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Biology Molecular: Virus and Plants interactions

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Introduction

Written by Prof. Dr. Ir. Hasriadi Mat Akin, this book on Molecular Biology of Virus and Plant Interactions contains basic concepts about the molecular genetics of plant viruses and their interactions with host plants. Viruses are parasites obligate at the molecular level require genetic interactions with the host plant to complete the life cycle, survive and develop. Viruses cannot metabolize independent, therefore virus metabolism occurs through interaction molecular with host plant cells. This book reveals the latest information about interaction molecular link between viruses and plants. Language used are easy to understand and necessary as internal reading material studying the biology of viral parasitism on host plants. Writer realizes that this article still has many shortcomings. Therefore any criticism and suggestions from readers are very necessary to improve the contents of this book. Viruses physically consist of enveloped nucleic acid by proteins so that virus particles are also called nucleocapsids. Some viruses are also surrounded by cell membranes, which are fat associated with proteins or lipoproteins. Outside the host cell viruses are just macromolecules that do not carry out life activities. Stanley in 1935 succeeded in crystallizing it. Tobacco mosaic virus can be stored for a long time and does not lose its infectivity. For that discovery Stanley was awarded the Nobel Prize.

Viruses are not composed of cells that have cell organelles whose function is to carry out independent metabolism so that they are viruses unable to carry out independent metabolism. To complete in its life cycle, viruses need the help of host cells to synthesis of viral genomes and proteins. The viral genome contains genetic code that produces structural proteins (coat proteins, movement proteins), functional proteins (replicase, protease). Expression of viral genes to produce viral proteins requires molecular interactions between viruses and host plants. The character of viruses is different from other microorganisms such as bacteria and fungi which are plant pathogens. The development of molecular genetics has become more rapid since Watson and Crick in 1953 discovered the DNA molecule helix structure as genetic material. Since then started era of molecular genetics with stages of genetic transformation from DNA, RNA and protein or also known as dogma senta molecular genetics. Mechanism of genetic transformation of DNA which involves the stages of DNA replication, RNA transcription and protein translation and its regulatory mechanisms are a study in molecular genetics. Gene expression regulation is the process of modulating gene expression according to the needs of cells, tissues, and the presence of foreign objects in the cell cytoplasm and the stage of plant development. Regulation of gene expression can occur at any stage starting before transcription through methylation of gene promoters, at the transcription stage which is modulated by gene regulators (enhancers, promoter and terminator), posttranscriptional RNA degradation and post translationally via protein activation. Molecular genetics of viruses essentially discusses about molecular interactions between viruses and plants. Viruses' character that only consist of protein and genetic material such as DNA or RNA does not have the metabolic machinery to synthesis of viral proteins and nucleic acids. Hence the virus requires the plant's molecular machinery to do so carry out their life cycle through genetic interactions with host plant cells. Virus replication is an acidic replication process nucleic acid (DNA or RNA) in the host cell by utilizing host cell metabolic machinery. A host cell infected with a virus becomes a means for virus multiplication.

Replication of viral DNA occurs in the host cell nucleus using host cell metabolites, nucleotides (A, T, C, G), DNA polymerase, and energy (ATP); Viral RNA replication occurs in the cytoplasm cells

use host cell metabolites, such as nucleotides (A, U, C, G), tRNA, and ATP. RNA viruses generally synthesize RNA polymerase (RdRp) uses the viral RNA genome. Protein synthesis for both DNA viruses and RNA viruses occurs in the cytoplasm of the host cell. Viral protein synthesis is also beneficial traps host cell metabolic machinery and plant metabolites host, such as amino acids, ribosomes, enzymes, and ATP. Viral gene expression requires interactions at different levels of molecules between the viral genome and the plant genome. Viruses only as macromolecules that is not equipped with organelles and metabolites that can function for viral gene expression. The virus gen can only be expressed if the virus is in the host cell's metabolic system. Therefore viruses are also called molecular parasites because parasitism requires molecules such as amino acids, nucleotides and energy in the form of ATP from host cells. Effect of viral infection on macromolecular synthesis in plants is observed in a decrease in the synthesis of nucleic acids, protein and carbohydrates. Viral infection of the host plant photosynthesis is observed on the effect of viral infection on reduced photosynthesis rate of the host plant. Apart from cells function, viral infection also results in changes in cell morphology. Several changes in cell phenotype are common in viruses infection are changes in cell shape, lysis, membrane permeability, formation of inclusion bodies, changes in chloroplast morphology. Several reports indicate that viral proteins are also toxic to host plant cells. Based on the mechanism of virus parasitism on host plants, viruses can be classified as obligate parasites molecular due to parasitism on virus host cells requires simple molecules from plants such as amino acids, nucleotides. Viruses are also called energy parasites because viruses cannot produce energy independently from carbohydrates and only take energy from host cells in the form of ATP to reactions for the synthesis of nucleic acids and virus proteins.

References

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