Essay on powdery mildew-a disease in strawberry

Business, Management

Powdery Mildew-A Disease in Strawberry

Strawberries are dicotyledonous, herbaceous, non-deciduous, perennial plants (Sarah 2007). They are widely cultivated for their fruit that is valued for its juicy quality, sweetness, bright red color, and distinctive aroma. The plant can fall victim to various diseases in its life cycle. The following paper aims at discussing the causal organism of powdery mildew disease in strawberries, its impact on the host, and environmental conditions that are needed for the disease to develop. Moreover, the paper describes steps I have undertaken in the practice class to prove the causal organism was using Koch’s Postulate.

Powdery Mildew is caused by a coerce fungus referred to as sphaerotheca macularis that infects fruits, flowers, and leaves (Gubler 2008). Early plant infection symptoms are characterized by fungus growing under the leaf surface forming white patches (Figure 2). In vulnerable environments, various chains of spores and thick mycelial growth make the patches powdery (Figure 3). Under favorable circumstances, the patches increase and combine completely covering the leaf’s lower surface (Figure 2). Due to varying environmental conditions, little mycelium may be produced, leading hard to see the white powdery parts. Instead, uneven reddish or yellowish brown patches grow on populated parts of the lower side of the leaf, and consequently develop to the upper side.

As the disease develops, the edges of leaves begin to twist upwards (Figure 4). In some cases, dark round coverings known as cleistothecia can develop inside the mycelia on the lower side of leaves (Figure 1). The cleistothecia are primarily white but turn black as they grow. Flowers can also be infected by the fungus, leading to deformed or aborted fruit. Fruits may also be infected while they are still green, where they continue being hard and fail to mature. They may even grow purple spots similar to those on leaves. Diseased ripe fruits are pulpy and soft with seeds appearing smaller and outstretched from the fruit service. Heavily diseased fruits are covered with immense white mycelia and may even lead to wilting.

Sphaerotheca macularis is a coerce fungus that contaminates living tissue of cultivated or wild strawberry (Gubler 2008). The parasite readily contaminates young, green leaves still in the nursery. When leaves are infected, the conidia produced are circulated to other plants by wind, under favorable conditions. The spread and development of powdery mildew occurs under favorable conditions of temperatures between 60˚ to 70˚ F and high to moderate humidity (Sarah 2007). Overhead irrigation, dew, and rain are not favorable conditions for the development and spread of the fungus. However, plastic tunnels and greenhouses are highly prone to the fungus due to the high humidity and dry conditions. Powdery mildew highly develops where temperatures range between 10 and 21˚ C. The causal organism development, deteriorations when flowering starts as temperatures increase to over 25˚C (Gubler 2008).

In its early stages, the fungus develops chains of conidia that mainly contribute to the spread of the disease through rain, wind, and insects. Although they only last for a few days, they can spread over large areas. New spots of conidia occur every seven to eleven hours at optimum conditions and develop repeating pustules (Figure 4). Conidia chains sprout quickly at 98 to 100% relative humidity, but their rich water content enables them to propagate under 50% humidity (Gubler 2008). Regular light rains can slow the propagation of conidia as they eliminate conidia form leaves consequently slowing the germination rate. Frequent heavy rains completely slow the germination of new blotches due to constant removal of conidia. However, conidia do not grow in free moisture and exposure to such conditions can cause the patches to burst. Sphaerotheca macularis do not invade plant tissue on their own, instead they nourish by sending root-like structures known as haustoria into the top cells of the leaves (Gubler 2008). The fungus survives winter through plant debris as mycelium and cleistothecia that are the main sources of inoculum during spring. They then spread to vulnerable host tissue by wind, insects or splashing raindrops.

Sphaerotheca macularis highly impacts strawberries in regards to productivity and management (Sarah 2007). Powdery mildew begins by infecting the lower side of strawberry, which reduces the plants ability to develop healthy consequently resulting in poor or no yields. Diseased leaves eventually lead to weak plants that cannot be productive. As the plant develops, flowers are infected severely affecting the budding process that results to deformed or dead fruits. These fruit end up falling or being discarded during harvesting or sorting as a result of poor quality. In some cases, healthy fruits can be infected while they are still green, forming spots around infected areas. The fruits become hard and fail to ripen causing minimal or even poor yields. Infected strawberry reduced with over 20% in productivity compared to healthier plants (Sarah 2007). The diseases resistance to winter conditions makes it hard to control and manage. Without proper control and management of powdery mildew, strawberry productivity will still be under constant risk.

In terms of management there are several ways of controlling the casual organism. Crop rotation can be applied in favorable areas as a way of reducing the pathogen source, reducing the occurrence of infections (Strand 2008). Cultivators ought to use tested and approved disease-free seedlings and disease-resistant strawberry varieties. The causal organism initially infects leaves and can remain in the leaves even after the plant becomes old and turns into debris. Old deceased leaves should be destroyed and isolated from growing plants to reduce the chances of re-infection. Use of irrigation can reduce the chances of powdery mildew, by shedding moisture that does not favor development of the causal organism (Strand 2008). However, such practices may not be effective and can only be considered as preventive measures. Chemical control can be the best effective method of controlling and managing powdery mildew. In chemical control, it is important to prevent the disease in the early stages of plant growth. Timely prevention requires fungicide spraying at least 2 times before budding (Strand 2008). Application should be thorough especially around the leaves followed by reapplication as it can easily be washed off by rain. Bicarbonate pharmaceutical products can supplement spraying when the disease is first observed. Moreover, when choosing the right fungicide to apply, it is important to consider the quality of strawberries and if the chemicals negatively affect flowering or fruit quality. Furthermore, the application of fungicide should be economical in terms of yield production (Agrios 2005).

The following aims describing the steps undertaken in practical class to prove the causal organism was using Koch’s Postulate. Associating the existence of a particular pathogen with an infected plant is a simple process. However, determining which pathogen actually causes a specific disease is a more rigorous process. Robert Koch developed a sequence of experimental processes to prove causal organisms (Narayanasamy 2010). He developed a practical theory known as Koch’s Postulates based on the science of medicine and plant pathology. Symptoms of powdery mildew have numerous associated organisms that do not necessarily cause the disease.

The first postulate in proving pathogenicity is association with indicative tissue that aims at proving the suspect organism must be constantly found linked with the disease in all plants inspected. Second postulate is separation form the infected tissue that involves the isolation of suspected pathogen and developing it in a pure culture based on its characteristics and nutrient media. Third postulate involves immunizing the host with separated pathogens (Narayanasamy 2010). Pathogens developed in a pure culture must be injected to a healthy vulnerable host and effects recorded that should match the initial symptoms the disease demonstrations normally. The fourth postulate ensures that the injected host plant demonstrates similar symptoms of normal diseased plants. The last postulate involves the isolating the pathogen again in a pure nature where its characteristics must be identical as to those observed in the second postulate.

In demonstrating the Koch’s Postulates in powdery mildew of strawberries, there are several steps I undertook. The first step involved identifying the symptoms of powdery mildew by comparing a healthy and diseased strawberry plant. The health plant is essential for comparing the infected plant (Agrios, 2005). All symptoms and signs are described in detail after the observation. The second step involved isolating the suspected pathogen from the diseased plant and developing it on a pure nature. The main objective is isolating the microorganisms and transferring it to media. In this step, I started by sterilizing the surface for placing plant material that ensures any organism present are from the inside of the plant not on the plant. To isolate the pathogen, one is required to cut the tissue and add a medium for essential nutrients needed for Sphaerotheca macularis growth (Agrios 2005).

The medium is the constituent that provides nutrients for the development of the suspected pathogen (Sphaerotheca macularis). The substance used as media is potato dextrose agar (PDA) (Narayanasamy 2010). Tissues from infected plant parts are removed using a sterile scalpel and placed on a plate contacting the media (PDA). The suspected pathogen will develop from the cut tissue parts where they are sub cultivated aseptically for supplementary study. The pathogens are then incubated in desired conditions that inhibit the growth of the fungus. Once mycelia start growing, bits of the mycelia should be transferred on fresh PDA slants. In my observation, it was evident that the suspected pathogen is Sphaerotheca macularis, since mycelia continued developing. The third step involves inoculating the purely grown pathogen to a healthy strawberry plant. The inoculation is done by cutting the leaf tissue and placing a small piece of the pathogen colony from the PDA plate and covering the wound with a microspore tape. This has to be conducted in an inoculation chamber to ensure there is no contamination from unwanted fungus (Narayanasamy 2010). The plant should be incubated for about 5 days at moderate humidity and room temperature.

The fourth step involves examining the inoculated plant for symptoms and signs that should match those of diseased plants. The symptoms and signs were of the similar nature as those I had earlier noted down in the first step. These symptoms should be well described and recorded followed by a close examination using the original signs as comparisons. The fifth step involves re-isolating the pathogen through the same process followed in the step two. Results from the process should be used to determine if the pathogen (Sphaerotheca macularis) is similar to the one developed in step two. In my practical, the pathogen re-isolated was similar to the initial Sphaerotheca macularis proving that Koch's postulates was used in identifying Sphaerotheca macularis as the causal organism in powdery mildew.

In conclusion, powdery mildew is a mycological disease caused by Sphaerotheca macularis and mostly infects the lower surface of leaves in strawberry plants. As it develops it can spread to flowers and fruits that can impact strawberry productivity. Powdery mildew can be controlled conventionally or using fungicides. The causal organism can survive develops on leaves and can overwinter on dead leaves to the season where it thrives and starts growing again. As we work on securing sufficient and health food it is important to understand underlying elements in plant pathology.

References

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