

In several storage diseases, the temperature range at which disease development occurs, coincides with the temperature range at which growth of the incitant occurs. The optima for growth of incitants like *Penicillium spp., Diplodia sp.* and *Botryodiplodia sp*. and for the decay of fruits are nearly the same. But in Rhizopus rot of sweet potato the optimum for growth of the pathogen and the optimum for decay of fruits do not coincide. In this disease, protective action due to formation of wound cork in the host increases as the growth of incitant increases with the temperature.

In black root rot of tobacco, the optimum for disease development differs from the optima for growth of the pathogen and the host. The optimum for disease development is 17 to 23 °C. Neither the host nor the pathogen grow well in this range, but the host is more weakened than the pathogen and even the weakened fungus incites the development of disease.

The root rots of wheat and maize are incited by *Gibberella zeae*. While maximum disease development in wheat occurs at temperatures above optima for development of the pathogen and the host, in maize it occurs at temperature below the optima for pathogen and

host. Wheat thrives best at low temperatures and is more severely damaged at high temperature. On the other hand maize that grows best at high temperatures is damaged more temperatures. The muskmelon wilt becomes severe at temperatures below 27 °C., which is the optimum temperature for growth of *Fusarium oxysporum f. niveum*. The plants become severely at low resistant at 30 °C, or higher, which is the optimum for growth of melons. The resistance at higher temperatures can be due to the increased ability of the host to exclude the fungus from the vascular region (due to periderm formation).

Moisture

In fungal diseases moisture is needed for germination of spores. Many fungi need a film of water for successfully infecting the host. Some fungi can infect under high relative humidity. Increase in rainfall decreases incidence and severity of powdery mildews. In Pythium damping-off of seedlings, moisture plays a great role. The disease becomes most severe near the saturation point. Moderate to high moisture favours several soil-borne diseases.

Moisture is essential for the dissemination of most bacterial plant pathogens. After their entry into the plant, bacteria become more active in the wet weather. The moisture especially in case of virus diseases primarily influences host and vectors. The movement of insects is interfered by rain. Increased soil moisture usually favours movement of fungi and nematodes. In some virus diseases, the plants remain symptomless in wet season.

Humidity

High humidity levels encourage the development of many plant diseases. The relative humidity is usually 25%-70% during the day in greenhouses and generally no problem. However, humidity levels are generally 90-100% during the night. During periods of rainy weather in winter, the relative humidity may stay near 100% for a number of days and nights. When plants are crowded together, disease development is encouraged by the high humidity in the canopy. Plants hung overhead reduce normal water evaporation and contribute to high humidity in the crop canopy.

In greenhouse, air circulation is maintained during periods of high humidity. Most greenhouses are equipped with air circulation, fan-jet or horizontal airflow systems. These systems should operate continuously when high humidity occurs in the greenhouse, i.e., every night of the year and during rainy overcast days.

Light

Light influences the susceptibility of plants and the severity of certain diseases. Disease development can be influenced by duration of light and dark periods. Short day lengths favour infection of tomato with Fusarium. Low light intensity can predispose tomato plants to attack by *Fusarium oxysporum f. lycopersici*. Intensity and duration of light can affect survival of inoculum, germination, incubation and degree of sporulation etc. In stem rust of wheat, the pathogen may sporulate abundantly and the incubation period may become shorter with increase in light. In flax rust, the incubation period is reduced under continuous light. In certain virus diseases, more number of lesions develops if plants are kept in dark for a day for a day or two, prior to inoculation. In some virus diseases, symptoms are masked, if low light intensities prevail after inoculation. Effects of light can vary with different host-virus combinations.

Soil Reaction (Soil pH)

Club root of crucifers (*Plasmodiophora brassicae*) and common scab of potato are soil-borne. Dry alkaline soils favour scab, while club root is favoured by wet acid soils. The club root becomes a serious problem at pH about 5.7. The disease is completely checked if the soil pH is raised to 7.8. Common scab of potato (Streptomyces scabies) is severe at a pH range from 5.2 to 8.0 or more and its development drops sharply at pH less than 5.2. Most of the

fungi, bacteria and nematodes can tolerate the pH range in which their hosts grow. However, certain pathogens have narrow tolerance limits. Therefore, disease can be managed whereas some their respective hosts are able to grow outside these limits. For such cases, it is possible to manage the diseases through manipulation of the soil pH.

References

1. Agrios, G (2005). Plant Pathology. Academic Press. ISBN 978-0-12-044565-3. Arneson, PA (2011).
2. Rossi V, Ravanetti A, Pattori E, Giosuè S. (2001). Influence of temperature and humidity on the infection of wheat spikes by some fungi causing Fusarium head blight. *J Plant Pathol*. **83**:189–198.
3. Tevens RB. Cultural practices in disease control. In: Horsfall JG, editor. (1960). *Plant Pathology: An advanced treatise, volume III: The diseases population epidemics and control*. London: Academic Press Inc. pp. 357–429.
4. Van der Plank, J.E. (1983). Plant diseases: epidemics and control. Academic Press, New York.
5. Yellareddygari SKR, Reddy MS, Kloepper JW, Lawrence KS, Fadamiro H. (2014) Rice sheath blight: A review of disease and pathogen management approaches. *J Plant Pathol Microb*. **5**:241.
6. Zadoks, J.C. and Schein, R.D. (1979). Epidemiol"ogg and plant disease management. Ot'ord Universitv Press. New York and Oxford.