Sample Paper – 01 (2016-17)
Class 12 Biology

General Instructions:

(i) All questions are compulsory.

(ii) This question paper consists of four Sections A, B, C and D. Section A contains 5 questions of one mark each, Section B is of 5 questions of two marks each, Section C is of 12 questions of three marks each and 1 question of four mark and Section D is of 3 questions of five marks each.

(iii) There is no overall choice. However, an internal choice has been provided in one question of 2 marks, one question of 3 marks and all the three questions of 5 marks weightage. A student has to attempt only one of the alternatives in such questions.

(iv) Wherever necessary, the diagrams drawn should be neat and properly labelled.

Section A

1. Define the term clone.
2. What are the pre-fertilisation events in plants?
3. Define linkage.
4. Name the first Restriction Endonuclease to be identified?
5. Expand ELISA.

Section B

6. Write the transcription product sequence for
   (a) 5' ATGCACTGATCCAA 3'
   (b) 3'GTACGTACGTAC 5'
7. Give the diagram of the dogflower experiment.
8. What are the types of acquired immunity?

   Or

   What are biological response modifiers?
9. What is out crossing?
10. Name the genes that encode the Bttoxi.

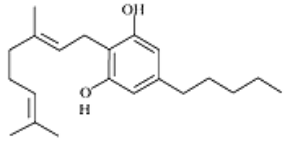
Section C

11. What are the symptoms of the disease which is confirmed by a Widal test?

    Or

    What are the primary lymphoid organs?
12. What are the complexities involved in transcription of eukaryotic DNA?
13. What are the major causes of cancer?
14. How can DNA fragments be separated on basis of size?
15. The rate of decomposition of detritus is affected by the abiotic factors like availability of oxygen, pH of the soil substratum, temperature etc. Discuss.
16. What are the advantages of GM plants?
17. In peas, tallness is dominant over dwarfness, and red colour of flowers is dominant over the white colour. When a tall plant bearing red flowers was pollinated by a dwarf plant bearing white flowers, the different phenotypicgroups were obtained in the progeny in numbers mentioned against them.
    Mention the genotypes of the two parents and of the types of four offspring.
18. How BOD is related to water pollution?

19. Identify the chemical structure. Give the scientific name of the plant from which it is obtained. Which two plant parts are used to extract this compound? Name the body system most affected by this compound.



20. What are the complexities involved in transcription of eukaryotic DNA?
21. Diagrammatically represent the genetic basis of blood group inheritance.
22. What are the factors that contribute to Population density?
23. On world population day Aman and his friends arranged an awareness campaign programme in their locality. Some narrow minded people rebuked the children and asked them not to talk on such things in public. The children convinced the elders about the need for the programme and on understanding their point of view, they also joined the campaign.
    (a) What values did the elderly people and Aman show on the occasion?
    (b) Why is such awareness programme necessary?
    (c) What role has the government played in controlling population explosion?

Section D

24. When does the secondary oocyte become an ovum?

Or

Write a detailed note on male gametophyte of plants. Illustrate.

25. What is integrated organic farming

Or

Who demonstrated the semi-conservative replication of DNA? Explain the procedure in detail.

26. Explain the five population interactions.

Or

Describe the different causes of Biodiversity Loss.

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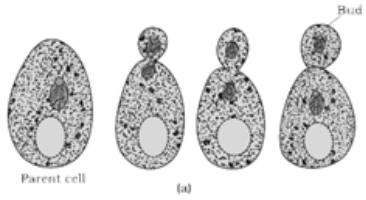
Answers

Section A

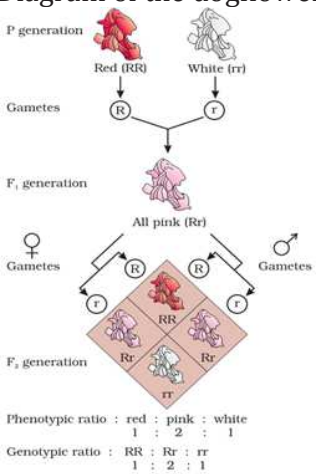
1. In asexual reproduction a single individual (parent) is capable of producing an offspring. As a result, the offspring that are produced are not only identical to one another but are also exact copies of their parent. The term **clone** is used to describe such morphologically and genetically similar individuals.



2. Several hormonal and structural changes are initiated which lead to the differentiation and further development of the floral primordium. Inflorescences are formed which bear the floral buds and then the flowers. In the flower the male and female reproductive structures, the androecium and the gynoecium differentiate and develop.
3. When two genes in a dihybrid cross are situated on the same chromosome, the proportion of parental gene combinations is much higher than the non-parental type. This physical association of genes on a chromosome is termed linkage and the term was coined by Morgan.
4. AUG
5. Enzyme linked Immuno Sorbent Assay.

Section B

6. The transcription product sequence is
   (a) 3' TACGTGACTAGGTT 5'
   5' AUGCACUGAUCCAA 3'
   (b) 5'CATGCATGCATG 3'
   5' CAUGCAUGCAUG 3'
7. Diagram of the dogflower experiment



8. Antibody mediated immunity or humoral immune response by the production of antibodies against antigens.Cell mediated immunity initiated by T lymphocytes.

Or

Tumor cells have been shown to avoid detection and destruction by immune system. Therefore, the patients are given substances called biological response modifiers such as **interferon** which activates their immune system and helps in destroying the tumor.

9. The practice of mating of animals within the same breed, but having no common ancestors on either side of their pedigree up to 4-6 generations. The offspring of such a mating is known as an out-cross.
10. The toxin is coded by a gene named cry. The toxins encoded by the genes *cryIAc* and *cryIIAb* control the cotton bollworms, that of *cryIAb* controls corn borer.

Section C

11. *Salmonella typhi* is a pathogenic bacterium which causes **typhoid** fever in human beings. These pathogens generally enter the small intestine through food and water contaminated with them and migrate to other organs through blood. Sustained high fever (39° to 40°C), weakness, stomach pain, constipation, headache and loss of appetite are some of the common symptoms of this disease. Intestinal perforation and death may occur in severe cases. Typhoid fever could be confirmed by Widal test

Or

The primary lymphoid organs are **bone marrow** and **thymus** where immature lymphocytes differentiate into antigen-sensitive lymphocytes.

(i) The bone marrow is the main lymphoid organ where all blood cells including lymphocytes are produced.

(ii) The thymus is a lobed organ located near the heart and beneath the breastbone. The thymus is quite large at the time of birth but keeps reducing in size with age and by the time puberty is attained it reduces to a very small size.

(iii) Both bone-marrow and thymus provide micro-environments for the development and maturation of T-lymphocytes.

12. The complexities involved in transcription of eukaryotic DNA

(a) There are at least three RNA polymerases in the nucleus (in addition to the RNA polymerase found in the organelles) The RNA polymerase I transcribes rRNAs (28S, 18S, and 5.8S), whereas,

(i) The RNA polymerase II transcribes precursor of mRNA, the heterogeneous nuclear RNA (hnRNA).

(ii) RNA polymerase III is responsible for transcription of tRNA, 5srRNA, and snRNAs (small nuclear RNAs)

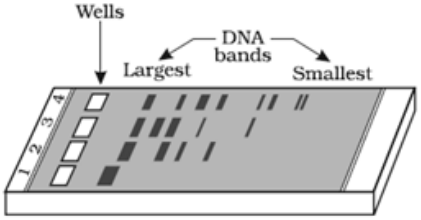
(b) The primary transcripts contain both the exons and the introns and are non-functional. Hence, it is subjected to a process called splicing where the introns are removed and exons are joined in a defined order.

(c) hnRNA undergoes additional processing called as capping and tailing. In capping an unusual nucleotide (methyl guanosine triphosphate) is added to the 5′-end of hnRNA. In tailing, adenylate residues (200-300) are added at 3′-end in a template independent manner. It is the fully processed hnRNA, now called mRNA, that is transported out of the nucleus for translation.

13. Transformation of normal cells into cancerous neoplastic cells may be induced by physical, chemical or biological agents called **carcinogens**. Ionising radiations like X-rays and gamma rays and non-ionizing radiations like UV cause DNA damage leading to neoplastic transformation. The chemical carcinogens present in tobacco smoke have been identified as a major cause of lung cancer. Cancer causing viruses called **oncogenic viruses** have genes called **viral oncogenes**. Furthermore, several genes called **cellular oncogenes** (*c-onc*) or **proto**

oncogenes have been identified in normal cells which, when activated under certain conditions, could lead to oncogenic transformation of the cells.

14. The cutting of DNA by restriction endonucleases results in the fragments of DNA. These fragments can be separated by a technique known as gel electrophoresis. Since DNA fragments are negatively charged molecules they can be separated by forcing them to move towards the anode under an electric field through a medium/matrix. Nowadays the most commonly used matrix is agarose which is a natural polymer extracted from sea weeds. The DNA fragments separate (resolve) according to their size through sieving effect provided by the agarose gel. Hence, the smaller the fragment size, the farther it moves.



The separated DNA fragments can be visualised only after staining the DNA with a compound known as ethidium bromide followed by exposure to UV radiation. The separated bands of DNA are cut out from the agarose gel and extracted from the gel piece. This step is known as elution. The DNA fragments purified in this way are used in constructing recombinant DNA by joining them with cloning vectors.

15. Decomposition is largely an oxygen-requiring process. The rate of decomposition is controlled by chemical composition of detritus and climatic factors. In a particular climatic condition, decomposition rate is slower if detritus is rich in lignin and chitin, and quicker, if detritus is rich in nitrogen and water-soluble substances like sugars. Temperature and soil moisture are the most important climatic factors that regulate decomposition through their effects on the activities of soil microbes. Warm and moist environment favour decomposition whereas low temperature and an aerobiosis inhibit decomposition resulting in build-up of organic materials.

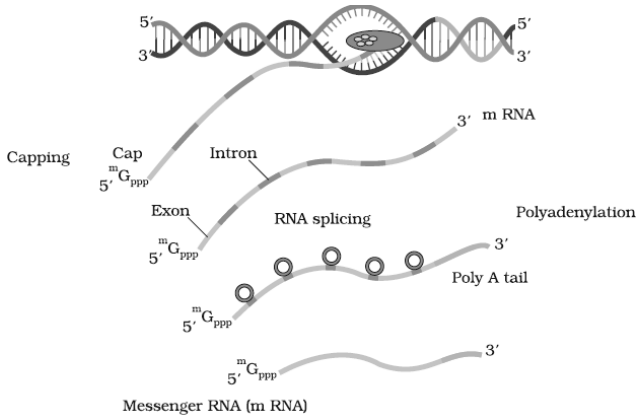
    The important steps in the process of decomposition are fragmentation, leaching, catabolism, humification and mineralization

16. Plants, bacteria, fungi and animals whose genes have been altered by manipulation are called Genetically Modified Organisms (GMO). GM plants have been useful in many ways. Genetic modification has:
    (i) Made crops more tolerant to abiotic stresses (cold, drought, salt, heat).
    (ii) Reduced reliance on chemical pesticides (pest-resistant crops).
    (iii) Helped to reduce post harvest losses.
    (iv) Increased efficiency of mineral usage by plants (this prevents early exhaustion of fertility of soil).
    (v) Enhanced nutritional value of food, e.g., Vitamin 'A' enriched rice.
    (vi) Create tailor-made plants to supply alternative resources to industries, in the form of starches, fuels and pharmaceuticals

17. Tall, Red = 138
    Tall, White = 132
    Dwarf, Red = 136
    Dwarf, White = 128
    Since the numbers obtained are In a ratio of 1 :1:1: 1, it is a dihybrid test cross involving a Cross between the heterozygous and recessive parents.
    The genotypes of the parents are TtRr and ttrr.

And the genotypes of the offspring are TtRr, Ttrr, ttRr, ttrr.

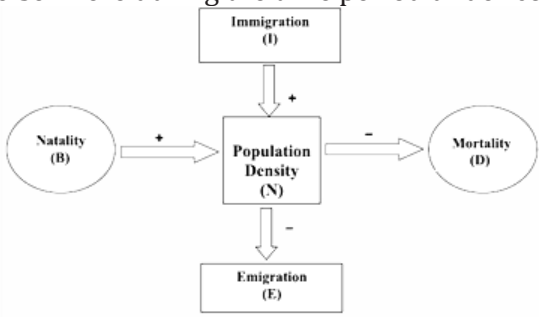
18. The amount of biodegradable organic matter in sewage water is estimated by measuring Biochemical Oxygen Demand (BOD). BOD refers to the amount of the oxygen that would be consumed if all the organic matter in one liter of water were oxidised by bacteria. The sewage water is treated till the BOD is reduced. The BOD test measures the rate of uptake of oxygen by micro-organisms in a sample of water and thus, indirectly, BOD is a measure of the organic matter present in the water. The greater the BOD of waste water more is its polluting potential.
19. This is the skeletal structure of cannabinoid.
    Natural cannabinoids are obtained from the inflorescences of the plant Cannabis sativa. The flower tops, leaves and the resin of cannabis plant are used in various combinations to produce marijuana, hashish, charas and ganja. Generally taken by inhalation and oral ingestion, these are known for their effects on cardiovascular system of the body.
20. Transcription of eukaryotic DNA:
    (a) There are at least three RNA polymerases in the nucleus (in addition to the RNA polymerase found in the organelles)
    The RNA polymerase I transcribes rRNAs (28S, 18S, and 5.8S), whereas the RNA polymerase II transcribes precursor of mRNA, the heterogeneous nuclear RNA (hnRNA). RNA polymerase III is responsible for transcription of tRNA, 5srRNA, and snRNAs (small nuclear RNAs).
    (b) The primary transcripts contain both the exons and the introns and are non-functional. Hence, it is subjected to a process called splicing where the introns are removed and exons are joined in a defined order.
    (c)



    hnRNA undergoes additional processing called as capping and tailing. In capping an unusual nucleotide (methyl guanosine triphosphate) is added to the 5′-end of hnRNA. In tailing, adenylate residues (200-300) are added at 3′-end in a template independent manner. It is the fully processed hnRNA, now called mRNA, that is transported out of the nucleus for translation.
21. The genetic basis of blood group inheritance.

Allele from Parent 1	Allele from Parent 2	Genotype of offspring	Blood types of offspring
I^A	I^A	$I^A I^A$	A
I^A	I^B	$I^A I^B$	AB
I^A	i	$I^A i$	A
I^B	I^A	$I^A I^B$	AB
I^B	I^B	$I^B I^B$	B
I^B	i	$I^B i$	B
i	i	$i\,i$	O

22. The density of a population in a given habitat during a given period, fluctuates due to changes in four basic processes,
    (i) ***Natality*** refers to the number of births during a given period in the population that are added to the initial density.
    (ii) ***Mortality*** is the number of deaths in the population during a given period.
    (iii) ***Immigration*** is the number of individuals of the same species that have come into the habitat from elsewhere during the time period under consideration.
    (iv) ***Emigration*** is the number of individuals of the population who left the habitat and gone elsewhere during the time period under consideration.

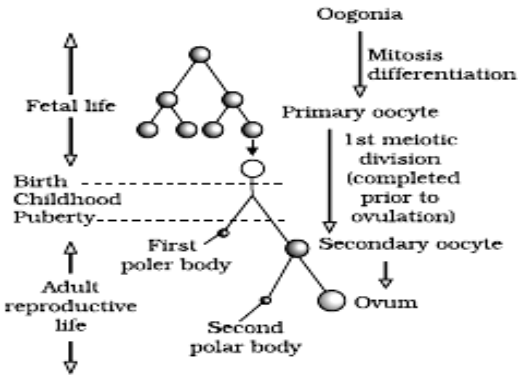


23. (a) Aman and his friends show understanding of population explosion, team work and motivational capacity.
    (b) To understand the problem faced by the family and the nation due to increasing population, simultaneously the benefits of having a small family.
    (c) (i) Public awareness through mass media.
    (ii) Education at all levels
    (iii) Family planning
    (iv) Increasing marriageable age (18 for girls, 21 for boys)

Section D

24. The process of formation of a mature female gamete is called oogenesis.
    (i) Oogenesis is initiated during the embryonic development stage when a couple of million gamete mother cells (oogonia) are formed within each fetal ovary.
    (ii) These cells start division and enter into prophase-I of the meiotic division and get temporarily arrested at that stage, called primary oocytes. Each primary oocyte then gets surrounded by a layer of granulosa cells and is called the primary follicle. A large number of these follicles degenerate during the phase from birth to puberty.
    (iii) The primary follicles get surrounded by more layers of granulosa cells and a new theca and are called secondary follicles.

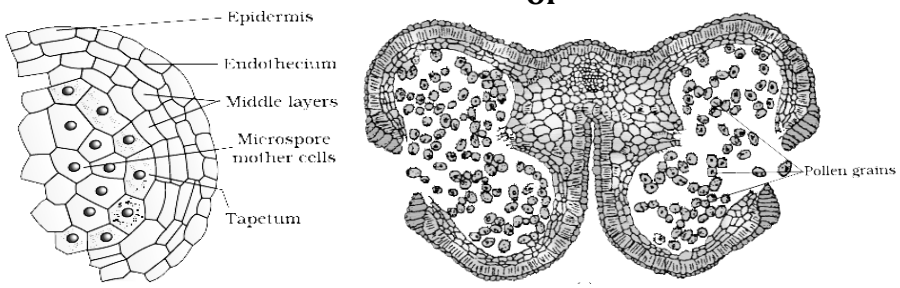
(iv) The secondary follicle soon transforms into a tertiary follicle which is characterised by a fluid filled cavity called antrum. The theca layer is organised into an inner theca interna and an outer theca externa. It is at this stage that the primary oocyte within the tertiary follicle grows in size and completes its first meiotic division. It is an unequal division resulting in the formation of a large haploid secondary oocyte and a tiny first polar body. The secondary oocyte retains bulk of the nutrient rich cytoplasm of the primary oocyte. The tertiary follicle further changes into the mature follicle or Graafian follicle .The secondary oocyte forms a new membrane called zona pellucid surrounding it. The Graafian follicle now ruptures to release the secondary oocyte (ovum) from the ovary by the process called ovulation.



The process of fusion of a sperm with an ovum is called fertilisation.

(v) During fertilisation, a sperm comes in contact with the *zonapellucida* layer of the ovum and induces changes in the membrane that block the entry of additional sperms. The secretions of the acrosome help the sperm enter into the cytoplasm of the ovum through the zonapellucida and the plasma membrane. This induces the completion of the meiotic division of the secondary oocyte. The second meiotic division is also unequal and results in the formation of a second polar body and a haploid ovum (ootid). Soon the haploid nucleus of the sperms and that of the ovum fuse together to form a diploid zygote.

Or



As the anther develops, the cells of the sporogenous tissue undergo meiotic divisions to form microspore tetrads. As each cell of the sporogenous tissue is capable of giving rise to a microspore tetrad. Each one is a potential pollen or microspore mother cell (PMC). The process of formation of microspores from a pollen mother cell through meiosis is called microspore genesis. The microspores, as they are formed, are arranged in a cluster of four cells–the microspore tetrad. As the anthers mature and dehydrate, the microspores dissociate from each other and develop into pollen grains. Inside each microsporangium several thousands of microspores or pollen grains are formed that are released with the dehiscence of anther.

25. Integrated organic farming is a cyclical, zero-waste procedure, where waste products from one process are cycled in as nutrients for other processes. This allows the maximum utilization of resource and increases the efficiency of production. It includes bee-keeping, dairy

management, water harvesting, composting and agriculture in a chain of processes, which support each other and allow an extremely economical and sustainable venture. There is no need to use chemical fertilizers for crops, as cattle excreta (dung) are used as manure. Crop waste is used to create compost, which can be used as a natural fertilizer or can be used to generate natural gas for satisfying the energy needs of the farm.

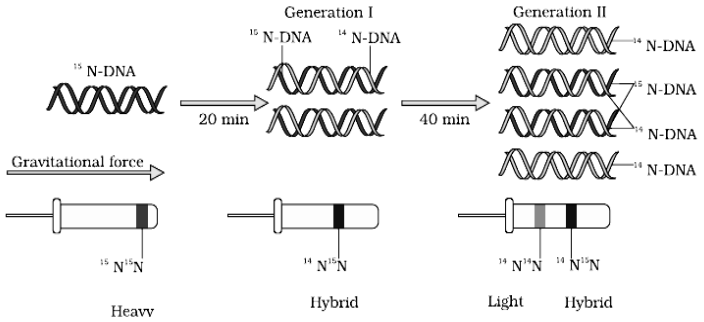
Or

DNA replicates semi conservatively. It was shown first in Escherichia coli and subsequently in higher organisms, such as plants and human cells. Meselson and Stahl proved the semi conservative replication

(i) They grew E. coli in a medium containing 15NH4Cl (15N is the heavy isotope of nitrogen) as the only nitrogen source for many generations. The result was that 15N was incorporated into newly synthesised DNA (as well as other nitrogen containing compounds). This heavy DNA molecule could be distinguished from the normal DNA by centrifugation in a cesium chloride (CsCl) density gradient.

(ii) Then they transferred the cells into a medium with normal 14NH4Cl and took samples at various definite time intervals as the cells multiplied, and extracted the DNA that remained as double-stranded helices. The various samples were separated independently on CsCl gradients to measure the densities of DNA.

(iii) The DNA that was extracted from the culture one generation after the transfer from 15N to 14N medium [that is after 20 minutes; E. coli divides in 20 minutes] had a hybrid or intermediate density. DNA extracted from the culture after another generation [that is after 40 minutes, II generation] was composed of equal amounts of this hybrid DNA and of 'light' DNA.



26. Inter specific interactions arise from the interaction of populations of two different species. They could be beneficial, detrimental or neutral (neither harm nor benefit) to one of the species or both. Assigning a '+' sign for beneficial interaction, '-' sign for detrimental and 0 for neutral interaction, the possible outcomes of inter specific interactions are

Species A	Species B	Name of Interaction
+	+	Mutualism
-	-	Competition
+	-	Predation
+	0	Parasitism
+	0	Commensalism

The inter specific relationships may be broadly classified as:

(a) Symbiosis: In symbiosis, either both or one of the species of population is benefited while none is harmed. Symbiosis may further be classified into commensalism, proto cooperation and mutualism.

(b) Commensalism: The association of two or more populations which live together, but do not enter into any kind of physiological exchange, and in which only one of the populations called commensal is benefited while the other, host is not effected is called commensalism. Sea anemone that has stinging tentacles and the clown fish that lives among them. The fish gets protection from predators which stay away from the stinging tentacles. The anemone does not appear to derive any benefit by hosting the clown fish.

(c) Mutualism: Association of two populations in which there occurs a close and often permanent and obligatory contact, and where both the populations are benefited. Here each population is completely dependent upon the other.

(d) Antagonism: In antagonism, one species is benefited at the cost of the other i.e. one species is generally harmed. Antagonism may further be classified into amensalism, parasitism, predation and competition.

(e) Amensalism: The relationship between the two populations, in which one population inhibits the other while remaining unaffected itself, is called as amensalism.

(f) Parasitism: An association between two animals which live together, in which one derives its nourishment at the expense of the other is called as parasitism. Lice on humans and ticks on dogs.

(g) Predation: Predation represents a direct and often complex interaction of two or more species, of the eaters and the being eaten.

(h) Competition: When two species in the same community require the same resources as food, shelter, light etc., which are in short supply in relation to the number seeking it, or interact in such a way that it affects their growth and survival, they are said to be in competition with each other. on the rocky sea coasts of Scotland, the larger and competitively superior barnacle Balanus dominates the intertidal area, and excludes the smaller barnacle Chathamalus from that zone. In general, herbivores and plants appear to be more adversely affected by competition than carnivores.

(i) Neutralism: In neutralism none of the two populations which are in interaction with each other is affected.

Or

There are four major causes are.

(i) Habitat loss and fragmentation: This is the most important cause driving animals and plants to extinction. The most dramatic examples of habitat loss come from tropical rain forests. The Amazon rain forest (it is so huge that it is called the 'lungs of the planet') harbouring probably millions of species is being cut and cleared for cultivating soya beans or for conversion to grasslands for raising beef cattle. Besides total loss, the degradation of many habitats by pollution also threatens the survival of many species. When large habitats are broken up into small fragments due to various human activities, mammals and birds requiring large territories and certain animals with migratory habits are badly affected, leading to population declines.

(ii) Over-exploitation: Humans have always depended on nature for food and shelter, but when 'need' turns to 'greed', it leads to over-exploitation of natural resources. Presently many marine fish populations around the world are over harvested, endangering the continued existence of some commercially important species.

(iii) Alien species invasions: When alien species are introduced unintentionally or deliberately for whatever purpose, some of them turn invasive, and cause decline or extinction of

indigenous species. The Nile perch introduced into Lake Victoria in east Africa led eventually to the extinction of an ecologically unique assemblage of more than 200 species of cichlid fish in the lake.

(iv) Co-extinctions: When a species becomes extinct, the plant and animal species associated with it in an obligatory way also become extinct. When a host fish species becomes extinct, its unique assemblage of parasites also meets the same fate. Another example is the case of a coevolved plant-pollinator mutualism where extinction of one invariably leads to the extinction of the other.