A Review on Therapeutic Proteins in Plants

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***Abstract*: Proteins which are engineered in laboratories, these proteins are called Therapeutic proteins. These proteins are basically used in many severe diseases in human being such as Haemophilia, dental caries, Anaemia, Multiple sclerosis and Cancer. Human Insulin is the best example of Therapeutic proteins. These plants are generally used in therapeutic proteins these plants are Tobacco, Alfa alfa, Lettuce, Maize, Rice, Wheat. Mostly these proteins used in industrial proteins and Enzymes, Monoclonal Antibodies, Biopolymers as well as Antigens used for edible vaccines such as Hepatitis B virus, Human Papillomavirus, Influenza virus, Rabies Virus. So, plants are effective and efficient bioreactors for the production of recombinant proteins.**

***Keywords*: Monoclonal Antibodies, Recombinant proteins, Bioreactors.**

1.) Introduction:-

Medicinal plants are generally used for the production of therapeutic proteins from 16 to 17 century. There are many proteins such as mammalian antibodies, blood substitutes, vaccines and therapeutic entities (Winslow LC etal., 1998; Fischer R etal., 2000).Plant derived proteins are used in human diseases and mammalian viral vectors. The transfer of genes from one organism to another that is a natural process to produce new traits example disease resistant corn**.** The Trans gene encoded the trait is inserted into plant cell with cassette of additional genetic material. Gene transformation and genetic engineering contribute to increase the crop productivity (Sinclair etal.2004).

There is the rapid developments in transformation technologies in many plant species it is first described in Tobacco(De Block etal.,1984; Horsch etal.,1984;Paszkowski etal.,1984).There is direct gene transfer method into protoplasts and particle bombardment method (Karesch H; Bilang R. 1991) Neuhaus and Spangenberg.,1990.,Birch and Franks.,1991.,Christou,1992;Seki etal.,1991;Takeuchi etal.,1992; Yao etal.,2006).

2.) Gene transfer method in Plants:-

Plant cells is transform the chemical method by using the polyethylene glycol to obtain direct uptake and stable maintaenance of DNA by protoplasts from a species of Wheat(*Triticum monococcum)* another monocot grass(*Lolium multiforum)* and dicot oilseed rape, tobacco and Petunias(Lorz etal.,1985;Potrykus etal.,1985a,b). There are number of genes transfer technologies such as Electroporation, Polyethylene glycol, Microinjection, Silicon carbide mediated transformation, Liposome mediated gene transfer, Pollen tube pathway method (Fisk, HJ., 2005;Miao YL.,2007).

a) Electroporation:-

Electroporation is also called Electro permeabilization is an electrical field is applied to cells to increase the permeability of the cell membrane with the help of drugs, DNA, chemicals is introduced the cell(Neumann E, Schaefer-Ridder M, etal1982).This technique is quiet efficient for the use of tissues in vivo transfect ion that is depend on voltage, repetition, pulses ,duration and visibility of ventricles for injections of nucleic acids and increased the permeability of dividing the cells(Gallego-Perez etal.,2017).Electroporation is introduced in maize, carrots, tobacco(Rhodes CA, Pierce DA.,1988;Rodenburg KW etal.,1989.).It is also done in wheat, rice, maize and barley(Abdul-Baki AA etal.,1990).The area of electroporation is rapidly in plant cells is rapidly vast to provide powerful tool for gene transfer to capable of a broad range of plants. This is the method to transfer the gene packages of plant species through the use of contact cells or different parts of plant.

b.) Polyethlene glycol method:-

It is direct gene transfer method, in this treatment there is the presence of divalent cations and PEG treatment take place in the presence of divalent cations. They provide the cell membrane permeable to naked DNA. It enters into the DNA that enters to the nucleus and integrates the genome of the host. It is first done in Petunia and Tobacco in the presence of poly-L- ornithine (Davey MR, Cocking EC etal.,1980;Draper J, Davey etal.,1982; Krens FAetal.,1982;Paszkowski J etal.,1984).then it is performed in Japonioca and Indian rice varieties such as maize and forages grasses(Potrrykus I etal.,1985;Hauptmann RMetal.,1987).

c.) Microinjection Method:-

Several plant species are transformed using microinjection such as cereal Rye, tobacco, petunia, soybean, barley, oilseed rape(de la Pena.,1987). This method is direct and has delivery of DNA. There is the transfer of limited amount of genetic information for

selection and backcrossing it is caused by the interplay of several different genes in the plant via interspecific crosses to enable the transfer of traits (Greisbach1983; 1987).

d.) Silicon carbide transformation Method:-

This method is capable of puncturing the cells without killing them. This method was processed to transform tobacco and maize crop. It is easy and cheap method to implemented the various cells. Silicon carbide fibres are added to a suspension of tissues and plasmid DNA. DNA coated fibres penetrate the cell membrane that is created by collisions between the plant cells and fibres. In this method carborandum, silicon nitrate and glass help to introduce the DNA (Yamagishi N, Terauchi H etal., 2006; Dalton SJ etal., 1997).

e.) Liposome mediated transfer method:-

Liposome basically formed by the self assembly by dissolved lipid molecules are conserved the entities with a head group of hydrophobic hydrocarbon tails that is connected to the linker of glycerol through one or more amines present in polar head groups with the help of vanderwall forces and electrostatic binding to the DNA which gives liposomes shapes because of the polyanionic nature of DNA cation, lipids are used for gene delievery (Israelachvili JN., 1991; Mayhew E etal., 1983).

f.) Pollen tube pathway method:-

This technique is done at receptor plant with the receptor cell directly. In this technique recombinant plasmid with target gene or donor total DNA target gene was not transferred. This technique is done in field experiment. There is the need for flowering structure, blooming behavior and fertilization process. For example in Rice and Cotton (Xiaoming Song etal., 2006).

3.) Production of Pharmaceuticals in plants:-

There are many biopharmaceuticals and recombinant antibiotics and vaccines are developed with plant expression of human growth harmone fusion protein, interferon, monoclonal antibodies and serum albumin are developed and there are other therapeutics used in plants. Such as Insulin**.**

a) Recombinant Antibodies retrieved by Transgenic plants

There are the plants that is potentially used as monoclonal antibodies that is called plantibodies such as Tobacco is generally used for antibody expression systems. Some other plants are also used such as potatoes, soyabeans, alfaalfa, rice, corn. There are the antibodies that are binding to the organisms and serum or body fluid effector proteins such as interleukin. From Tobacco leaf there are various immunoglobins from their cellular locations such as leaves, ER, Cytosol, Nucleolus, Apoplast, Chytosol, Sytosol, membrin, roots, seeds, tuber and their cells. These immunoglobins are IgG1, IgM ,scFv, IgG, IgA, IgM Plantibodies are currently used as commercialized purpose which has low immunogenicity of recombinant human antibodies used for future production of monoclonal antibodies(Fischer R etal.,2000)

b) Vaccines

There is the development of low cost of oral vaccines that is attenuated vaccines to induce IgG and IgA mediated immunity. Plant vaccines can express entire selected vaccines of selected proteins to encode their antigenic sequences can be synthesized from pathogenic viruses, bacterias and parasites examples Hepatitis virus B surface antigen, Diabetes associated autoantigen and Dental caries are derived from Tobacco plant. Similarly E. coli heat labile enterotoxin, *E.coli* heat labile entereotoxin, cholera toxin B subunit, Human insulin cholera toxin B is derived from potato species (Korban SS etal2002; Giddings G etal. 2000).

4.) Conclusion

Therapeutic proteins are basically used in many purposes such as vaccines, antibiotics. These all therapeutic proteins are derived from recombinant proteins with the help of gene transfer methods we discussed in this review article. These methods are very useful in our future to prepare all recombinant proteins with the help of these techniques**.**

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