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Advances of Epidemiology of Rice Blast Disease

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SUMMARY

Rice is a staple food crop for majority of human population worldwide. Significant grain yield losses are reported due to blast disease caused by *Magnaporthe oryzae* across all crop growing areas of the world. Though, presently available blast management strategies reduce disease significantly, blast epidemics are still common, thereby causing devastating yield losses. Epidemiology is the major tool for the study of the development of diseases in a population under a particular set of environment.

INTRODUCTION

Rice is one of the major staple food in the world and a pillar for food security in many developing countries. The crop is an important integral part of Indian dietary and staple food of more than 60 per cent. Rice is primarily a high energy and high calories food crop that contains about 6-7 per cent protein and 2.25 per cent fat. It occupies a pivotal place in the global food and live hood security. The crop cultivated in an area of 44.62 m ha with annual production of 93.08 mt with productivity of 2.0 t / ha that contributes 44.0 per cent of total food grain production China and India remains the top two largest producers of rice in the world (Rice/Wikipedia). India, hybrid rice cultivation is becoming more popular in Andhra Pradesh Karnataka, Tamil Nadu, Punjab, Haryana, West Uttar Pradesh and West Bengal. However, biotic stresses constantly threaten sustainable production of rice due to their dramatic impact on grain yield and quality. Blast disease caused by *Pyricularia grisesa* is one of the most destructive diseases in the world where rice is grown (kim, 1982). Under favourable conditions, rice blast can be the most important rice disease in China, Japan and the USA, causing severe damage to rice yields (Zeng et al., 2009). As a prerequisite for efficient and innovative control strategies, it is mandatory to improve the sharing of information among experts in a global and regional scale and increase expertise capacities in epidemiology and disease diagnosis. Epidemiology is the major tool for the study of the development of diseases in a population under a particular set of environment.

Types of Epidemics:

There are three types of epidemics:1. Monocyclic epidemics 2. Polycyclic epidemics 3.polyetic epidemics

1. Monocyclic epidemics are caused by pathogens with a low birth rate and death rate, meaning they only have one infection cycle per season. They are typical of soil-borne diseases such as Fusarium wilt of flax.

2. **Polycyclic epidemics** are caused by pathogens capable of several infection cycles a season. They are most often caused by airborne diseases such as powdery mildew. Bimodal polycyclic epidemics can also occur. For example, in brown rot of stone fruits the blossoms and the fruits are infected at different times.

3. Polyetic epidemics: For some diseases it is important to consider the disease occurrence over several growing seasons, especially if growing the crops in monoculture year after year or growing perennial plants. Apple powdery mildew is an example of a polyetic epidemic

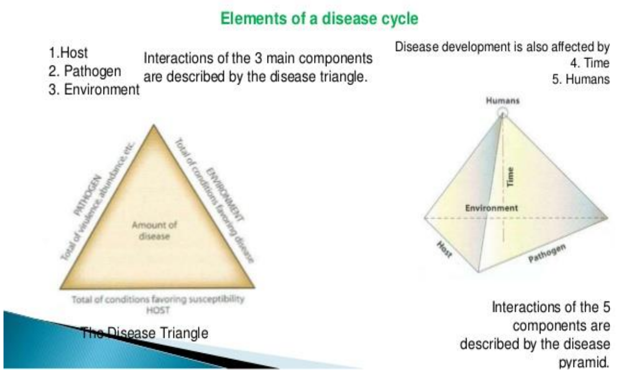
caused by a polycyclic pathogen and Dutch Elm disease a polyetic epidemic caused by a monocyclic pathogen. The terms compound interest and simple interest are for explaining rate of increase of pathogen. These terms were introduced by Van der Plank in 1963 in the book 'Plant Diseases-Epidemics and Control'. Based on the mode of multiplication of pathogen, the diseases are classified of two types: 1. Simple interest diseases 2. Compound interest diseases
1. Simple interest diseases: In simple interest diseases the increase is mathematically analogous to simple interest in money. There is only one generation of the pathogen in the life of the crop.
2. Compound interest diseases: In compound interest diseases the rate of increase is mathematically analogous to compound interest in money.

Factors affecting plant disease epidemics –

An epidemic may cause widespread and mass destruction of crop in a short time or may persist for long periods depending upon the three following factors responsible for the disease:

1. Host 2. Pathogen and 3. Environment 4.Time and 5. Human

Diseases development may occur by



Epidemiology of rice diseases:

Blast:

Effect of predisposing factors and interaction of these factors with the varieties were investigated for blast. Seedling stage, rapid tillering stage after transplanting and flower emergence stage were identified as the most susceptible ones to blast. The fact that the age of the leaves influence the susceptibility to blast was also brought out. The older the leaves in the plant, the more they are resistant to blast. Excessive nitrogen and exposure to the cold night temperature predisposed susceptible varieties, but did not show any effect on highly resistant varieties. The critical range of temperature for penetration and establishment of infection was round about 25-26°C whereas germination of spores and appressoria formation occurred within 6-10 hours at 20-30°C in the presence of water on the surface of the leaf. The formation of dew or a little rainfall, occurrence of fog provided the necessary water required for the germination of spores. The analysis of the intensity of infection recorded in various experiments over a period of several years revealed the fact that blast infection had occurred under natural conditions when the minimum temperature during the night was 26°C and below with the concomitant occurrence of relative humidity of 90% and above. This fact has been subsequently verified by critical experiments. This led to the formulation of a forecasting technique based upon the above findings.

Forecasting blast occurrence

The weather factors, minimum temperature, maximum temperature, and relative humidity greatly influenced the colour of blast lesions and spore producing ability. Heavy disease incidence always occurred when the mercury column reached 21-25 mm in the manometer. For long range forecasting, the formula Y = 0.697 X -1.5 was developed, where Y = disease incidence and X = number of days with minimum temperature range 21-22^{o}C.

CONCLUSION

It can be concluded that the role of seed-borne inoculum should investigated. Development of simple summary model is necessary for disease forecasting which may be used by field and extension workers. Blast of rice cannot be managed by the scientists in a state or region working in isolation. A team of plant pathologists should be identified with a lead centre and the other scientists located at representative centres with clear cut mandate and objectives of the work. Monitoring of the change(s) in virulence of the pathogen should be done regularly and all the representative isolates should be maintained for further reference.

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