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SIGNS, CAUSES, FIGHTING APPLE DISEASES

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ПРИЗНАКИ, ПРИЧИНЫ, БОРЬБА С БОЛЕЗНЯМИ ЯБЛОК

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Abstract. Numerous diseases often damage apples in home orchards each year. These include fly agaric and sooty mold, summer blight, black rot, powdery mildew, and cedar apple rust. This article discusses the signs, causes, progression, treatment, and preventive measures for several apple tree diseases. Some infections attack the tree roots in the fall, but symptoms do not appear until the following spring, when the tree can no longer absorb enough water and nutrients to continue growing. Disease control in apple orchards is difficult due to the lack of effective chemical treatments. Preventive measures can help control these diseases.

Аннотация. Многочисленные болезни часто повреждают яблоки в домашних садах каждый год. К ним относятся летние болезни, черная гниль, мучнистая роса и ржавчина яблонь. В статье обсуждаются признаки, причины, прогрессирование, лечение и профилактические меры для нескольких болезней яблонь. Некоторые инфекции поражают корни деревьев осенью, но симптомы не проявляются до следующей весны, когда дерево больше не может поглощать достаточно воды и питательных веществ для продолжения роста. Борьба с болезнями в яблоневых садах становится сложной из-за отсутствия эффективных химических средств лечения. Профилактические меры могут помочь в борьбе с этими заболеваниями.

Keywords: Malus, orchard, rot, late blight.

Ключевые слова: яблони, плодовый сад, гниль, фитофтора.

Apple tree illnesses can be caused by a variety of non-infectious variables (abiotic factors including temperature, moisture, nutrients, soil conditions, and chemicals) as well as infectious disease agents (biotic pathogens like fungi, bacteria, viruses, nematodes, and mycoplasmas) [1].

The environment, the pathogen's aggression, and the host's vulnerability all affect how severe the disease is. The host's cultural management is a significant factor in the severity of the illness. Apple tree susceptibility is influenced by a number of factors, including planting density, tree maturity, vigor (a measure of stress), and genetic tolerance.

The majority of pathogenic bacteria experience a dormant phase in their life cycle. The organism is incapable of causing illness during this time [2].

Т. 10. №11 2024
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Disease severity is influenced by a number of factors, including population density and the pathogen's natural state of virulence (aggression), when it is not dormant. An important factor in disease epidemics is the environment.

When conditions are favorable for infection and illness development, disease is most severe. Tree growers should regularly check their plants for disease indicators. Keep an eye out for signs of stress, such as stunted growth, dieback of branches or twigs, yellowing, and sunken or discolored patches on the roots, trunk, branches, leaves, or fruit. For this kind of observation, it could be necessary to remove soil from the area surrounding the crown or lateral roots, dig feeder roots, or scrape bark. Maintain thorough records of every aspect of orchard management, including regular disease surveillance. Note the inspection date, environmental conditions, disease symptoms and indicators, information on recent pesticide, fertilizer, and irrigation treatments, and the presence of pests. Sometimes a positive diagnosis of a diseased tree cannot be made after initial examination. Apple tree diseases are greatly influenced by the seasons and surroundings. Certain diseases are seasonal in their activity [3].

These organisms generate diseases that are mostly influenced by the environment and only somewhat by the level of host stress. For instance, the majority of diseases that harm flowers, fruit, and leaves are brought on by an abundance of moisture; hence, these diseases become problematic in the spring during periods of high dew, rain, and fog. Certain infections target tree roots in the fall, but symptoms don't show up until the following spring when the tree can no longer absorb enough water and nutrients to continue growing.

Once plants are afflicted, controlling diseases in apple orchards becomes challenging. Many diseases, especially crown and root rots and cankers, have no known chemical cure. Only proper water management and hygienic measures can lead to the control of these diseases [4].

Fruit and foliage diseases caused by bacteria and fungi are targeted by chemical controls. It is challenging to keep an up-to-date list of materials that are available given the present pesticide registration environment. To find out which fungicides are currently registered, check the chemical references. Phytophthora crown, collar, or root rot is one of the most dangerous illnesses that affect apples. There are multiple Phytophthora species that cause this illness. The illness known as "crown rot" affects the bark at the crown, which is where the roots and stem meet. The condition is known as collar rot when it affects the scion section of the trunk (Figure 1, 2).

When the fungus infects roots that are not near the crown, it leads to root rot. Depending on whatever part of the tree is affected, these illnesses can manifest alone, concurrently, or in any combination [5].

Phytophthora-infected trees usually deteriorate gradually over many years; if the infection occurs in an abnormally rainy spring or fall, the tree may not survive its first year. It is necessary to remove the bark in order to observe symptoms at the collar or crown. The underlying tissue has an orange-red to brown discoloration. Dark brown to nearly black infections are older. There is a clear border separating sick from healthy tissue. The first infection spots on the roots are hard to spot, but as the illness worsens, the roots deteriorate and turn stiff, brittle, and discolored. They may go mushy when secondary organisms infiltrate rotting roots [6].

Soil-borne fungi called phytophthora spp. thrive in heavy, moist, poorly drained soils. The fungus lives for a very long time in soil when there is no host plant present. When there are large rains from late fall to spring and the soil is wet or inundated for an extended period of time, severe disease problems arise. The fungus is most active when it's comparatively chilly outside. Due to the fact that the development of illness is contingent upon both high soil moisture content and cool temperatures, the fungus's activity is restricted in adverse conditions. When the fungus cannot thrive in the environment, trees with only root rot may be able to regrow roots and recover from infection.

Т. 10. №11 2024
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Figure 1. Apple root infected with Phytophthora root rot

Figure 2. Symptoms of scab on leaves (left) and fruit (Right)

The secret to preventing infections brought on by Phytophthora spp. is water management. Keep water from building up near tree crowns! Make sure there is enough drainage and stay away from planting in regions that flood frequently, have low spots, or have thick soil. It is hard to completely eliminate Phytophthora from an orchard once it has taken hold. Replanting is therefore dangerous in areas where this disease has killed trees. When replanting trees in infected regions, place them on wide ridges or raised mounds where the tops of their roots are close to the soil's surface. The graft union should always be planted well above the soil line [7].

Crown gall is a significant plant disease that affects many different species and is present in all types of soils globally. It is brought on by the soil-borne bacteria *Agrobacterium tumefaciens*. The behavior of the bacterium is a little different. It causes aberrant growth and division of plant tissue, resulting in the formation of tumor-like galls at infection sites. The formation of galls obstructs the plant's ability to absorb water and nutrients, which causes below-ground signs of deterioration and slower growth [8].

Through wounds from frost damage, insects, pruning, and culture, the bacteria gets into the roots, crowns, and branches of the plant. Once within the tree, the bacteria encourage aberrant plant

Т. 10. №11 2024
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cell growth with a tumor-inducing plasmid. The resultant tumors have a rough feel and appearance and are formed of plant tissue.

Common saprophytes, or organisms that can grow and survive without the assistance of another living thing, like *Alternaria alternata*, have the ability to spread some illness to apple fruit that is already susceptible to infection due to an injury. *Alternaria* rot is frequently caused by chemical or mechanical wounds, sunburns, or cold trauma. Although infection is more frequently a post-harvest issue, it can happen before or after harvest.

A number of diseases are prevalent in backyard and commercial apple plants that recur year after year. Depending on the weather and the phenology (or development) of the apple host, these illnesses do not all manifest at the same time. Instead, they start during dormancy and progress until the fruit is harvested. Therefore, to harvest a high percentage of viable fruit, a season-long program for disease management is generally required. Apple scab, cedar-apple rust, black rot, and the summertime illnesses sooty blotch and flyspeck are among the frequent diseases that affect apples. Powdery mildew is an occasional problem on certain apple cultivars [9].

One way to handle alternaria rot is to prevent damage during harvest and packing. Chlorine fruit dips after harvesting can also aid in preventing post-harvest illness issues. Another wise technique that will lessen illness issues is cold storage.

Another infrequent issue is fire blight, which can be very devastating when it does occur. Plant diseases can vary significantly in terms of frequency and severity depending on the weather. Therefore, years with high temperatures, high humidity, plenty of rainfall, and cloud cover are typically the hardest to control for diseases.

The most common apple disease is called apple scab, which is primarily severe during rainy seasons and is brought on by the fungus *Venturia inaequalis*. The leaves, fruit, and immature fruit stems are affected by round, olive-black patches caused by the fungus. Severe infections may cause defoliation, and the impacted fruit may fall, wilt, or shatter [9].

The fungus overwinters on dead, fallen leaves. In the spring, it develops primary spores that can infect fresh leaves, fruit, and sepals when it rains. If the right environmental conditions are present, infection from these basic spores can occur at any point after apple growth starts until mid- to late-June.

The fungus produces a separate spore (secondary) in the summer that can spread additional diseases when it rains and lands on foliage and fruits.

Priscilla, Macfree, Jonafree, and Liberty are resistant types that are best at controlling apple scab. Eliminating unhealthy leaves and fruit from the tree's surroundings through a thorough sanitation program will also aid in removing potential inoculum sources in the spring. Additionally, scab can be managed using a well-chosen and administered fungicide.

Numerous rusts frequently afflict apples. The fungus *Gymnosporangium juniperi-virginianae*, which causes cedar-apple rust, is an issue when apple trees and specific red cedar and juniper species are planted adjacent to one another. For this rust to finish its life cycle, it needs two distinct hosts. On apple leaves, the fungus produces vivid yellow-orange or reddish spots or lesions, and on occasion, it causes lesions on the fruit's calyx end. The

fungus causes ¼–2" diameter brown to reddish-brown galls on cedar. These galls have characteristic bright-orange, gelatinous spore-horns that sprout out of their surface during springtime rainy spells. The wind carries the spores to apple trees, where they infect and cause their distinctive wounds [10].

G. clavipes is another *Gymnosporangium species* that causes quince rust. This rust needs two distinct hosts junipers and a few members of the rose family and has a life cycle with cedar-apple and hawthorn rust. Apple leaves are not affected by quince rust, but it does affect the fruit and

Т. 10. №11 2024
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leaves of other plants including quince, hawthorn, and other rosaceous species. On apple fruit, the symptoms manifest as dark-green lesions at the calyx end. These lesions, which are brown and spongy all the way to the center, cause the fruit to pucker and distort. On the juniper hosts, this fungus causes spindle-shaped or cylindrical swellings called galls.

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