HOW DOES MOLECULAR BIOLOGY HELP TO IDENTIFY PLANT DISEASE?

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ABSTRACT

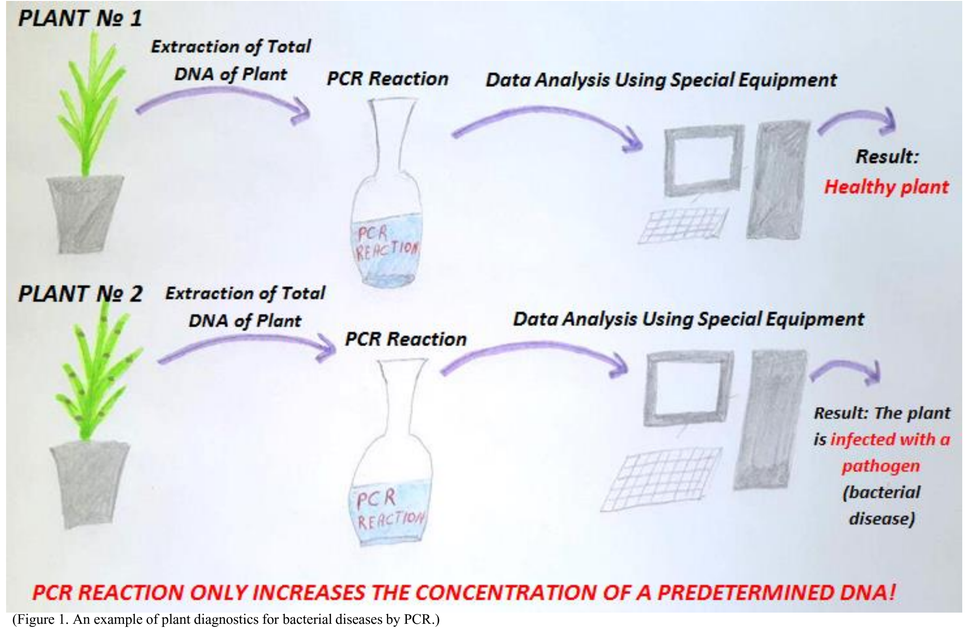
This study examines a process of plant disease diagnostics in light of a particular method of molecular biology - polymerase chain reaction.

INTRODUCTION

How can we know what is wrong with our garden plants or houseplants on a windowsill? We should be a good detectives, and take into consideration such multiple causes as physical factors (light, temperature), chemical factors (water, fertilizers) and biological factors (insects, bacteria, fungi and viruses). And when we limit our variants to biological factors and also rule out insects, we should be able identify the cause of plant disease more accurately down to the very type of microorganism (types of microorganisms that cause disease are called pathogenic organisms). (Riley et al., 2002)

In this situation, molecular biology will help us with its advanced method of polymerase chain reaction (PCR). In the PCR process, molecular biologists many times increase the concentration of a certain DNA region (where the specific genes of bacteria, fungi and viruses are located) and, thanks to an increase in their concentration, we can detect the pathogenic organisms and understand what infects our plant. (Van Pelt-Verkuil et al., 2008)

Plant diseases can be caused by various organisms such as bacteria, fungi and viruses. Based on the fact that organisms have genes specific only to them, molecular biology helps to identify each pathogenic organism that affects a plant by detecting their genes in the plant. (Ilardi & Loreti, 2014)

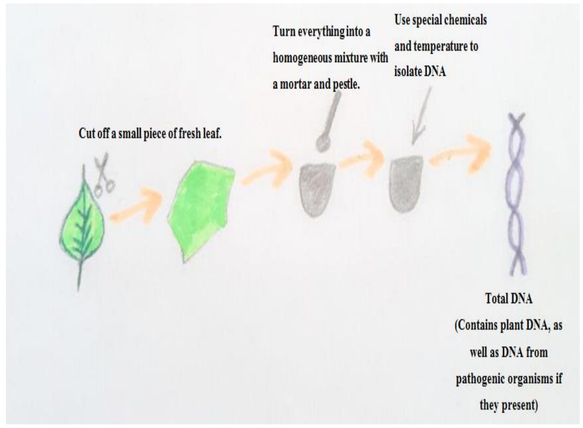


(Figure 1. An example of plant diagnostics for bacterial diseases by PCR.)

METHODS

(Figure 2. Bell pepper affected by the fungal disease Anthracnose. (Ownley & Trigiano, 2016, p.26))

1. Detection of pathogenic organisms in a plant containing hereditary information in the form of DNA (bacteria, fungi, DNA viruses)

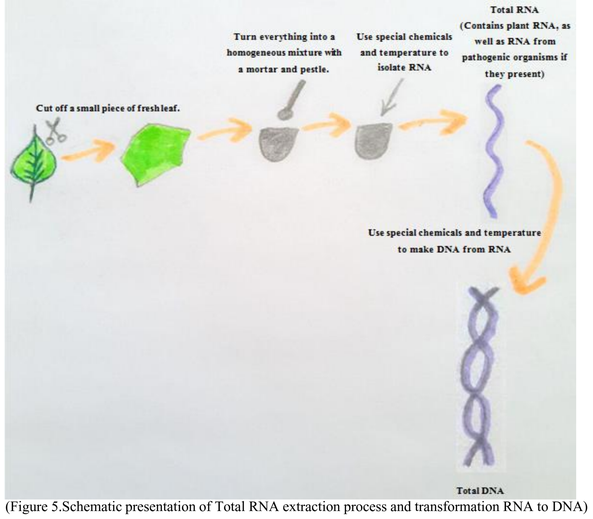


(Figure 3.Schematic presentation of Total DNA extraction process.)

1.1 Extract Total DNA from plant.
1.2 Run PCR reaction.
1.3 Analyze and interpret the data. (Boonham et al., 2016)

(Figure 4. Tobacco leaves have light green and dark green spaces which caused by tobacco mosaic virus (Ownley & Trigiano, 2016, p.24))

2. Detection of pathogenic organisms in a plant containing hereditary information in the form of RNA (RNA viruses)



(Figure 5.Schematic presentation of Total RNA extraction process and transformation RNA to DNA)

2.1 Extract Total RNA from plant.
2.2 Make Total DNA from Total RNA, for the PCR reaction is possible only on the basis of - DNA.
2.3 Run PCR reaction.
2.4 Analyze and interpret the data (Boonham et al., 2016)

CONCLUSION

Taking into account the universality of diagnostics of plants for pathogenic organisms using molecular biology, it should be added that the polymerase chain reaction method (PCR) is highly valued because of its speed and sensitivity. (Narayanasamy, 2011) In this way, despite the fact that our pathogenic organisms belong to completely different species (bacteria, fungi, viruses), molecular biology helps us to find the cause of a plant disease, by offering a convenient and reliable method of polymerase chain reaction (PCR).

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