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BIOTECHNOLOGY IN THE DIAGNOSIS AND SURVEILLANCE OF ANIMAL DISEASES PCR IN RINDERPEST VIRUS

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ABSTRACT
Modern biological methods are used in the diagnosis, surveillance and even treatment of diseases. A number of methods are applied in this case including Polymerase Chain Reaction. More specifically the reverse reaction in this procedure is largely applied. This paper analyses the methods and surveillance of rinderpest virus and disease in animals. This disease affects ruminants but it is known as peste-des–petits ruminants. Past methods have been unable to diagnose and treat these two diseases. This is one of the most devastating viruses that cause a lot of loss of cattle especially in developing countries. Initially, the virus took long to recognize but the use of modern biotechnology methods goes a long way in making the surveillance and diagnosis of the virus quite easy.

KEYWORDS: Peste-Des–Petitsruminants, Rinderpest, Animal Diseases

INTRODUCTION

Biotechnology involves the use of living organisms in order to improve or make novel products. Biotechnology plays an important role in a variety of fields including agriculture. Agriculture is one of the most important economic fields in the world because it provides food for consumption and also for economic purposes (Rassmusen, 2014). However, agriculture is threatened by the existence of diseases and viruses. However, biotechnology is quite important in the process of diagnosing, surveying and even treating some of these diseases. Rinderpest (RP) is an exceedingly contagious disease that affects livestock like cattle and other wild animals such as buffaloes. The disease is a consequence of animals being affected by the rinderpest virus (RPV). The disease spreads very fast and at a very high rate thus has a high mortality rate (Roeder, Mariner and Kock, 2013). Economically, rinderpest is of great importance due to the cost f drugs and also issues related with loss of livestock. This is why biotechnology is of utmost importance when it comes to this disease. Biotechnology has been used in the diagnosis of the disease to the extent that the disease is now almost inexistent in most parts of the world. However, it is necessary to keep up the surveillance of the disease because of the dynamism of the virus.

Surveillance indicates that even small ruminants are affected by the virus causing a disease known as peste-des–petits ruminants (Ayari-Fakhfakh, Ghram, Bouattour, Larbi, Gribaa-Dridi, Kwiatek, Bouloy, Libeau, Albina & Cetre-Sossah, 2010). However, the two diseases need to be diagnosed and treated differently. These animals are of great importance to developing countries and the lack of effective methods has always led to a lot of losses for farmers. Initially, the methods used in the identification, diagnosis and also surveillance of the virus took a long time. Classical methods such as agar gel immune- diffusion, viral neutralization and viral neutralization were not very effective in rinderpest virus. This is where biotechnology comes in. biotechnology allows for the identification of various aspects related to rinderpest virus. in addition to this, it was impossible to differentiate rinderpest and peste-des–petits ruminants has always been difficult (African Union Interafrican Bureau for Animal Resources, 2011). This has posed a major problem when it comes to treating and surveillance of the two diseases. This paper analyses the use and effectiveness of Reverse Transcription Polymerase Chain Reaction in analyzing these two diseases.

Table 1. Sequence and position of primers set and oligonucleotide probe.

Primer Gene (Position) Sequences
B12 RP-N (1322>1344) 5’ CAA GGG AGT GAG GCC CAG CAC AG
B2 RP-N (1594<1618) 5’ TAG GAA CAG CAA CAT ACG AGA GTC
Probea
Probe SB1 : RP-N (1463>1482) 5’ ACT CTG ATT GAT GTG GAC AC
Materials and methods

This research uses both existing data and primary data for the collection of information on rinderpest virus in cattle and livestock. The secondary data used is from existing literature on the rinderpest virus in both cattle and ruminants. In order to collect primary data, the research uses cells in the process of conducting the reverse polymerase chain reaction. The selected animals were cattle and goats as ruminants. These animals were susceptible to rinderpest virus but not necessarily affected. Cells were collected by swabbing the nasal mucosae of the selected animals. The cells were placed inside a microfuge that contains a buffer. These swabs were placed under low temperature for study in the laboratory. The next step was extracting ribonucleic acid. This was done through the processes followed in the Polymerase Chain Reaction. This process was followed by conducting the reverse transcriptase or reverse transcription polymerase chain reaction. polymerase chain reaction is one of the latest biotechnological methods. Each of the ribonucleic acid extracted was tested for both rinderpest disease and Peste des petits ruminants. This is usually a process that takes quite long but through biotechnology various kits have been developed to ease this process. In this case, the researchers tested the ribonucleic acid using one of the industrial test kits. As in the reverse polymerase chain reaction test, water that is free of nuclear material was added in each test. This water is used to develop both negative and positive controls. In order to make the ribonucleic acid even more visible, the researchers performed agarose gel electrophoresis. Without biotechnology this would not have been possible. From the results obtained, the researchers found out that there are both affected and unaffected animals. to find out the prevalence of the disease, the researchers divided the total number of positive samples by the total samples multiplied by 100. This percentage was used in finding out the prevalence of both rinderpest and peste- des- petits ruminants.

RESULTS AND DISCUSSION

The researchers used a total of one hundred and eighteen goats and cows for the analysis of peste- des- petits ruminants disease and rinderpest disease. The cows were 20 and the goats were 98. All these animals were highly susceptible to the two diseases. 16.3% of the goats were infected with peste-des-petits ruminants while 95% of the cows were affected by rinderpest virus. It was quite easy to find out these diseases in the two types of animals. this is because the two diseases affect different parts of the primers. According to Ayari-Fakhfakh et al (2010), the neucloprotein gene is usually affected when it comes to rinderpest disease and peste-des-petits ruminants. However, the diagnostic specificity and diagnostic sensitivity tests used in this case were of great importance in the process of differentiating these two diseases. This makes the reverse polymerase chain procedure quite important in diagnosing the two diseases. Cells whose ribonucleic acid tested positive for rinderpest disease did not test positive for peste-des-petits ruminants. This result is only obtainable after the use of reverse transcriptase polymerase chain reaction also another advancement brought about by biotechnology. The use of reverse transcriptase polymerase chain reaction does not require the use of cold chain methods. This sets a specificity for the primers (Balamurugan, Krishnamoorthy, Veeregowda, Sen. Rajak, Bhanuprakash, Gajendragad and Prabhudas, 2012; Saravanan, Sen, Balamurugan, Rajak, Bhanuprakash, Palaniswami, Nachimuthu, Thangavelu and Dhinakarraj, 2010). In addition to this, the restriction enzyme did not react to the buffer and thus it was amplified in rinderpest virus as found in cows. This issue is clearly discussed by Carrillo, Prarat, Vagnozzi, Calahan, Smoliga, Nelson and Rodriguez (2010) who further explains that the specific restriction enzyme known as Rsal is more sensitive in the case of rinderepest disease as depicted in cows. It is noteworthy that biotechnology plays a major role in the process of identifying these two diseases.

According to Chen, Hu, Qu, Hu, Zhang, Zhi, Huang & Bu (2010), the processes of reverse transcriptase polymerase chain reaction were developed back in history. However, the use of various chemicals and hybridization techniques has made this process even more effective. In the process of eradicating rinderpest from small ruminants and cattle, this technique is quite effective. in addition to this, the test provides room for improvement to the extent that it is now possible to test the effectiveness of the disease. Roeder, Mariner and Kock (2013) also confirm that the process has been very instrumental in the creation of a vaccine. The quickness of the process is effective in the process of diagnosis and eradication of the two diseases. The major problem facing most developing countries like Africa is that the demand does not meet the supply (Zinsstag, Schelling and Tanner, 2011; Saeed, Ali, Khalafalla & Rahman-Mahasin, 2010). The main issue in this case involves the logistical processes such as transportation and also the storage of the vaccine. The current vaccine requires low temperatures for storage, an aspect which is making the whole process quite difficult (Rich, Roland-Holst and Otte, 2012). For this reason, it is necessary to continue improving the reverse transcriptase polymerase chain reaction in order to improve access to the vaccine. Rinderpest virus has a great impact on farmers especially in developing countries. This is especially true in countries which practice farming as a major economic activity. The virus causes two types of diseases, one in ruminants and the other in cattle and large wild

animals. Sometimes, it is difficult to diagnose and differentiate these two diseases thus treatment is not provided accordingly. At the end of the day, farmers suffer a great economic loss and the country is plunged back to poverty. Polymerase Chain Reaction is a modern technique that was coined for effective identification of disease. In the case of rinderpest virus, reverse polymerase chain reaction technique has proven to be quite effective in the identification of rinderpest disease and peste-des-petits-ruminants. In as much as the procedure is not completely effective, it is advantageous as it provides room for improvement.

The African Union Interafrican Bureau for Animal Resources (2011) explains that in Africa, farming is not only a method of earning a living, it is also a part of the culture. the organization has benefited greatly from biotechnology. For this reason, it is necessary to ensure that the practice is carried on throughout generations. To this end, it is necessary to alleviate some of the major problems that are inflicting farmers. Biotechnology has accorder ways of doing this and polymerase chain reaction is quite applicable in this case. More specifically, the reverse transcriptase polymerase chain reaction would help in differentiating rinderpest disease in small ruminants and also large animals like cattle and even wild animals. In most instances, biotechnology has been applied in the creation of genetically modified plants and even animals (Rassmusen, 2014). This is still one of the ways in which biotechnology can be used in the eradication of rinderpest virus. By creating genetically modified animals that are resistant to the virus, it becomes easier to deal with the disease permanently. This is an effective way of using biotechnology.

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