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Pathogens as Agent of Seed Borne Diseases

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Abstract

The pathogenic microorganism usually attack seed at different stages of their development which may prevent germination or the seed may grow into young seedling before it die or the seed may grow giving rise to poor quality plant with reduce or poor quality yield. In the seed borne disease, the pathogen may either be outside or inside the seed. When an infected seed is grown, the infection will be transferred to the root then the infection may spread within the plant. The pathogens acquired the ability to derived nourishment from the host plant by feeding on the manufactured food substances and in some instances, the survival of the pathogens is dependent upon these substances.

Introduction

Seed borne pathogens may be defined as any external or internal infections carried on the seeds, which has the potential to cause disease in either seeds or the developing plants [1-3]. Seed borne disease is the result of an infection, overtime, between a susceptible host, a pathogen, the environment, and a transmitting agent, resulting in signs or symptoms of such effects. Any infectious agent associated with seeds that have the capacity to cause plant or seedling disease may be considered as seed borne pathogen. This term comprised the plant pathogens such as bacteria, fungi, nematodes, and other micro-organisms, and viruses, all of which can be carried in, or with the seeds [4,5]. Despite the fact that fungi comprise the largest group of pathogens, the bulk of seed-specific diseases are caused by bacteria or viruses. This is due to the fact that bacteria and viruses are more adept at entering and then travelling through the veins of the plant, a phenomenon known as 'systemic infection,' and from the vascular system may make their way into the developing embryos of seeds [1,6]. In many instances the seed infection is not insignificant when compared with the number of disease organisms that exist in soil or on weed species. However, in other cases, the transmission into seed is the initial stage by which by which a disease enter into the plants [7].

Growing of plant from seed already infected by pathogens may results in the spread of that type of disease inside the crop, and may results in rise in the number of infection sites were the disease may spread. For instance, for the case of development ascochyta blight in a chickpea crop. Because of the high incidence of transmission of infection from seed-to-seedling therefore even a small proportion of seed infection may in the field cause a large scale seedling infection. For instance seed lot

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with 0.1 per cent infection of ascochyta (one infected seed in 1,000 seeds) with a planting density of three to four plants/ft.2, 175 seedlings infection per acre could potentially result. This is a usually an important amount of early sign of infection for such an aggressive disease [1,7].

Seed borne pathogen

Location of seed borne disease

Pathogens attack seed during stages of their evolutionary development, they acquired the ability to feed off the substances manufactured by their host and some of these substances are important for the survival of the pathogens [2,8]. The location of these pathogen in relation to the seed is referred to either externally or internally seed borne diseases. Where such pathogen are located on the outside of the functional part of the seed, it is called externally seed borne disease, while if inside the seed, it is called internally seed borne diseases. Pathogens like *U. Segetum* Var. *Avennae* and *U. Segetum* Var. which survive as teliospores on the surfaces of the seed of Oats and barley, respectively, are the external seed borne diseases. However, barley stripes mosaic virus and *U. Segetum* Var. tritici, which are internally seed borne pathogens, are deep seated and localized inside the barley and are internally seed borne [1,6]. In addition a pathogen may be both internally and externally. For example, *Sclerospora graminicola*, which causes downy mildew or green ear of pearl millet, is carried internally as hyphae in the scutellum and on the surface of the seed as oospore and both the inocula are capable of causing seed disease [3].

Crop losses due to seed borne diseases

Losses due to seed borne pathogens may include reduced seed germination (Table 1), increased damping-off, and mortality of older seedlings in nursery beds. The influence of seed borne pathogens in the production of seed and seedling may sometimes go occur without being noticed up to a time were failure of germination occurs in seedbed or containers [3,9-11]. The intensity in which seed borne pathogens cause nursery beds losses is however, not easy to differentiate from other causes of poor germination, slike damping-off by soil borne fungi. Knowledge of the biology of seed borne pathogens and practices in their management and control assist in seed orchard and nursery managers reduce seed and seedling losses.

Pathogens causing seed borne diseases

Pathogens may infect seeds internally and spoiled the endosperm including the embryo or damage the seeds and affect germination and development of the seedling [2,3].The occurrence of seed-borne disease differs widely between diseases of crop and location. A number of diseases may sometimes become a problem when grown in an area or condusive environment to the disease. In many cases most of the diseases inside or outside the seed are soil-borne or air-borne and the only fate of the crop may be its dependent on the degree of resistance and crop management practices as on the presence of seed-borne innoculum.

Seed borne infection by virus

Transmission infection into the seed plays an important role in the survival of viruses from one season to another Virus transmission via seed, even at a very low rate, can be significant in perpetuation of virus, overwintering and long range dissemination. Transmission of seed borne infection provides an initial source of inoculums for transmission of vectors of the virus which may have a considerable impact on crop yield. Seed transmission of CMV in various host species including species of weeds was reported from 0 to 100% the virus may sometimes become inactivated during the germination and may not contribute to seed transmission. Seed embryo can be infected by two routes, either from infected gametes during fertilization or through direct invasion of the immature embryo from virus-infected seed coat plant viruses may infect all reproductive tissues, but seed coat and embryo infections are mostly associated with seed transmission. However, it does not necessarily follow that the presence of virus in the seed coat and embryo infection will always lead to seedling infections. Seed coat infection might play a role in seed transmission of some plant viruses but not always. In contrast, embryo infection is important for seed transmission of the majority of plant viruses [3]. But may not always produce virus-infected seedlings. The non- appearance of symptoms in CMV-infected pepper seedlings derived from infected seed is not an unusual character. A number of viruses such as CMV have been found to produce symptomless infected seedlings through seed transmission. For example, the symptomless CMV produced seedlings of chickpea (Stellaria media) infected through seed.

Seed borne infection by fungi

Many fungal diseases are seed transmitted where the seed borne infection can spread in to the seedling to infect the whole plant body [12-14]. The fungus was shown to infect the seed leaves as soon as germination occur and remain without sign of infection in lettuce seed by *Botrytis cinerea* [15].Stewart and Franicevic [12] found that *Aspergillus flavus* causes seedling infection in young maize plant grown from contaminated seeds. However, it was found that the rate of germination was much lower when *Aspergillus flavus* entered and contaminated the seed. The distribution of the fungus suggests that initially the organism may have followed the meristem of the plant. Koycu and Ozer[16] isolated several fungi from onion seeds and seedlings, which were seed-borne, however, only *Aspergillus niger* and *Fusarium oxysporum* were transmitted from seed to onion sets. *Fusarium oxysporum* was reported as a seed-borne pathogen in common naranjilla (*Solanum quitoense*) Ochoa and Ellis [17] and can be transmitted from seed to seedling. *Fusarium oxysporum* was isolated from seeds and plant parts, which were surface sterilised before plating. Similarly in Ndor[18] reported *Penicillium* spp, *Aspergillus niger*, *Fusarium* spp and *C. Lindemuthanium* as the most devastating seed borne diseases responsible for losses of green gram seeds from six villages from Plateau State North Central of Nigeria (Table 2).

Despite, seed infection by pathogenic fungi can be transmitted in to the seedlings however, it appears fungal seed infection does not always lead to seedling infection. This is corroborate with the work of who isolated *Botrytis fabae*, the causative agent of chocolate spot of *Vicia faba* from bean seeds. Reported that the levels of *B. fabae* conidia on many infected seeds, which were tested, were too low to results into an aggressive lesion at 150C therefore the fungus dies without causing any seriously damage to the plant. They concluded that a high amount of inoculum is needed for an aggressive infection to occur in seeds. Burgess et al., [19] found that not all seed infections by endophytic *B. cinerea* results in seedling infection. This evidence was based on their inability to isolate *B. cinerea* from sections of surface sterilized asymptomatic epicotyl from seedlings with visible root lesions. In addition healthy seedlings were grown from infected seeds [20].

Table 1: The incidence of seed-borne fungal infection and germination of green gram seeds from six villages in Langtang North Local Government Area.

Villages	Occurrence	Incidence (%)	Germination (%)
Dadur	+	14.7	72.0
Mban	+	18.7	66.7
Gazum	+	16.0	86.7
Kuffen	+	88.7	11.3
Pilgani	+	6.7	91.3
Zamko	+	23.3	72.7
FLSD			

(P< 0.05)

Table 2: The percentage occurrence of different seed-borne fungi of green gram in six villages after 7 days incubation.

Villages	*Penicillium* Spp	*Aspergillus niger*	*Fusarium* spp	C.Lindemuthanium
Dadur	2.67	1.33	0.67	10.00
Mban	9.33	0.67	0.67	6.67
Gazum	3.33	6.00	2.67	4.00
Kuffen	42	22.67	2.67	22.00
Pilgani	2.67	0.67	0.00	2.67
Zamko	2.67	1.33	0.67	3.33
FLSD	1.5	2.75	1.05	3.32

(P< 0.05)

Seed borne infection by bacteria

Bacteria are tiny, one-celled microorganisms (prokaryotes) that, like fungi, require an external food supply for their energy [2,5]. They, too, are facultative parasites of plants and are capable also of independent existence in plant residues, water or soil. Bacteria gain entry into plants through the stomata or through wounds caused by abrasion, insects or pruning. Seed borne infections caused by bacterial diseases are highly infectious and are particularly difficult to control [11]. Bacteria are spread easily by splashing water, particularly wind-blown rain and overhead irrigation. Some bacteria are spread from one plant to another by insect vectors, and they are all spread by hands, machinery and tools. Many also are carried on or in seed. Some pathogenic bacteria are capable of infecting one or a few host species or cultivars, whereas others, such as *Erwinia carotovora* subsp. *carotovora*, a soft-rotting bacterium, have a very wide host range [2].

Conclusion

Seed borne infection by pathogens causes losses to plant and plant produce resulting in serious economic losses of both time and money. The Seed borne infection may occur either before or after harvest of the plant and its produce. The seed borne infection caused by pathogens normally occurs due to lack of poor handling and harvesting techniques. The quality of the plant grown from infected seed cannot be improved once the plant started germination. The seed borne infection after germination moved to the young seedling first into the root, stem then into the leaves and subsequently into seed. However, this loss can be control by following important cultural methods in addition to careful harvesting, handling and packaging techniques. Also careful use of recommended chemicals before and after harvest may prevent seed borne infection and maintained the freshness of the seed for a considerable length of time by protecting them against pathogens and other environmental factors.

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