Chapter 12

Biotechnology and its Applications

(Assertion Reason Questions)

Directions: In the following questions, a statement of assertion is followed by a statement of reason.
Mark the correct choice as:

(a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

(c) If Assertion is true but Reason is false.

(d) If both Assertion and Reason are false.

Q.1. Assertion: 'Cry' proteins are named so because they are crystal proteins.
Reason: In acidic environment of insect midgut 'Cry' proteins are solubilized and then release toxic core fragments after proteolytic action.

Q.2. Assertion: Cry gene expressing crop is resistant to a group of insects.
Reason: Cry proteins produced from Bacillus thuringiensis are toxic to larvae of certain insects.

Q.3. Assertion: Transgenic plant is a product of plant tissue culture.
Reason: An organism that contains and expresses a transgenic organism.

Q.4. Assertion: A crop expressing a cry gene is usually resistant to a group of insects.
Reason: Cry proteins produced from Bacillus thuringiensis is toxic to larvae of certain insects.

Q.5. Assertion: FlavrSavr, a transgenic tomato which remains fresh and retains their flavour for long time.
Reason: Production of polygalacturonase enzyme, which degrades pectin, is blocked in FlavrSavr.

Q.6. Assertion: GMO tomato i.e., 'flavr Savr' has increased shelf life and better nutrient quality.
Reason: This is achieved by reducing the amount of cell wall degrading enzyme 'polygalacturonase' responsible for fruit softening.

Q.7. Assertion: By insertion of gene encoding complementary RNA only the RNAi can be introduced in an organism.
Reason: In vitro there are no methods by which synthesised complementary RNA can be inserted in an organism to induce RNAi (RNA interference).

Q.8. Assertion: Cellular defence mechanism in eukaryotes is RNAi.
Reason: RNAi is silencing of a specific tRNA.

Q.9. Assertion: Tobacco plant yield is highly reduced because of damage to roots.
Reason: Nematode Meloidogyne incognita infects the root.

Q.10. Assertion: Biotechnology produces transgenic micro-organisms that acts as microfactories for
proteins.
Reason: To produce proteins of human use like insulin. Transgenic microorganisms can be developed.

Q.11. Assertion: Using biotechnology human insulin can be produced into bacterial cells.
Reason: To produce human insulin the A, B and C polypeptides of the human insulin are produced in the bacterial cells, separately extracted and combined by creating disulfide bonds.

Q.12. Assertion: Due to excessive synthesis of gene for adenosine deaminase ADA deficiency disorder is caused.
Reason: It affects the human digestive system.

Q.13. Assertion: The ADA gene gives instruction for producing the enzyme adenosine deaminases.
Reason: Throughout the body this enzyme is found but is most active in lymphocytes.

Q.14. Assertion: Via recombinant DNA technology transgenic plant production can be achieved.
Reason: Transgenic organism are an organism that contains and expresses a transgene is called.

Q.15. Assertion: The first transgenic animal was GM salmon for performing vaccine safety tests.
Reason: Genetically modified ova were fused with normal sperms of the same species For the production of GM salmon.

-x-x-x-

ANSWER KEY

Q.1 : (c) The cry gene of Bacillus thuringiensis produces a protein, that forms crystalline inclusions i.e., is crystal in nature in the bacterial spores. Due to their crystal nature these proteins are named 'cry' proteins and are responsible for the insecticidal activities of the bacterial strains. In alkaline environment of insect midgut 'Cry' proteins are solubilized. Then to release core toxic fragments these proteins undergo proteolytic digestion.These toxins bind to receptors in brush border of midgut epithelial cells. As a result, brush border, membrane develop pores, most likely nonspecific in nature and cause influx of ions and water into the cells resulting in their swelling and eventual lysis.

Q.2 : (b) A soil bacterium Bacillus thuringiensis (Bt) produces a Cry protein (crystal protein). This protein is toxic to the larvae of certain insects. There are several kinds of Cry proteins, which are is toxic to a different group of insects. The gene encoding Cry protein, that is cry gene has been isolated and transferred into several crops. A crop expressing a cry gene is usually resistant to the groups of insects.

Q.3 : (b) Plant tissue culture has various applications in the different fiields of biology. An example of this is the production of transgenic plants and animals.

Transgenic organisms contain genes, which are transferred into them through the genetic engineering. These genes are known as transgenic.

Q.4 : (b) Bacillus thuringiensis (Bt), a soil bacterium produces a Cry protein (crystal protein). This protein is toxic to the larvae of certain insects. There are several kinds of Cry proteins. Each Cry protein is toxic to a different group of insects. The gene encoding Cry protein, i.e., cry gene has been isolated and transferred into several crops. A crop expressing a cry gens is usually resistant to the groups of insects.

Q.5 : (a) FlavrSavr is a transgenic tomato variety. Fruits of this variety remain fresh and retain their flavour for much longer than normal fruits. It happens due to the blockage of the production of pectin degrading enzyme polygalacturonase.

Q.6 : (a) Genetically modified tomato i.e., flavr savr show delayed ripening. By the use of antisense RNA technology the enzyme polygalacturonase, that causes damage to pectin is deactivated and for longer duration the tomato is kept fresh.

Q.7 : (d)

Q.8 : (c) RNAi is the silencing of a specific mRNA.

Q.9 : (a) Meloidogyne incognita infects the root of tobacco plant that leads to the degradation of cell walls of the roots and reduce the yield.

Q.10 : (b) By inserting genes (or desired protein products transgenic micro-organisms can be developed using recombinant DNA technology. These transgenic organisms acts as living microfactories that produce proteins like human insulin, human growth hormone, etc. Production of proteins from such organisms is easier, more efficient and cost effective.

Q.11 : (c) Adult onset diabetes management is possible by taking insulin at regular time intervals, but insulin from other animals could elicit immune response in body. Biotechnology has helped to overcome this problem. Transgenic bacteria have been produced that translate the constituting polypeptide chains of human insulin from the bacterial cells. These polypeptides can be extracted and combined to produce human insulin, by creating disulfide bonds. In humans, insulin is produced as a prohormone with three polypeptides A, B and C. After processing, the C peptide is removed and mature insulin is formed. When transgenic bacteria are used, instead of producing extra stretch of C peptide, only A and B polypeptides are produced and then linked directly to produce mature insulin.

Q.12 : (d) ADA disorder is caused because of lack of gene for adenosine deaminase. It affects the human immune system.

Q.13 : (b) The ADA gene gives instructions for producing the enzyme adenosine deaminase. In all cells this enzyme is produced, but the highest levels of adenosine deaminase takes place in immune system cells called lymphocytes, that develop in lymphoid tissues. Lymphocytes form the immune system, that defends the body against potentially harmful invaders, such as viruses or bacteria.

Q.14 : (b) Transgenic organisms contain genes, that are transferred into them through the genetic engineering. These genes are called transgenes. Using recombinant DNA technology transgenic organisms can be produced.

Q.15 : (d) Those organisms that have their genetic material modified to meet some desired conditions are genetically modified (GM) organisms. They generally carry a foreign gene in their DNA. GM salmon was the first transgenic animal for food production. It was produced by fusion of normal ova (eggs) with genetically modified sperms. The zygotes with modified gene developed into embryos that gave rise to much bigger adults than either parent thus have greater food value. It is achieved by addition of a gene that codes for the growth hormone that allows the fish to grow larger more rapidly than the non-transgenic salmon.