



APPLIED ZOOLOGY

**Prof. Anilkumar
HOD of Zoology
SSCASC, Tumakuru.**


• **Introduction to Host-parasite Relationship** :

- The science which deals the occurrence, diseases caused, mode of transmission, prevention of the parasite and its cure is called Parasitology.
- Parasitism is an association in which two organisms of different species live together where one enjoys all benefits like nourishment, Shelter, reproduction etc. at the expense of the other.
- The benefited organism is called the parasite and the organism harbouring the parasite is called the host.

- Due to close association, the responsive reactions and resistance displayed by a host to its parasite and the protective mechanism adopted by a parasite in their respective environments are called **host-parasite-interactions.**
- The effects of parasitism on the hosts are associated on several factors, such as age, diet, genetic factors, susceptibility of the hosts, the size, number and virulence of the parasites, their mortality, migration, and method of feeding.

Effects of Parasites on Hosts:


- 1. Destruction of Host's Tissues - Some parasites injure the host's tissue during the process of entry,
- e.g. **Ancylostoma duodenale**, whose infective larvae causes extensive damage tissue while penetrating the host's skin.
- Some causes tissue damage after they have entered, e.g., larvae of *Ascaris lumbricoides* while passing through lungs causes pneumonia.
- **Entamoeba histolytica** destroy the host's large intestine and liver.

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- 2. Necrosis - parasite causes persistent cell degeneration
 - 3. Hyperplasia: an increased rate of cell division
 - 4. Hypertrophy: increase in cell size.
 - 5. Metaplasia: changing of one type of tissue into another
 - 6. Neoplasia: it is the growth of cells to a tumour
 - 7. Competition for host's nutrients

- 8. Mechanical interferences - parasite cause injuries to hosts, e.g. elephantiasis or filariasis
- 9. Effects of toxins, poisons and secretions - *P. vivax* produces toxic effect in infected persons and the patients suffer from periodic effect of high fever with chilliness and shivering.
- 10. Sex reversals: Gonads of parasitized hosts may change, leading to sex reversals e.g. crab when parasitized by *Sacculina* -display sex reversals.


HOST

- Host: A person or other animal, including birds and arthropods that affords or give shelter to an infectious agent under natural conditions are called host. Ex: Man, Mosquito
- Definitive host: Hosts in which the parasite attains maturity or passes its sexual stage are called definitive host or Primary host. Ex –Man is the primary host of Tape worm
- Intermediate host: Hosts in which the parasite is in larval or in asexual state are called intermediate host or secondary host. Ex: Pig is the intermediate host of Tapeworm.

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- Symbiosis : Mutualism is a symbiosis in which both members benefit from the relationship.
 - Commensalism, -Commensalism is a relationship in which one member benefits, and the other one neither benefits nor is harmed.


RESERVOIR

- Reservoir : A reservoir is defined as any person, animal, arthropod, plant ,soil or any substance in which an infectious agent lives and multiplies , on which it depends primarily for survival and reproduce and finally transmitted to a susceptible host. The reservoir may of 3 types:
- 1) Human reservoir: The most important reservoir of infection for human is man himself.
- Sick human -- Acute illness. Ex: influenza, chicken pox, cholera, strep throat.
- Carrier human -- subclinical infection or chronic infection. Ex: tuberculosis, syphilis, HIV infection, Hepatitis B

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- 2) Animal reservoir: wild animal ,domestic animals or birds .
 - 3) Non-living reservoir:
 - a) Soil harbours organisms that cause a variety of infectious diseases.
 - Ex: tetanus, anthrax, Pseudomonas infections, a variety of fungi. Water is often contaminated and can serve as a vehicle of infection. Ex. Typhoid , cholera etc.

ZOONOSIS

- Zoonosis. An infectious disease or infection transmissible under natural conditions from vertebrate animals to man. Ex: plague, rabies etc.
- It is classified into 1. Anthroozoonoses: in this, infection transmitted to man from vertebrate animals . ex –anthrax, plague.
- 2. Zooanthroozoonoses: infections transmitted from man to vertebrate animals .ex .human tuberculosis in cattle.

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- 3. Amphixenoses: Infections maintained in both man and lower vertebrates and transmitted in either directions. Ex .T.cruzi & S.japonicum.
 - 4.Epizootic: An outbreak of diseases in animal populations.
 - 5.Epiornithic: An outbreak of diseases in bird populations



TUBERCULOSIS:

It is a specific infectious disease caused by *Mycobacterium tuberculosis*.

It primarily affects lungs and causes pulmonary tuberculosis.

It also affect intestine,meninges,bones, joints, lymph glands etc. The disese also affect cattle –bovine tuberculosis.

Infection:

There are 2 sources of infection – human & bovine.

The most common source of infection is the human case whose sputum is positive for tubercle bacilli and who has either received no treatment. Such human can discharge the bacilli in their sputum for many years.

The bovine source of infection is usually infected milk.

Host Factors:

Tuberculosis affect all ages

More prevalent in males than females

It is not a hereditary disease

It is a social disease .the social factors include poor quality of life. Poor housing , overcrowding,under nutrition , lack of education,lack of awareness.

Mode of Transmission:

It is transmitted mainly by droplet infection and droplet nuclei generated by sputum- positive patients with pulmonary tuberculosis.Coughing generate largest number of droplets of all sizes.

The frequency and vigour of cough and the ventilation of the environment influences the transmission of infection.

Control of diseases:

Tuberculosis control means reduction in the prevalence and incidence of diseases in the community.

The control measures consist of curative component and a preventive component.

The first step in a tuberculosis control programme is early detection of sputum positive case.

Geological Time Scale Shows an outline of how the Earth's evolution.

- Geological time is broken up into eons, eras, periods, Epochs, and ages
- Eons: largest unit of geological timescale
- Eras: two or more periods
- Periods: longer than a epochs, shorter than an era
- Epochs: longer than age but shorter than a period

- Patient with pulmonary tuberculosis have persistent cough and fever with chest pain.
- In india , DTP – DISTRICT TUBERCULOSIS PROGRAMME – direct smear examination of sputum of patient.
- Culture of sputum is the second method of detecting Tuberculosis.

treatment: Chemotherapy is the main treatment in every active case.

Anti –Tuberculosis drugs – 2 types :
bactericidal –kill the bacteria. And
bacteriostatic-inhibit multiplication of
bacteria

RIFAMPICIN –powerful bactericidal drug

(rmp)

STREPTOMYCIN

Ethambutol –baccteristatic

Thoacetazone

BCG Vaccination – BACILLI CALMETTE GUERIN – living bacteria derived from attenuated bovine strain oftubercle bacilli.

Liquid and freeze dried vaccine

TYPHOID FEVER

Staphylococcus typhi. (**S.typhi**)

Continous fever for 3-4 weeks


It occurs in all parts of the world where water supplies and sanitation are substandard.

It is endemic in INDIA.

Man is the only known resorvoir and carrier.

Faeces and urine

Contaminated water and food ,flies

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- it may occur at any age
 - Highest is 5-19 yrs.
 - More case are reported among males than females
 - Peak is july –september coincidence with rainy season and increase in fly population.



- MODE OF TRANSMISSION :

- FAECAL –ORAL ROUTE

- SOILED HANDS CONTAMATED WITH FAECES OR URINE.


- INDIRECTLY BY FOOD, WATER AND FLES.

- Control:

- 1. control of resorvoir

- 2. control of sanitation

- 3.immunization


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- ANTI –TYPHOID VACCINES
 - Monovalent anti- typhoid
 - Bivalent
 - TAB vaccine
 - (typhoid, paratyphoidA, paratyphoid B)

RICKETTSIAL ZOOONOSES

- These are a group of specific communicable diseases caused by rickettsial organisms and transmitted to man by arthropod vectors (louse, tick, mites)

RICKETTSIA PROWAZEKKI


- **Epidemic Typhus**
- **Insect vectors – louse**
- **Reservoir – Humans**
- **Rickettsiae are small intracellular bacterial parasite. They are pleomorphic -rods or as cocci found in single, pairs, & chains. its growth is enhanced by the presence of **sulfonamides****

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- **Clinical features:**
 - **Rickettsial infections are characterized by fever, headache, skin rash, enlargement of spleen & liver.**
 - **The infection is transmitted from man to man by the infected louse.**
 - **The louse get infected by feeding on an infectious patient.**


- **The organism multiply in the cells lining the intestinal tract of the louse and begin to appear in 3-5 days in the louse faeces.**
- **Man acquires the disease by the bite of louse,by scratching the the infected louse faeces.**
- **By crushing an infected louse and also by inhalation of infected louse faeces or dust.**
- **The infected louse dies after 10-14 days.**
- **In humans, the organisms can persist for many years.**


Control measures

- **Treatment : Tetracycline is the only drug for typhus.**
- **Control of louse by hair shampoos and clinical oils.**
- **Health education of the people in the mode of transmission by louse and means of personal protection is important**

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- Treatment :
 - Primary and secondary Syphilis are easy to treat with
 - Pencilin
 - Doxycycline
 - Azithromycine
 - Prevention:
 - Safe sex, Using Condoms, Avoid multiple partners
 - Avoid sharing needles

EON	ERA	PERIOD	MILLIONS OF YEARS AGO	KEY EVENTS
Phanerozoic	Caenozoic	Quaternary	1.6	<p>Humans evolve</p> <p>← Extinction of Dinosaurs</p> <p>← Permian mass extinction</p> <p>← Invertebrates become common</p> <p>← Earliest life</p>
		Tertiary		
	Mesozoic	Cretaceous	138	
		Jurassic		
		Triassic		
	Paleozoic	Permian	240	
		Carboniferous	330	
		Devonian	410	
		Silurian		
		Ordovician	500	
Cambrian				
Proterozoic		Also known as Precambrian	3500	
Archean				
Hadean				

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- Precambrian Time :The interval of time, in geologic time scale from Earths formation to the beginning of the Paleozoic Era, from 4. 6 Billion year to 542 million years.

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- Paleozoic Era :The geological era that followed the Precambrian time and that lasted from 543 million to 251 million years .
 - Abundant fossil record, plants and animal species on Earth

- Mesozoic Era:
- Geological era that lasted from 251 million to 65.5 million years ago; also known the Age of the Reptiles .Lizards, turtles, crocodiles, snakes and a variety of dinosaurs



- **Cenozoic Era-Present Period**

Current geologic era, which began 65.5 million years ago, also called the Age of Mammals.

- Split into 2 periods and 7 epoch

Coenozoic Era

Period	Epoch	
Quaternary	Holocene	← Today
	Pleistocene	← 11.8 Ka
Neogene	Pliocene	
	Miocene	
Paleogene	Oligocene	
	Eocene	
	Paleocene	← 66 Ma

Tertiary Period 65.5 Million – 1.8 Million

- Paleocene Epoch
- Eocene Epoch – most modern mammal families, including whales, carnivores, hoofed animals, and primates have appeared. And first grasses
- Oligocene epoch- India collides with Asia, and Antarctica drifts over the south pole
- Miocene Epoch
- Pliocene Epoch- first early humans, Modern Ice Age begins

Quaternary Period

- Pleistocene Epoch- dire wolves became extinct. Fossil record indicated early humans discovered during this times. Also, known as Stone Age.
- Holocene Epoch –Present (modern humans) began 11,500 years ago, the last glacial period ended. Sea level rose, modern humans(Homo Sapiens).

Animal Distribution

- Animals are not uniformly distributed on land and in water.
- They are restricted to certain places by several factors such as climate, food, shelter, flora and fauna etc.
- Generally distribution can be classified into three categories, namely,
- **Continuous, Discontinuous and Bipolar distribution**

Continuous distribution

- Eurytopic or wide-ranging animals are adapted to a wide variety of environmental conditions and are not specific to any particular type of food.
- may have special power to cross barriers either by flight, rafting or swimming .
- adapt to new environmental conditions.
- animals include rats, bats, hawks, cuckoos, cockroaches, flies, mosquitoes, lizards, snakes and man.

Discontinuous distribution

- When continuity of distribution of a species is broken by uninhabited areas which are sometimes very large stretches of oceans.

reasons for discontinuous distribution

- Animals reach distant areas by different ways. as insects, snails and rats by rafting, turtles by floating and swimming and birds blown by storms.
- The species was earlier distributed continuously but the land masses in the intermediate areas submerged, breaking the species into widely separated populations.
- Continental drift separated the continents and carried them to long distances, isolating the animals from other areas

- A widely distributed species can become extinct in the intermediate areas due to change in the climate to which the species is unable to adapt.
- Examples:
 - *Peripatus* (Phylum Onychophora) has 75 species distributed in Southeast Asia, East Indies, Australia, New Zealand, Africa, South and Central America.
 - The three surviving genera of lungfishes occur in three different continents; *Protopterus* in Africa, *Lepidosiren* in South America and *Neoceratodus* in Australia.

3. Bipolar distribution

- Some species are adapted to the cold arctic climate cannot migrate to the warmer areas and hence restricted to the Polar Regions.
- Polar bears, arctic fox, lemmings, and reindeers are found in the northern Polar Regions
- while penguins are restricted to the Antarctica region.

Dispersal & barrier

- **dispersal** refers to both the movement of individuals animals, plants, fungi, bacteria, etc. from their birth site to their breeding site .
- as well as the movement from one breeding site to another .
- Dispersal is also present in seeds and spores.

- The dispersal of animals is usually linked with a change in abiotic and biotic environmental conditions and in the population size of the animals.
- an increase in number that causes greater population density, stimulates the dispersal of the animals.
- Dispersal can be either **active** (running, swimming, or flying) or **passive** (carried by rivers, ocean currents, objects floating in the ocean, or wind).

dispersals

- a flock of white herons was transported by a storm from Africa to America, where the birds then settled. Small reptiles, such as snakes and geckos, sometimes are dispersed on floating tree trunks.
- **Non-motile animals : sponges, corals, molluscs**
- **Motile animals :**
- **Dispersal by dormant stages:** dormant eggs, dormant embryos or, in some cases, dormant adult stages.
- [rotifers](#)

barrier

- A **barrier** is an object or agent that physically prevents something from moving from one place to another.
- **two major barriers to dispersal of animals.**
- **1. Physical Barrier**
- **2. Biological Barrier.**
- The land is a barrier to aquatic animals and water is barrier to most land animals.
- Salt water:
- The Pacific Islands are usually uninhabited by amphibians

barriers


- Mountains serve as barriers to low-land animals and the low lands are barrier to animals inhabiting mountain ranges.
- Extensive forests serve as barriers to the dispersal of grassland animals, prairies serve as barriers to forest animals.
- **The temperature** is an effective barrier to dispersal of animals.

biological barrier

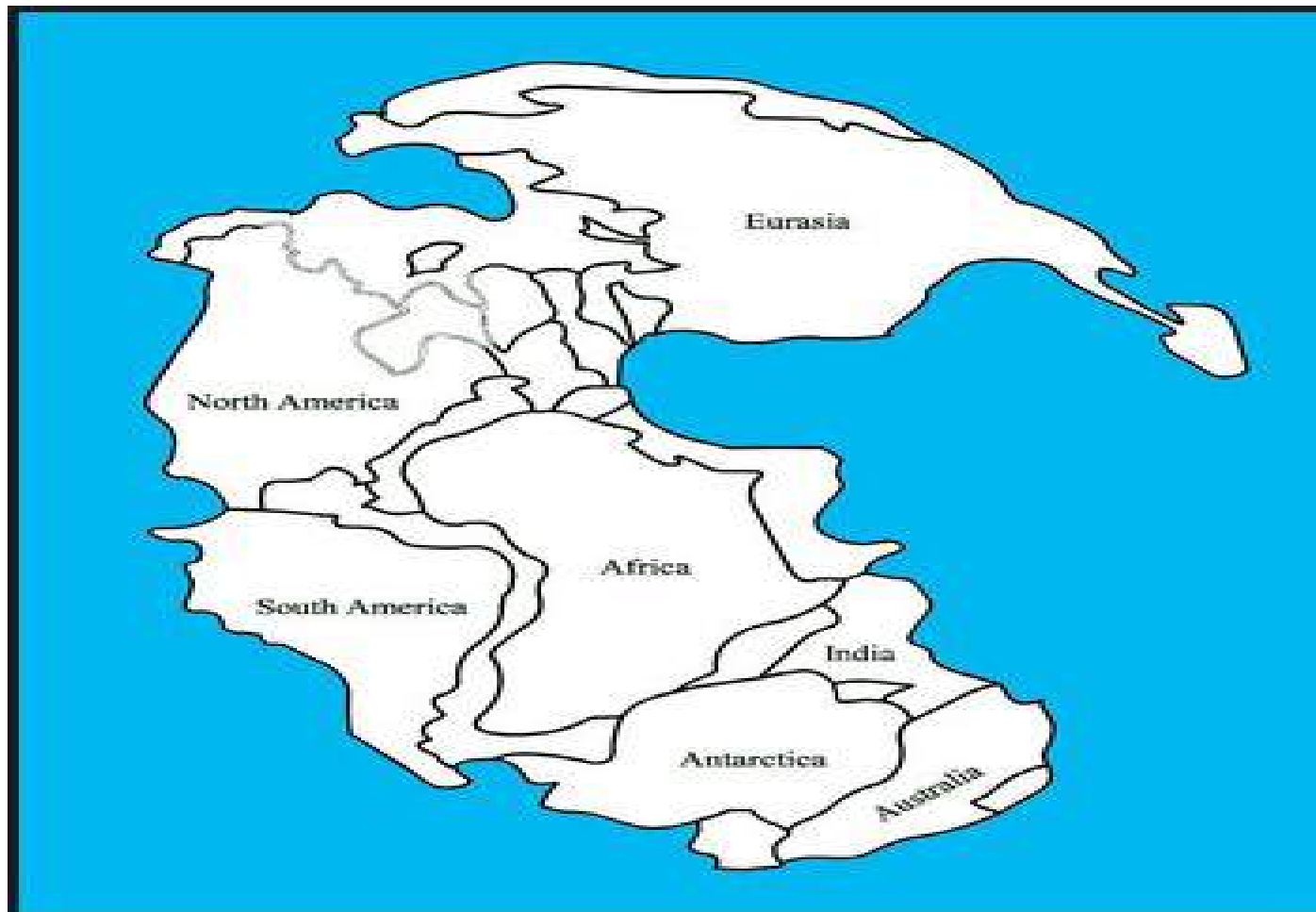
- **Sedentary habit:**
 - A number of marine invertebrates, viz., cnidarians, echinoderms and others are sessile, but their free-living larvae can travel long distances.
- **Homing instinct:**
 - In birds and other vertebrates, homing instinct is an effective barrier and limits distribution.

CONTINENTAL DRIFT THEORY

- The theory was put forward in 1912 with **Alfred Wenger**. He suggested that all the continents were once joined together in a super continent called **Pangea**. Over millions of years the pieces separated, first into two smaller supercontinents during the Jurassic period, called **Laurasia** and **Gondwanaland**, and then by the end of the Cretaceous period, into the continents we know.

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- Laurasia consists of Europe and Asia and Gondwana consists of Australia, Africa, South America, India and Antarctica. Gondwana then split up forming the rest of the world. Australia is moving northwards at a rate of 1cm a year

continental drift hypothesis



Philip Sclater (1858) and Alfred Wallace (1876) identified the main zoogeographic regions of the world used today-

1. Palearctic region
2. Nearctic region
3. Neotropical region
4. Ethiopian region
5. Oriental region
6. Australian region

1. Palearctic region

- 1. Palearctic region : consist Europe , temperate regions of Asia & the northern temperate part of Africa lying north of atlas mountains.
- Extreme cold of Siberia and extreme hot of Sahara desert are characteristic climate of this region, Deciduous forest, large grass land, coniferous forest and mixed forest.
- Carp, Salmon, Pike, Sticklebacks
- Salamander, Proteius, Alytes,
- Sand boa, lizard and Alligator.
- Arctic tern, pheasant, wrens, finches, warblers, gees
- porcu-pine, dog, wild ass, European bison, polar cat, deer,

Nearctic

- Nearctic or North American regions : consist of north America , north to central Mexico
- Eastern side of California has a high and rocky mountain range. has extreme cold and hot climate. Deciduous forest range, huge grass land, coniferous forest, dry land
- Lepisosteus, Polydon, Acipenser
- Siren, Amphiuma, Cryptobranchus, Ambystoma
- snakes. Phrynosoma, & lizards
- Turkey, pelican, crow, cuckoo, pigeon, kite, owl
- srew, mole, bear, wolf, monkey, deer, bat, goat, mask ox, bison

Neotropical

- Neotropical or south American region : consist of south & central America & southern Mexico.
- Most parts of this region is covered by tropical dry lands. Amazon valley there is tropical rain forest
- Lepidosiren, eel, catfish
- Caecilia, Hyla, Salamander, frog, toad
- snakes, Gecko, Alligator, 700 genus of birds, ree, whatgin, to wean, thrush, parakeet, opossum, sloth, armadillo, rodents, American tapir, bat, spider monkey

Ethiopian

- Ethiopian region : consist of Africa & southern Arabia .
- Mainly temperate in most of the areas, West Africa possess rain forest along the sides of large rivers.
- Cat fishes, lung fishes (Protopterus, Polypterus)
- Xenopus and several species of caecilians
- lizards, Monotrophis, Cordylus, Agama, Chame-leon,
- 67 families of Aves, Ostrich, cuckoo, parakeet, eagle, kite, pigeon, hornbill, Zebra, gorilla, antelope, leopard, two horned rhino-ceros, hippopotamus, lemur, gnu, beboon, lion, giraffe

Oriental :

- Oriental :
- India, south China, Indochina, portions of Indonesia, Tropical forest; deserts in western portion, Most part experience temperate atmosphere. Annual rainfall more than 1500 mm. carp, cat-fish, anurans, some salamanders and caecilians, viper, pit viper, kraits, etc.; lizards- like, Gekko, Aagamid, Varanus, Chamellion, Crocodiles, Pigeons, owls, finches, phesants, peacock, saras. rabbit, dog, cat, boar, rodents, flying lemur, elephants, ox, tiger, orangutan, gibbon, tapir, pangolin

Australian

- Australian region : consist of Australia , New Guinea & Tasmania. Hot and tempe-rate, both types of climate are present here. Average rainfall in a year is 75 mm. Rain forest, grass-land, eucalyptus forest , Neoceratodus Lung fish, Amphibians: Helioporus, Pelodyrus , snakes and lizards, emu, kiwi, scrub, bawar, Kanga-roo, Dasyures, Dendrolagus (climbing kangaroo), Petaurus (flying opossum),

Table 4.5 : ZOOGEOGRAPHICAL REALMS — COMPARATIVE ASPECT (Characteristic fauna number corresponds to the sub-region number)

Realms	Geography	Climate	Ecology	Sub-regions	Some vertebrate fauna of respective Sub-regions
1. Palearctic	Whole of Europe, North of Africa, Asian Himalayas.	Extreme cold of Siberia and hot of Sahara	Deciduous, Tundra, Coniferous and mixed forest	1. European 2. Mediterranean 3. Siberian 4. Manchurian	1. <i>Myogale</i> 2. Hyrax, Shrew, Civet, Upupa, Pastor 3. <i>Moschus</i> , <i>Phoca sibirica</i> , Yak, Mole 4. <i>Ailuropus</i> , <i>Hydropotes</i> , <i>Rhinopithecus</i> .
2. Nearctic	Entire North America, Mexico, Greenland, Aleutian island	Extreme cold and hot	Deciduous forest, Tundra, Coniferous forest and huge grass land	1. Californian 2. Rocky mountain 3. Allegheny 4. Canadian	1. Vampire and free-tailed bat 2. Haplocerus, Bison, <i>Heloderma</i> , <i>Cynomys</i> 3. Vampire, Mole, Carolina parrot 4. Polar bear, Arctic fox, Bison, Lemmings, Rain deer.
3. Neotropical	South and Central America, Lower Mexico and West Indies	Tropical dry lands and temperate	Tropical rain forest, Savannah grass land and desert-like	1. Chilean 2. Brazilian 3. Mexican 4. Antillean	1. Rhea, Oil birds, Lama 2. Vampire bats, Armadillo, Tapir, Cavis 3. Tapir, Terrapin, Anguidae, Plethodon-tidae 4. American monkey.
4. Ethiopian	Southern part of Tropic of Cancer of Africa, Arabia and Madagascar	Temperate but most of the time is hot	Rain forest, Deciduous forest and desert	1. East African 2. West African 3. South African 4. Malagasy	1. <i>Rhinoceros bicornis</i> , Giraffe, Zebra 2. Gorilla, Chimpanzee, Flying squirrel 3. Ostrich, Secretary bird, African mole rat 4. <i>Chiromydae</i> , <i>Cententidae</i> , Helmet bird, Lemur.
5. Oriental	Most of Asia	Temperate, annual rainfall more than 1800 mm	Eastern dense rain forest, Western desert and other part with moderate forest	1. Indian 2. Ceylonese 3. Indo-Chinese 4. Indo-Malayan	1. Sloth, Chousingha, Black buck, Antelope 2. Loris, Spring rat, Shield tails 3. Panda, Takin, Flying lemur, Rhino, Frog 4. Orang-utan, Gibbon, <i>Mydas</i> , Broad bills, <i>Rhinoceros unicornis</i> .
6. Australian	Australia, New Zealand, New Guinea, Tasmania	Hot to temperate. Rainfall 75 mm	Rain forest, Grassland, Eucalyptus forest	1. Austro-Malayan 2. Australian 3. Polynesian 4. New Zealand	1. Crowned pigeon, Fly-river turtle, <i>Gymnophyona</i> 2. Wombat, Duckbill, Liar birds, Emu, Kangaroo 3. Bat, Frog, Toad 4. Murids, Parrots, Kiwi, <i>Sphenodon</i> .

SERICULTURE

Sericulture

(Anilkumar.M,hod zoology)

Sericulture, or silk farming, is the cultivation of silkworms to produce silk.

Bombyx mori is the most widely used silkworm.



Mainly four types silk worms.

(i) Mulberry Silk- *Bombyx mori*

Non Mulberry silk

Tasar Silk:

Eri Silk:

Muga Silk:



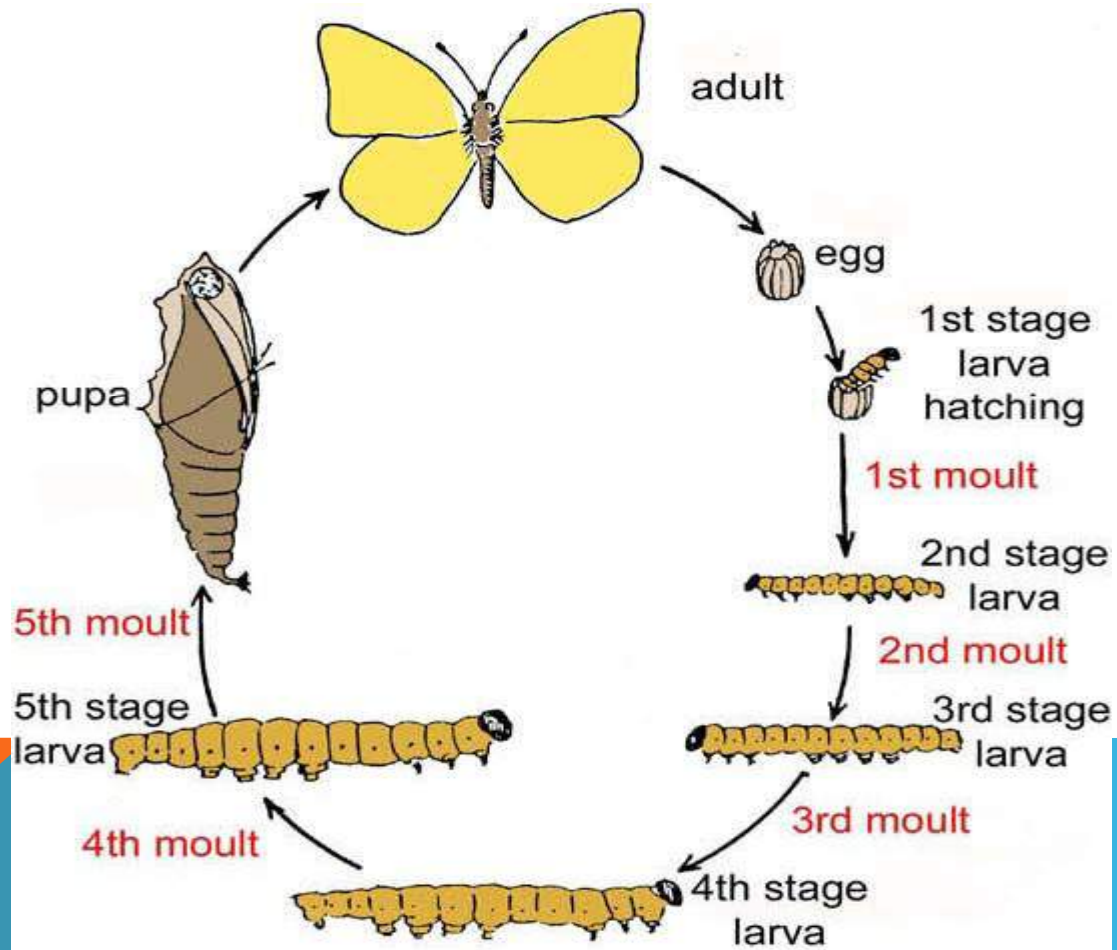
They are Japanese,
Chinese,
European
and Tropical races.

European races are native of Europe and Central Asia.

Tropical or Indian races are native of India and south East Asia.



LIFE CYCLE OF SILK MOTH



Silkworm moths go through four stages of development – egg, larva, pupa and adult .

Mulberry Silkworms are the caterpillars or larvae of silkworm moths and feed on the leaves of mulberry trees (Morus).

The female moths lay 200-300 pale-yellow eggs over a couple of days and usually die within 2 weeks.

Fertile eggs then turn to brown or purple in a week



The eggs hatch in 10-14 days to produce a very small blackish first instar larva, less than 2mm in length.

At ideal temperatures (25° to 30° C), the larva grows to 3 inches .

it sheds its skin four times and therefore goes through 5 larval stages or instars .

2nd- 3rd instar -4th instar- 5th instar.

When the silkworm larva is fully grown and ready to pupate, it stops feeding, and starts to spin silk in the form the cocoon.



When the cocoon is complete, the larva starts to shrink in length, develops a hard skin and turns into a pupa, inside which the adult moth develops and metamorphoses .

Metamorphosis takes about two to three weeks and the silk moths then emerge from their cocoons.



Races of *Bombyx mori* Based on voltinism & moultinism.

RACES: A population within a species that is distinct in some way.

Indigenous- originating in and characteristic of a particular region or country; native.
Eg., Pure Mysore, Nistari.

Exotic- plant or animal species introduced into an area where they do not occur naturally, non-native species. Eg., E16, Daizo etc.



Voltinism in *Bombyx mori*

Univoltine races: produce one generation per year. They lay only diapausing eggs.

Bivoltine races: produce 2 generations per year.

Multivoltine races: • produce more than 5-6 generations per year.

- length of the larval duration is short.



diapausing or Non- diapausing races :

Diapause is a period of suspended or arrested development during an insect's life cycle.



MULBERRY CULTIVATION



SILK GLANDS OF BOMBYXMORI

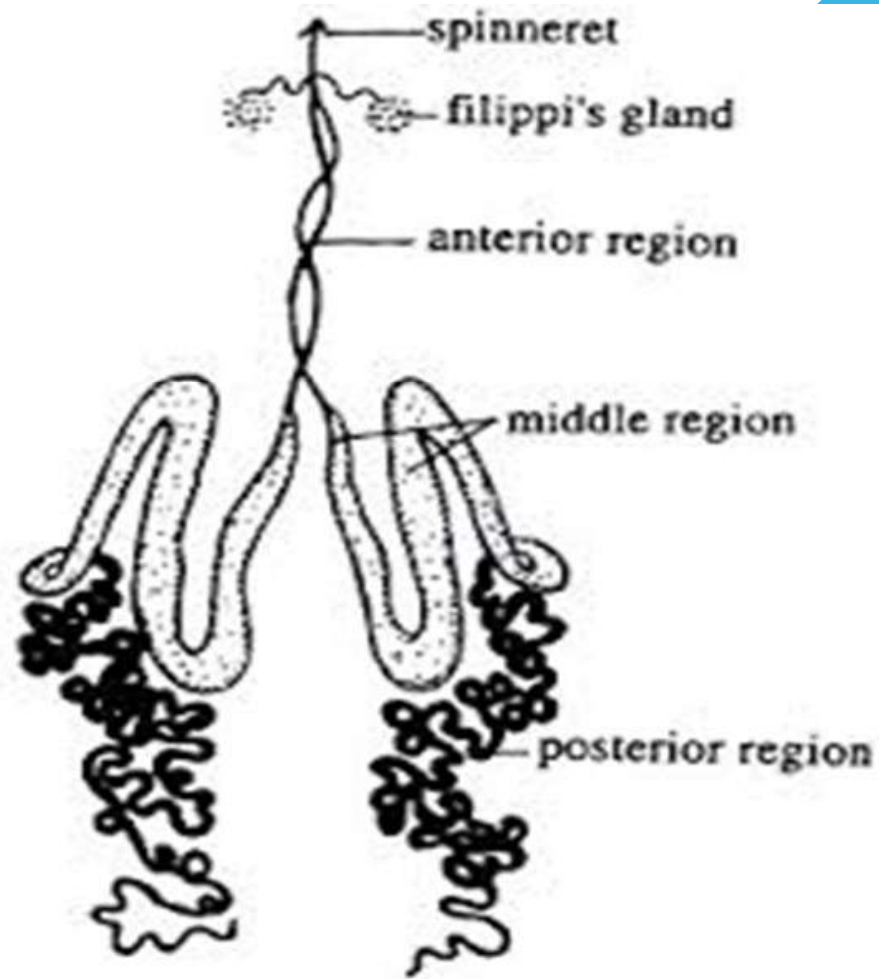


Fig. 8.3 : *Bombyx mori*. Silk gland

The silk of silkworms is secreted by a pair of labial gland, known as silk glands. The silk glands lie ventral to the alimentary canal.

The silk glands are tubular in shape with different diameters in different regions. Each gland has 3 distinct regions.

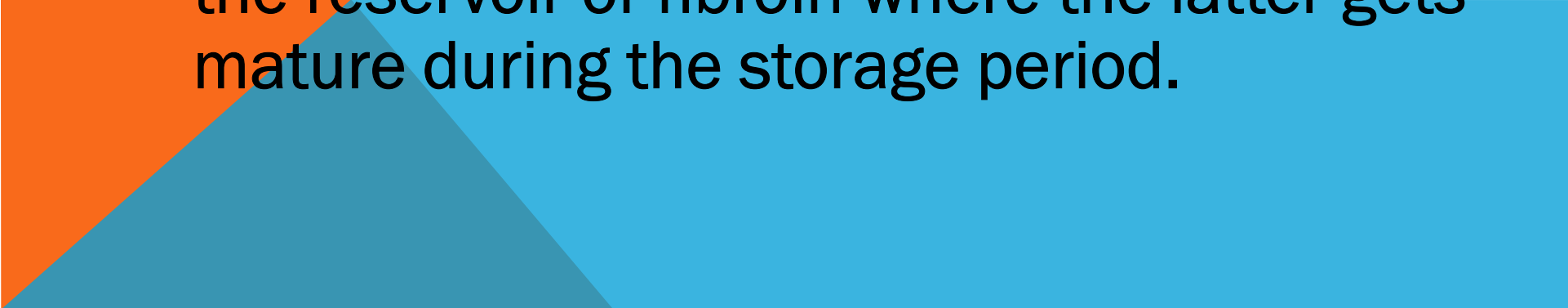


Anterior region: The thin anterior region of silk gland has no secretory role and only transports the assembled silk to the spinneret.

Middle region: Most prominent and widest part of silk gland. It has 3 limbs – posterior, middle and anterior limbs. The posterior arm secretes sericin-I. It gets surrounded by sericin-II secreted from the middle limb.

This sericin again gets surrounded by sericin- III secreted from the anterior limb.

The middle region of silk gland also acts as the reservoir of fibroin where the latter gets mature during the storage period.



Posterior region:

Blunt, highly folded tubular posterior regions of both glands remain attached to tracheal tubes of silkworm. This part secretes fibroin as fibrinogen.

Spinneret: It is a projection of the median part of the labium, which draws the silk out in the form of fine filament. The secreted silk comes out as a thread or filament as it passes through silk press which resembles a typical salivary pump



Filippi's gland or Lyonnet's gland:

In the head region of the larvae, a pair of glands are situated which open into the anterior part of silk gland near its opening into the spinneret. It is thought that these glands contribute some waxy materials to the silk thread or lubricate the passage of silk while coming out.



Histologically the entire gland has 3 layers:

1) The outer tunica propia with uniform thickness;

2) The middle glandular layer with gland cells which increase in size during later instar stages of larval development and

3) The inner tunica intima: It has varying thickness



<p>1. PEBRINE Worms show black spots,irregular moulting, cocoons are irregular, silk will be poor quality.</p>	<p>Protozoan Parasite Nosema bombysis nageli Spores are deposited in eggs.</p>	<p>Congenital through eggs and contamination through excreta.</p>	<p>Pasteurisation. Contamination can be prevented with 2% formalinsolution.</p>
<p>2.FLACHERIE A group of infection produced by bacteria. Worms show sluggishness, slow growth rate, diarrhoea, injury to skin</p>	<p>Bacillus thurigenis -toxicosis, Streptococci and Staphylococci infect blood and causes septecemia.</p>	<p>Transmission through faeco oral route.</p>	<p>Strict Disinfection and sanitary methods followed during rearing</p>

3. GRASSERIE

Larva shows swelling and skin bursts.

BORRELINA
VIRUS
Infect guts,
trachea, blood.

Transmission
through blood
contact of wounds
of affected worms.

Formalin
disinfection
Application of
silk worm
pesticides

4. MUSCARDINE

Loss of appetite.
oily secretions
from the body.

Fungus –
BEAUVERIA
BASSIANA
&
ISARIA
FARINOSA
These fungus
send network of
hyphae into the
body

Transmission
through the skin to
skin

BY PRODUCTS OF SILK INDUSTRY

Silk industry generate different types of byproducts from
grainages,
rearing,
silk reeling
and during weaving



At grainages silkworms are allowed to emerge from cocoon in the form of moth to produce quality seeds.

- such pierced cocoons produced in grainages are used as raw materials for the production of MUTKA YARN-they are used in handloom industry.

Pierced cocoons are used for making Garlands.

Litter of silkworms are used in the extraction of Vit E & K , It is also used in the preparation of activated carbon and acid resistant plastic sheets.

The litter is used as organic manure, fish food, and cattle feed., raw material for Gobar gas plants.

Left leaves and branches of mulbery are used to fed cattle

Stems are used as fire wood and fruits are edible and used in the preparation of wine and jam.

Major amount of silk waste is used in manufacturing of carpets,window curtains etc.

Hard waste and bonda waste are used in thread and rope manufacturing.

Dead pupa –extraction of fats & non edible oils,

Cattle feed poultry feed. Etc.



PISCICULTURE (POND CULTURE)

Culture of fishes in small water bodies by man is called pond culture. It is a branch of fishery science. Now it is growing as an industry and also a source income to farmers.

Shell fish -

Fin fish – Catla, labeo, Mrigal, clarias, tilapia, mystus

20000 species of fishes

India- 1000 species

20 lakh people are engaged in fishing



TECHNIQUES OF FISH CULTURE

Egg collection & Hatching

Hapas

Nursery Tanks

Rearing tanks

Stocking Tank

Harvesting and Marketing



EGG COLLECTION

Traditional practice to collect young fishes from the rivers

By using dip nets or scoop nets

In Recent days – Induced Breeding Technique to get the eggs of carps

Male & Female Carp will be injected with pituitrin or HCG



HAPAS (HATCHERY)

The miniature tanks where the eggs are placed

Made up of Mosquito mesh net

3 feet long , 1.5 feet wide. 1 feet depth

The tanks are kept immersed in water with outer hapas

2-3 days eggs hatch out

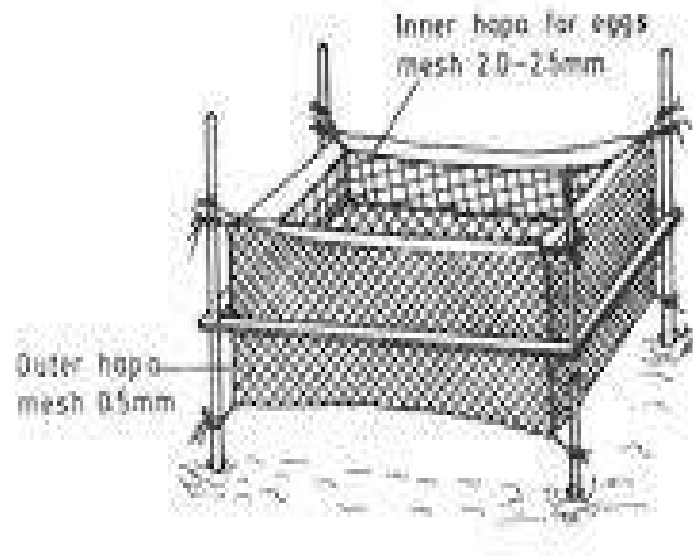
The hatchlings or fry are fast growing

It should be fed daily

After 15-20 days they are transferred to nursery tanks



HAPAS



NURSERY TANKS

These tanks are little big in size 50x30 feet with 4 feet depth

Normally rectangular in shape

It is drained first to remove all un wanted animals & weeds

Then filled with clean water and enriched with nutrients

Provide temporary roof

Oil cakes & bran of rice

These fry become fingerlings to 1-2 cm & ready to transfer to rearing tanks



3. REARING TANKS

50X50X10 FT

Deeper than nursery tank

Fry is transferred here

4-6 months

Grow bigger – one foot



STOCKING TANK – MAIN TANK

Young fishes are stocked till ready for marketing\

Quality of water

Removal of weeds

Predatory animals

Enriched with nutrients

Feeding with artificial food



Harvesting & Marketing:





Induced breeding



INDUCED BREEDING

The artificial process by means of which the extract of the **pituitary gland** is introduced into the body of matured male and female fishes, to stimulate fertilization and the process is called induced breeding or **hypophysation**.



COLLECTION OF PITUITARY EXTRACT:

From the matured fishes of both sexes the pituitary glands are collected.

In the fish markets, where the head of the cut fishes are available the pituitary glands can be taken out from the posterior end of the cranium through the foramen magnum after cleaning the brain tissue.

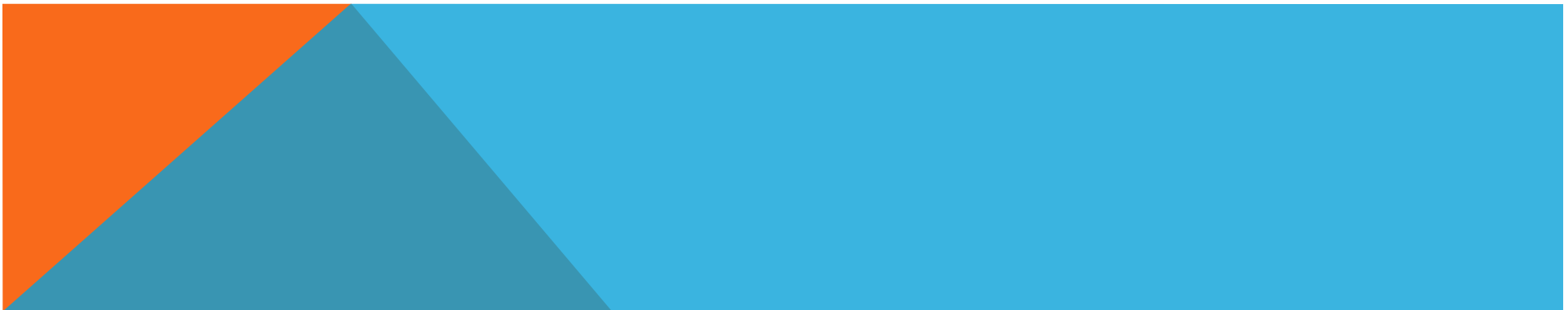


PREPARATION OF PITUITARY EXTRACT:

Immediate after the collection of the pituitary glands ,should kept in absolute alcohol for dehydration.

After 24 hours, the alcohol is changed for further dehydration The glands are then weighed and preserve in fresh alcohol .

At the time of injection ,the required quantity of pituitary glands are taken out of and the alcohol is allowed to evaporate. The glands are then macerated with distilled water .it is then centrifuged and fluid is drawn into a hypodermic syringe for the injection.



METHOD OF INJECTION AND SPAWNING:

During the rainy season, the extract of the pituitary gland is injected in the muscle of the matured carps Just before evening.

Injection of the carps is to be done on a piece of sponge which is used only to avoid the injury of the carps.

In case of male carps the pituitary extracts are introduced once and in case of female carps it is introduced twice.



Then one female and two male are placed in a breeding hapa for spawning.

After breeding, the female carps lays eggs.

The eggs are externally fertilized by the spermatozoa that are discharged by the males.

After that all the fishes are removed from the breeding hapa and then the eggs are collected by a net and are transferred to the inner part of the hatching hapa.

After 24hrs, the spawns enter into the outer hapa and the induced breeding process completed. Then the spawns are collected from the outer hapa and transferred to the nursery pond.



ADVANTAGES OF INDUCED BREEDING

Eggs that are collected from the river bed causes the possibility of mixture of other fishes of eggs.

Whereas, in the induced breeding there is no possibility of mixture and as a result the pure form of fish seeds are obtained.

Desired species of carps can be cultured through the induced breeding.

Large numbers of eggs are available from a fish through induced breeding.

ECONOMIC IMPORTANCE OF FISH

Fishes are one of the most important group of vertebrates serving as food for human. They possess a great economic, nutritional, medicinal, industrial, aesthetic and religious values as well as providing employment for millions of people in the world. They contribute to food security in many regions of the world.



I. Food value

Fish serves as an important food for human. Edible tissues of fish are appreciably greater than that in chicken, pig and sheep/goat.

II. Nutritive value

Fish is highly nutritious. The protein of fish is highly digestible and with well-balanced amino acids. Fish are low in fat and cholesterol. Fish is a good source of Vitamins- A, B and D and also offers a good source of calcium, iodine, fluorine, magnesium and zinc. Fish are rich in Omega-3.



III. Medicinal value

.

Regular consumption of fish can reduce the risk of various diseases and disorders.

Asthma: Children who eat fish are less likely to develop asthma.

Brain and eyes: Fish rich in Omega-3 fatty acids can contribute to the health of brain tissue and the retina of the eye.

Cancer: The Omega-3 fatty acids in fish reduce the risk of many types of cancers.

Cardiovascular disease: Eating fish every week reduces the risk of heart disease and stroke by reducing blood clots.



Dementia: Elderly people who eat fish or seafood at least once a week may have a lower risk of developing dementia, including Alzheimer's disease.

Depression: People who regularly eat fish have a lower incidence of depression.

Diabetes: Fish may help people with diabetes to manage their blood sugar levels.

Prematurity: Eating fish during pregnancy may help reduce the risk of delivering a premature baby.



IV. FISH PRODUCTS

- a. Fish meal: The dried and ground preparation of unused or trash fish is called fish meal and is a highly nutritive product that makes an excellent feed for poultry, pig, cattle and fish.
- b. Fish oil: Fish oil is of two kinds, body oil and liver oil. The oil extracted from the whole body of the fish is called fish body oil. It is very rich in iodine. The fish body oil is mostly used in manufacture of paints, varnishes, soaps, lubricants,
The oil obtained from the liver of fishes is called fish liver oil. It is very rich in Vitamin A and D.



d. **Fish flour:** Fish flour is made up of dried and powdered fish. It is a superior quality of fish meal which is used for human consumption.

Fish manure

Low grade, unedible fish are utilized to prepare the fish manure. These residues are dried, ground, mixed with ash and converted into manure, which contains a high percentage of nitrogen and phosphorous.



Fish glue:

The gelatinous adhesive material obtained from the connective tissues of skin and bones of certain fish, is called fish glue. It is used in gummed tape, and adhering the wood, leather, glass, etc.

g. Isinglass:

Isinglass is a substance obtained from the dried swim bladders of fish. It is a high-grade collagen used mainly in wine, beer and vinegar industry.

Fish leather:

The scaly skins of several fishes (e.g., sharks and rays) are used for manufacturing, polishing and smoothing materials in place of sand paper.



Biological control

Many species of carnivorous and larvivorous fishes prey upon insects and their larvae in water.

These fishes can be used to control harmful insects, mosquito larvae, etc. *Gambusia* is a well known fish for mosquito control, hence called mosquito fish.

They help in biological control of dengue, malaria, filaria, encephalitis, etc.



Sports and games

Sport or recreation fishing is the fishing for pleasure or competition.

The most common form of sport fishing is done with a rod, line and hooks with baits, called angling.

Decorative value

Many species of colored fish are kept in aquarium, ponds and lakes for decoration or ornamentation. The common ornamental fish species gold fish (*Carassius* spp.), gourami (*Colisa* spp.), zebra fish (*Brachidanio* spp.), guppy (*Poecilia* spp.), fighting fish (*Betta splendens*), koi (*Cyprinus carpio*), etc.



- i. Fish fin: The fins of the sharks and rays are used to make tasteful sauce and soups.
- j. Fish caviar: Caviar is a high value fish product. It is a salt-cured eggs of certain species of fish such as sturgeon, salmon and trout. Caviar is considered a delicacy and luxurious food and is eaten as a garnish or a spread.

Fish insulin:

Insulin is extracted from the pancreas of large sized fishes such as sharks



Employment opportunity

Fisheries and aquaculture sector provide, either directly or indirectly, a great employment opportunity for millions of people around the world.



PROCESSING AND FISH PRESERVATION

Normally the fish farms or sites are located far off from the market place and there is chance of fish decomposition and the uncertainties of their sale in market.

Causes of spoilage of fishes : **1.temperature**

In tropical regions such as India, the hot climate favours rapid growth of bacteria and so the spoilage of fish flesh

fishes may ordinarily remain fresh for not more than 8 hours and begin to decompose rapidly after that.



2.The chemical action- involves oxidation of fat, contained within the fatty tissues of the fish,as a result become decolourised. The oil starts getting oxidized as soon as it comes in contact with the atmospheric air, which is known as **rancidity**.

3. Microbial action :

Microbial action involves bacterial decomposition of the fish flesh. The bacteria are found in the lower part of the gastrointestinal tract and on the general body surface of the fish. Streptococcus, Micrococcus etc.

4. Enzymatic action :

Enzymatic action is due to action of various enzymes found in the body tissues / cells of fishes. They spoil the tissue by the process of autolysis.



PRESERVATION :

Preservation can be done, both for short and long duration:

Chilling :This is obtained by covering the fish with layers of ice.& deep freezing.

Preservation for long time :

Cleaning: fish washed thoroughly in cold, clean water to remove bacteria, slime, blood, faeces, and mud, etc. from the body surface of the fish.

Gutting:the fishes are cut along their mid ventral side, and their visceral organs are removed,prevent bacterial decomposition and enzymatic autolysis respectively.



Freezing :

Freezing means removal of heat from the body. To check the enzymal bacterial action and putrefaction it is preferred to store the fish under lower temperatures. The fishes are chilled in ice when they are to be stored for a few days.

The fishes are arranged in tiers in shelves or boxes and stacked, and should not be dumped in heaps in cold storage. It is preferred to store at a temperature below 6.0C to prevent microbial spoilage of fish.



Deep or quick freezing : for a long period, quick freezing is preferred which inhibits bacterial action. During quick freezing every part of the fish comes within the range of 0 to - 5C.

Properly frozen fish at -20oC retains its physical properties and nutritive values for a year .

Freeze drying :

This is modified deep freezing, completely eliminating all chances of denaturation. The deep frozen fish at -20oC is then dried by direct sublimation of ice to water vapour with any melting into liquid water. This is achieved by exposing the frozen fish in a vacuum chamber



Pit curing :

In this process the fish treated with salt are buried in pits lined with leaves.

Smoking :

In this method, landed fish is cleaned and brined. It is then exposed to cold or hot smoke treatment. In cold smoking, first a temperature of 38°C is raised from a smokeless fire. After this heating, cold smoke at a temperature below 28°C is allowed to circulate past the fish



SALTING

Salting is a process where the common salt, sodium chloride, is used as a preservative which penetrates the tissues, thus checks the bacterial growth and inactivates the enzymes.

Dry salting :

In this process the fish is first rubbed in salt and packed in layers in the tubs and cemented tanks.

Wet salting:

The cleaned fish are put in the previously prepared salt solution. It is stirred daily till it is properly pickled.



DRYING

Natural drying:

In natural drying, the fishes after being caught are washed and dried in the sunshine. They are suspended or laid out flat on the open ground.

only the thin fishes can be preserved by this method, because the fat fishes have much flesh allowing bacterial decomposition to continue in deeper parts of their body.

Artificial drying

In artificial drying the killed fishes are cleaned, and have their heads removed. They are then cut lengthwise ,, followed by washing and drying them mechanically.



Canning

The canning process involves pre-treatment of fish, preparation of can, filling and closure of the can, technique of heating the filled cans to kill micro-organisms without damage to fish, finally cooling, cleaning and storage of the product.







POULTRY

It is the scientific method of rearing of chickens, turkeys, ducks etc. for meat, and egg purposes. but also for feathers and manure.

The chicken has originated from jungle fowl *Gallus gallus*.

Chickens are more easy to handle and more economical.



IMPORTANCE OF EGG

Proteins are the important constituent of Egg.

Proteins are essential to build tissues, synthesis of enzymes, haemoglobin, etc.

Egg contains —

Water -65 gm

Protein- 12 gm

Fats -11 gm

Carbohydrate -0.78gm

Minerals -9.6 gm

Vitamins- 5gm

An egg weighing 100 gm –yield 387 calories of energy



BREEDS OF POULTRY:

1.DESI or INDIGENOUS BREEDS

2.EXOTIC BREEDS

1.DESI or INDIGENOUS BREEDS :Origin of these breeds is India. Poor Layers,small sized eggs,but good sitters and ideal mother. They are known for natural immunity against certain diseases.

Ex: ASEEL, CHITTAGONG,BASRA,

2.EXOTIC BREEDS :These breeds have vbeen imported from other countries. They are the modern chickens and improved breeds, They are good egg layers and meat producers.

Ex:Whiteleghorn, Plymouth rock , Rhodeisland



BASED ON UTILITY:

3. LAYERS: The breeds of Chicken which lays more eggs and commercially reared for the supply of eggs are called layers. They have early maturity, lay 280 eggs per year, large sized eggs, disease resistant.

4. **BROILERS:** The breeds of chicken which are reared for meat production are called broilers or table varieties. Fast growth, good quality meat, resistance to diseases.

5. Dual Purpose breeds: The breeds of poultry which are both good layers and meat producers are dual purpose breeds. Ex : GIRIRAJA.



SUSSEX (ENGLISH CLASS)

The Sussex is a British breed of dual-purpose chicken, reared both for its meat and for its eggs.

The Sussex chicken is graceful with a long, broad, flat back; a long and straight breastbone; wide shoulders; and a rectangular build.

The tail is held at a 45 degree angle from the body. The eyes are red in the darker varieties but orange in the lighter ones. The comb is single.

The earlobes are red and the legs and skin white in every variety. Cocks weigh approximately 4.1 kg and hens about 3.2 kg

Economic importance: It may be kept as a dual-purpose bird. Hens lay some 180–200 tinted eggs per year; some layer strains may give up to 250. The eggs weigh about 60 g. The Sussex is also reared for recreation.



PLYMOUTH ROCK (AMERICAN CLASS)

The Plymouth Rock is the most popular breed developed in America.

The Plymouth Rock has a single comb with wattles and ear-lobes are bright red.

The legs are yellow and unfeathered.

The beak is yellow-colored.

The average weight of cock is 4.5 kgs and that of hen is 3.2 kgs.

In the United States, seven color varieties of the Plymouth Rock are recognized: Barred, Blue, Buff, Columbian, Partridge, Silver-penciled and White.

Economic importance:The Plymouth Rock is a dual-purpose breed, and is kept both for its meat and for its large brown eggs, of which it lays about 200 per year. It has been extensively used for the production of broiler chicks. The average weight of cock IS 4.5 Kg, hen weighs 3.2 Kg.



GIRIRAJA

Giriraja is a breed of chicken developed by Karnataka Veterinary, Animal, and Fishery Sciences University in Bangalore, India,

- This breed is also called as Bonda Chicken .

Giriraja females lay s large number of eggs, 130–150 per year, with each egg weighing 52–55 grams.

The eggs have a good hatchability (80–85 per cent), and enable farmers to raise their own stock.

Egg shells are brown in color and thicker than that of other commercial eggs, and resist breaking.

The birds exhibit better growth compared to local varieties, and is suited for mixed and backyard farming.

For backyard rearing, a flock of five hens and one cock is ideally grown. No special care is required to grow them. •

They can be raised as free range birds and can be fed with locally available materials. Being good scavengers, they feed on a variety of insects and green foliage. They can also be fed on farm and kitchen waste. The birds are resistant to many diseases.



4. WHITE LEG HORN

This variety is originated in Italy,

White leg horns are the most popular breeds for poultry farming, because they are excellent layers.

They can adapt to all climates but thrive well in dry areas.

The flesh is not delicious as that of other breeds.

The body is short with a long back, a protruding breast and a yellow beak.

Creamy ear lobes and a rose comb are present.

They mature early and begin to lay eggs at the age of 5 to 6 months.

This breed is highly reputed as large white egg producers, they produce more than 250 eggs in a year.



5.LANGSHAN :

This variety has originated in langshan district of china.

The body is comparatively shorter with longer legs.

The Langshan is a nicely proportioned bird with feathered legs.

The cock weighs 4.5 Kg and Hen weighs 3.5 Kg.

They are good meet producers, but poor egg layers.

They lay pretty brown eggs.

They are dual purpose breeds.



DISEASES OF POULTRY FOWLS:

Fowl pox is viral infection that affects most bird species, Fowl pox is caused by an avian DNA pox virus.

The wet form is characterised by plaques in the mouth and upper respiratory tract. The dry form is characterised by wart-like skin lesions that progress to thick scabs.

The disease may occur in any age of bird, at any time

. Fowl pox can cause depression, reduced appetite and poor growth or egg production.

The course of the disease three to five weeks. no treatment for fowl pox prevention is through vaccination. As mosquitoes are known reservoirs, mosquito control can help in prevention.



2.COCCIDIOSIS

Coccidiosis is one of the most common diseases of chickens worldwide.

It is caused by a parasitic organism that damages the host's intestinal system, causing death.

Coccidial parasites are protozoans .

Chickens ingest sporulated oocysts (the parasite 'egg') from contaminated litter, and these pass into the intestinal tract,

mild loss of appetite, weight loss or decreased weight gain, diarrhoea (which can be bloody), dehydration and death.

Hygiene, anticoccidial drugs and vaccines are effective



3.RANIKHET OR NEWCASTLE DISEASE

Ranikhet or Newcastle Disease is a highly contagious viral infection

The disease can result in digestive, respiratory or nervous

**very severe depression, drop in egg production, increased respiration,
profuse diarrhoea followed by collapse,**

. Newcastle Disease is caused by a paramyxovirus

Spread is usually by direct physical contact with infected or diseased birds.

There is no treatment for Newcastle Disease,



4.AVIAN LEUKOSIS

Avian Leukosis is a neoplastic (tumour causing) viral infection of chickens

an avian Leukosis virus.

Affected birds show clinical signs including reduced feed intake, weakness,

diarrhoea, dehydration,

weight loss, depression and reduced egg production.

Palpation often reveals an enlarged bursa of Fabricius and sometimes an enlarged liver.



A BRIEF ACCOUNT OF POULTRY FARMING.

Production Type: or Selection of Chicken

First of all determine the production type of poultry farm. We can raise broiler chickens for meat production purpose and choose layers if you want to produce eggs commercially.

You can also start your poultry farm for selling poultry products and breeding stocks directly to your local customers..



FARM LOCATION:

Selecting a good farm location for business is very important. select such a location which has all required facilities and favorable for your business.

It can be slightly far from the town, where land and labour is pretty cheap.

But don't setup the farm too far from the town. Because most of the towns have high density population, and you have to target that market.

Also try to avoid setting up the farm in residential areas, because poultry farms produce offensive odour.

While selecting the farm location, consider transportation system and medication facilities also.



POULTRY HOUSE:

After selecting farm location, construct a good house for birds.

Ensure all required facilities are available in the new house.

There are three types of poultry housing system you can use. Extensive, semi intensive and intensive.

For commercial production, intensive system is most convenient.

We can raise your birds in floor or in cage system.

On an average, broiler poultry needs about 2.5 square feet space and layer poultry needs about 4 square feet space.

For example, if you want to raise 200 layers then you have to ensure about 800 square feet space is available. Don't forget to add proper lighting and ventilation system in the house.



REQUIRED EQUIPMENT

List of required equipment are listed below for running a poultry farm successfully.

Feeders

Waterers,

Nests, Cages.

Coops,

Crates,

Incubator,

egg tray,

Lighting instruments,Perches

Brooders or heaters,Ventilation system,Waste disposal system



LABOUR OR MANPOWER

Based on the number of birds, you need more or less manpower/labor.

As a beginner, if you start with a minimum number of birds (200-500) then you can manage your farm by yourself easily.

If you plan for raising more birds then you will need additional manpower.

Ensure cheap labour is available in your selected area.



PURCHASING CHICKS :

After setting everything up and having everything ready, purchase quality chicks from trusted breeder in your area and start caring them.

As a beginner, it is wise to start with day old chicks instead of older chicks.

If you are a complete beginner without any prior experience, keep the number of chicks to minimum.



FEEDING & HEALTH MANAGEMENT

Feeding is the most important part of poultry farming business. After constructing house and purchasing equipment and chicks, you have to spend a large amount of money for feeding your birds.

Health Management

We have to ensure proper medication system in the area.

Poultry birds are prone to various types of diseases and you have to be ready for controlling them. We know 'prevention is better than cure', so you have to be conscious and take proper care of your birds to keep them safe.

Vaccinate them timely and always try to provide them fresh water and food. Also stock some required vaccine and medicine so that you can use them when needed.



MARKETING :

Marketing :

Good marketing strategies influence the profit from business.

If you can sell your products in the market easily, then it will encourage you in getting more production.

We always recommend determining marketing facilities in your area before starting any farming business.

Because business will not be much profitable if you can't market your products properly.



Anilkumar.M , HOD ZOOLOGY, SSCASC,TUMAKURU MOB:9448101860.

Establishment of mulberry Plants

Land Preparation. Land for mulberry cultivation is ploughed deep up to a depth of 30-35 cm. Thereafter the land is repeatedly ploughed two or three times with a country plough to bring the soil to a fine tilth. The land should be properly levelled. A basal dose of well decomposed manure or compost is applied .

Spacing. The spacing commonly followed for a rainfed garden is 90 x 90 cm, Pits of 35 x 35 cm are prepared.

Stakes and planting. Branches of 8-10 months old and about 50 mm in diameter should be used for the preparation of stakes of 22-25 cm length with five to six healthy buds. Three stakes are planted per pit in a triangular form with a spacing of 15 cm, leaving only one bud exposed above soil surface. Planting should be done during June/July after the onset of the monsoon.

Intercultivation: During the first year, intercultivation should be done manually. Once mulberry plants are established, bullock ploughing is carried out.

Fertilization: NPK (kg/ha/year) in two doses. after 2 months of planting. Second dose: urea 55 kg or cam (100 kg) or ammonium sulfonate (125 kg), at end of September or early October before stopping of monsoon rains.

Pruning and leaf harvest. The first crop should be harvested six months after plantation when the mulberry is well established. Two more crops are harvested during the first year by the leaf picking method. Mulberry should be pruned after one year at the onset of the next monsoon. Pruning is done by sharp sickle or pruning saw at a height of 25-30 cm from the ground.

Green manuring and mulching. Green manure crops can be grown as an intercrop with mulberry during the monsoon only. Subsequently, plots may be mulched with any dry material or plants that will not cause needs.

Pond culture or Pisciculture:

The culture of fishes in ponds or in small water bodies is called pond culture or Pisciculture. Juvenile fish or fingerlings are put into a pond and fed until they reach market size. The fish are caught, either by draining the pond or by using large nets. Food can be from natural sources—commonly zooplankton feeding on pelagic algae, or benthic animals, such crustaceans and mollusks.

There are a number of factors that determine the amount of fish that any given pond can produce. The first is the size of the pond, which determines the amount of water available for the fish, which in turn determines the amount of oxygen available for the fish. If there are too many fish in the pond, there will not be enough oxygen, and the fish will become stressed and begin to die. Fish density can be increased if fresh water can be introduced to the pond to flush out wastes

Another factor affecting pond culture is predation from birds such as egrets and herons, and animals . If the pond is small, fences and overhead netting can control predation.

Another concern is algal blooms, which can lead to an exhaustion of nutrients, followed by a die-off of the algae, depletion of the oxygen, and pollution of the water, leading to a loss of fish.

Advantages of pond culture include its simplicity, and relatively low labor requirements. Another disadvantage concerns the marketing of the fish.

Techniques of Pond Culture :

- **Egg collection & Hatching** : Traditional practice to collect young fishes from the rivers By using dip nets or scoop nets ,In Recent days – Induced Breeding Technique to get the eggs of carps ,Male & Female Carp will be injected with pituitrin or HCG
- **Hapas** : The miniature tanks where the eggs are placed ,Made up of Mosquito mesh net 3 feet long , 1.5 feet wide. 1 feet depth,The tanks are kept immersed in water with outer hapas,2-3 days eggs hatch out.The hatchlings or fry are fast growing,It should be fed daily,After 15-20 days they are transferred to nursery tanks.
- **Nursery Tanks** : These tanks are little big in size 50x30 feet with 4 feet depth,Normally rectangular in shape,It is drained first to remove all un wanted animals & weeds,Then filled with clean water and enriched with nutrients,Provide temporary roof,Oil cakes & bran of rice,These fry become fingerlings to 1-2 cm & ready to transfer to rearing tanks
- **Rearing tanks:** will be larger and deeper, measure about 0.1 hectare and 1.5 mtr.deep, In rearing tanks, fishes are kept for 4-6 months.
- **Stocking Tank** : It is the main tank about 1-2 hectre. In this tank fish grow to marketable size in 12 months.
- **Harvesting and Marketing** : it is the last step in pond culture.The harvesting can be done by scoop nets or dip nets.it is estimated that a pond can yield 3000kg -10000kg per hectre/per year.

∴ Fresh water fishes of Karnataka

	Name		Name
1.	Rohu (<i>Labeo rohita</i>)	5.	Mangur (<i>Clarias batrachus</i>)
2.	Calbasu (<i>L. calbasu</i>)	6.	Singhi (<i>Heteropneustes fossilis</i>)
3.	Catla (<i>Catla catla</i>)	7.	Malli (<i>Wallago attu</i>)
4.	Singhara (<i>Mystus seenghala</i>)	8.	Mirgala (<i>Cirrhinus mrigala</i>)

Important Edible Marine Fish of India:

1.	Bombay duck (Harpodon sp)	7.	Mackerel (Rastrelliger)
2.	Eel (Anguilla sp)	8.	Flying Fish (Exocoetus)
3.	Hilsa (Hilsa)	9.	Ribbon Fish (Trichiurus)
4.	Pomfret (Stromateus)	10.	Tuna (Thunnus)
5.	Salmon (Aluitheronema)	11.	Seer Fish (Scomberomorus)

Induced breeding of fishes:

The artificial process by means of which the extract of the pituitary gland is introduced into the body of matured male and female fishes, to stimulate fertilization and the process is called induced breeding or hypophysation.

Collection of Pituitary extract:

From the matured fishes of both sexes the pituitary glands are collected. It is preferred to collect the pituitary gland from freshly killed fishes. In the fish markets, where the head of the cut fishes are available the pituitary glands can be taken out from the posterior end of the cranium through the foramen magnum after cleaning the brain tissue. But it has been observed that the pituitary glands taken from five to eight days old ice-preserved fishes have also given successful results.

Preparation of Pituitary extract:

Immediate after the collection of the pituitary glands ,should kept in absolute alcohol for dehydration. After 24 hours, the alcohol is changed for further dehydration The glands are then weighed and preserve in fresh alcohol . It may be stored at room temperature or in a refrigerator.

At the time of injection ,the required quantity of pituitary glands are taken out of and the alcohol is allowed to evaporate. The glands are then macerated with distilled water .it is then centrifuged and fluid is drawn into a hypodermic syringe for the injection

Method of injection and Spawning:

During the rainy season, the extract of the pituitary gland is injected in the muscle of the matured carps Just before evening. Injection of the carps is to be done outside of the water lying on a

piece of sponge which is used only to avoid the injury of the carps. In case of male carps the pituitary extracts are introduced once and in case of female carps it is introduced twice

Advantages of induced breeding

Eggs that are collected from the river bed causes the possibility of mixture of other fishes of eggs, whereas, in the induced breeding there is no possibility of mixture and as a result the pure form of fish seeds are obtained. Desired species of carps can be cultured through the induced breeding. Large numbers of eggs are available from a fish through induced breeding. In the same season, a carp can be induced to breed more than once. Transportation cost becomes very low as the carps can be breed in any desired pond. Between the different species of fishes, hybridization can be done and it is possible to get hybrid variety of fishes

ECONOMIC IMPORTANCE OF FISH:

Fishes are one of the most important group of vertebrates serving as food for human. They possess a great economic, nutritional, medicinal, industrial, aesthetic and religious values as well as providing employment for millions of people in the world. They contribute to food security in many regions of the world.

I. Food value

Fish serves as an important food for human. Edible tissues of fish are appreciably greater than that in chicken, pig and sheep/goat. The total estimated fish production of the world in 2017 was 200 million metric tons with a per caput consumption around 19.2 kg.

II. Nutritive value

Fish is highly nutritious. The protein of fish is highly digestible and with well-balanced amino acids. Fish are low in fat and cholesterol. Fish is a good source of Vitamins- A, B and D and also offers a good source of calcium, iodine, fluorine, magnesium and zinc. Fish are rich in Omega-3. They cannot be produced in human body, but are essential in the diet. the risk of heart attack.

Medicinal Value

Fish is low in fat, high in protein and an excellent source of Omega-3 fatty acids.

Regular consumption of fish can reduce the risk of various diseases and disorders.

Asthma: Children who eat fish are less likely to develop asthma.

Brain and eyes: Fish rich in Omega-3 fatty acids can contribute to the health of brain tissue and the retina of the eye.

Cancer: The Omega-3 fatty acids in fish reduce the risk of many types of cancers.

Cardiovascular disease: Eating fish every week reduces the risk of heart disease and stroke by reducing blood clots.

Dementia: Elderly people who eat fish or seafood at least once a week may have a lower risk of developing dementia, including Alzheimer's disease.

Depression: People who regularly eat fish have a lower incidence of depression.

Diabetes: Fish may help people with diabetes to manage their blood sugar levels.

Prematurity: Eating fish during pregnancy may help reduce the risk of delivering a premature baby.

different fishes are used as Ayurvedic medicines which help in treatment of duodenal ulcers, skin disease, night blindness, weakness, loss of appetite, cough and cold, bronchitis, asthma, tuberculosis, etc.

Fish products :

a. Fish meal: The dried and ground preparation of unused or trash fish is called fish meal and is a highly nutritive product that makes an excellent feed for poultry, pig, cattle and fish.

b. Fish oil: Fish oil is of two kinds, body oil and liver oil. The oil extracted from the whole body of the fish is called fish body oil. It is very rich in iodine. The fish body oil is mostly used in manufacture of paints, varnishes, soaps, lubricants,

The oil obtained from the liver of fishes is called fish liver oil. It is very rich in Vitamin A and D.

d. Fish flour: Fish flour is made up of dried and powdered fish. It is a superior quality of fish meal which is used for human consumption.

Fish manure and guano:

Low grade, unedible fish are utilized to prepare the fish manure. These residues are dried, ground, mixed with ash and converted into manure, which contains a high percentage of nitrogen and phosphorous.

Fish glue:

The gelatinous adhesive material obtained from the connective tissues of skin and bones of certain fish, is called fish glue. It is used in gummed tape, and adhering the wood, leather, glass, etc.

g. Isinglass:

Isinglass is a substance obtained from the dried swim bladders of fish. It is a high-grade collagen used mainly for the clarification of wine, beer and vinegar.

Fish leather:

The coarse scaly skins of several fishes (e.g., sharks and rays) are used for manufacturing, polishing and smoothing materials in place of sand paper.

Biological control

Many species of carnivorous and larvivorous fishes prey upon insects and their larvae in water.

These fishes can be used to control harmful insects, mosquito larvae, etc. *Gambusia* is a well known fish for mosquito control, hence called mosquito fish.

They help in biological control of dengue, malaria, filaria, encephalitis, etc.

Sports and games

Sport or recreation fishing is the fishing for pleasure or competition.

The most common form of sport fishing is done with a rod, line and hooks with baits, called angling.

Decorative value

Many species of colored fish are kept in aquarium, ponds and lakes for decoration or ornamentation. The common ornamental fish species gold fish (*Carassius* spp.), gourami (*Colisa* spp.), zebra fish (*Brachidanio* spp.), guppy (*Poecilia* spp.), fighting fish (*Betta splendens*), koi (*Cyprinus carpio*), etc.

Employment opportunity

Fisheries and aquaculture sector provide, either directly or indirectly, a great employment opportunity for millions of people around the world.

PROCESSING AND FISH PRESERVATION of FISHES:

Fish preservation is a very important aspect of the fisheries. Normally the fish farms or sites are located far off from the market place and there is chance of fish decomposition and the uncertainties of their sale in market.

Causes of spoilage of fishes : 1.temperature

In tropical regions such as India, the hot climate favours rapid growth of bacteria and so the spoilage of fish flesh

fishes may ordinarily remain fresh for not more than 8 hours and begin to decompose rapidly after that.

2. The chemical action- involves oxidation of fat, contained within the fatty tissues of the fish, as a result become decolourised. The oil starts getting oxidized as soon as it comes in contact with the atmospheric air, which is known as rancidity.

3. Microbial action :

Microbial action involves bacterial decomposition of the fish flesh. The bacteria are found in the lower part of the gastrointestinal tract and on the general body surface of the fish. Streptococcus, Micrococcus etc.

4. Enzymatic action :

Enzymatic action is due to action of various enzymes found in the body tissues / cells of fishes. They spoil the tissue by the process of autolysis.

Preservation :

Preservation can be done, both for short and long duration:

Chilling : This is obtained by covering the fish with layers of ice. & deep freezing.

Preservation for long time :

Cleaning: fish washed thoroughly in cold, clean water to remove bacteria, slime, blood, faeces, and mud, etc. from the body surface of the fish.

Gutting: the fishes are cut along their mid ventral side, and their visceral organs are removed, prevent bacterial decomposition and enzymatic autolysis respectively.

Freezing :

Freezing means removal of heat from the body. To check the enzymal bacterial action and putrefaction it is preferred to store the fish under lower temperatures. The fishes are chilled in ice when they are to be stored for a few days.

The fishes are arranged in tiers in shelves or boxes and stacked, and should not be dumped in heaps in cold storage. It is preferred to store at a temperature below 6.0C to prevent microbial spoilage of fish

Deep or quick freezing : for a long period, quick freezing is preferred which inhibits bacterial action. During quick freezing every part of the fish comes within the range of 0o to - 5oC.

Properly frozen fish at -20oC retains its physical properties and nutritive values for a year .

Freeze drying :

This is modified deep freezing, completely eliminating all chances of denaturation. The deep frozen fish at -20°C is then dried by direct sublimation of ice to water vapour with any melting into liquid water. This is achieved by exposing the frozen fish to 140°C in a vacuum chamber

Pit curing :

In this process the fish treated with salt are buried in pits lined with leaves.

Smoking :

In this method, landed fish is cleaned and brined. It is then exposed to cold or hot smoke treatment. In cold smoking, first a temperature of 38°C is raised from a smokeless fire. After this heating, cold smoke at a temperature below 28°C is allowed to circulate past the fish

Salting is a process where the common salt, sodium chloride, is used as a preservative which penetrates the tissues, thus checks the bacterial growth and inactivates the enzymes.

Dry salting :

In this process the fish is first rubbed in salt and packed in layers in the tubs and cemented tanks.

Wet salting:

The cleaned fish are put in the previously prepared salt solution. It is stirred daily till it is properly pickled.

Natural drying:

In natural drying, the fishes after being caught are washed and dried in the sunshine. They are suspended or laid out flat on the open ground.

only the thin fishes can be preserved by this method, because the fat fishes have much flesh allowing bacterial decomposition to continue in deeper parts of their body.

Artificial drying

In artificial drying the killed fishes are cleaned, and have their heads removed. They are then cut lengthwise, followed by washing and drying them mechanically.

Canning

The canning process involves pre-treatment of fish, preparation of can, filling and closure of the can, technique of heating the filled cans to kill micro-organisms without damage to fish, finally cooling, cleaning and storage of the product.

Poultry :

Poultry farming is the raising of birds domestically or commercially, primarily for meat and eggs but also for feathers and manure. Poultry birds include Chickens, turkeys, ducks, and geese. However poultry mainly deals with chicken. The chicken has originated from jungle fowl *Gallus gallus*.

Importance of Egg :

Proteins are the important constituent of the protoplasm. Proteins are essential to build tissues, synthesis of enzymes, haemoglobin, etc. Water -65 gm, Protein- 12 gm, Fats -11 gm, Carbohydrate -0.78gm, Minerals -9.6 gm, Vitamins- 5gm, An egg weighing 100 gm –yield 387 calories of energy.

BREEDS OF POULTRY:

Domestic fowls can be divided into 2 groups:

1. DESI or INDIGENOUS BREEDS

2. EXOTIC BREEDS

1. DESI or INDIGENOUS BREEDS : Origin of these breeds is India. Poor Layers, small sized eggs, but good sitters and ideal mother. They are known for natural immunity against certain diseases.

Ex: ASEEL, CHITTAGONG, BASRA

2. EXOTIC BREEDS : These breeds have been imported from other countries. They are the modern chickens and improved breeds, They are good egg layers and meat producers.

Ex: Whiteleghorn, Plymouth rock, Rhode Island

3. LAYERS: The breeds of Chicken which lay more eggs and commercially reared for the supply of eggs are called layers. They have early maturity, lay 280 eggs per year, large sized eggs, disease resistant.

4. BROILERS: The breeds of chicken which are reared for meat production are called broilers or table varieties. Fast growth, good quality meat, resistance to diseases.

5. Dual Purpose breeds: The breeds of poultry which are both good layers and meat producers are dual purpose breeds. Ex : GIRIRAJA.

Breeds of fowl.)

1.Sussex: □ The Sussex is a British breed of dual-purpose chicken, reared both for its meat and for its eggs. □ The Sussex chicken is graceful with a long, broad, flat back; a long and straight breastbone; wide shoulders; and a rectangular build. □ The tail is held at a 45 degree angle from the body. The eyes are red in the darker varieties but orange in the lighter ones. The comb is single. □ The earlobes are red and the legs and skin white in every variety. Cocks weigh approximately 4.1 kg and hens about 3.2 kg

Economic importance: It may be kept as a dual-purpose bird. Hens lay some 180–200 tinted eggs per year; some layer strains may give up to 250. The eggs weigh about 60 g. The Sussex is also reared for recreation.

2.Plymouth Rock : □ The Plymouth Rock is the most popular breed developed in America.

□ The Plymouth Rock has a single comb with wattles and ear-lobes are bright red.

□ The legs are yellow and unfeathered. □ The beak is yellow or horn-colored.

□ The average weight of cock is 4.5 kgs and that of hen is 3.2 kgs. □ In the United States, seven color varieties of the Plymouth Rock are recognized: Barred, Blue, Buff, Columbian, Partridge, Silver-penciled and White.

Economic importance: The Plymouth Rock is a dual-purpose breed, and is kept both for its meat and for its large brown eggs, of which it lays about 200 per year. It has been extensively used for the production of broiler chicks. The average weight of cock IS 4.5 Kg, hen weighs 3.2 Kg.

3.Giriraja: Giriraja is a breed of chicken developed by Karnataka Veterinary, Animal, and Fishery Sciences University in Bangalore, India, • This breed is also called as Bonda Chicken .

Giriraja females lay a large number of eggs, 130–150 per year, with each egg weighing 52–55 grams. The eggs have a good hatchability (80–85 per cent), and enable farmers to raise their own stock. Egg shells are brown in color and thicker than that of other commercial eggs, and resist breaking. The birds exhibit better growth compared to local varieties, and is suited for mixed and backyard farming. For backyard rearing, a flock of five hens and one cock is ideally grown. No special care is required to grow them. • They can be raised as free range birds and can be fed with locally available materials. Being good scavengers, they feed on a variety of insects and green foliage. They can also be fed on farm and kitchen waste. The birds are resistant to many diseases, an exception being Ranikhet disease.

ECONOMIC IMPROTANCE:

Giriraja is a dual purpose breed, and is kept both for its meat and for its eggs. Giriraja females lay a large number of eggs, 130–150 per year, with each egg weighing 52–55 grams. The eggs have a good hatchability (80–85 per cent), and enable farmers to raise their own stock. The birds exhibit better growth compared to local varieties.

4. WHITE LEG HORN: This variety is originated in Italy, □ White leg horns are the most popular breeds for poultry farming, because they are excellent layers. □ They can adapt to all climates but thrive well in dry areas. □ The flesh is not delicious as that of other breeds. □ The body is short with a long back, a protruding breast and a yellow beak. □ Creamy ear lobes and a rose comb are present. □ They mature early and begin to lay eggs at the age of 5 to 6 months. □ This breed is highly reputed as large white egg producers, they produce more than 250 eggs in a year.

5. Langshan : This variety has originated in langshan district of china. □ The body is comparatively shorter with longer legs. The Langshan is a grace full, nicely proportioned bird with feathered legs. The cock weighs 4.5 Kg and Hen weighs 3.5 Kg. They are good meat producers, but poor egg layers. They lay pretty brown eggs. They are dual purpose breeds.

Diseases of Poultry fowls: Raniket, Fowl fox, Avian leucosis and Coccidiosis:

1. Fowl pox is a relatively slow-spreading viral infection that affects most bird species, including all commercial forms of poultry. It occurs in both a wet and dry form. The wet form is characterised by plaques in the mouth and upper respiratory tract. The dry form is characterised by wart-like skin lesions that progress to thick scabs. The disease may occur in any age of bird, at any time. Mortality is usually not significant unless the respiratory involvement is severe. Fowl pox can cause depression, reduced appetite and poor growth or egg production. The course of the disease in the individual bird takes three to five weeks. Fowl pox is caused by an avian DNA pox virus. there is no treatment for fowl pox and prevention is through vaccination of replacement birds. Chicks may be vaccinated as young as one day of age. As mosquitoes are known reservoirs, mosquito control procedures may be of some benefit in limiting spread in poultry confined in houses.

2. Coccidiosis is one of the most common and economically important diseases of chickens worldwide. It is caused by a parasitic organism that damages the host's intestinal system, causing loss of production, morbidity and death. This disease has a major economic impact on the global poultry industry. Coccidial parasites are protozoa belonging to the phylum Apicomplexa. Chicken coccidiosis is caused by seven species, all from the genus Eimeria: Chickens ingest sporulated oocysts (the parasite 'egg') from contaminated litter, and these pass into the intestinal tract, Individual birds may show no clinical signs, or may suffer a mild loss of appetite, weight loss or decreased weight gain, diarrhoea (which can be bloody), dehydration and death. Resistance develops rapidly and infections can be self-limiting, but naïve birds which consume large numbers of oocysts can be severely affected and die. natural immunity to build up and preventing high oocyst exposure to naïve birds. Hygiene, anticoccidial drugs and vaccines all play major roles.

3. Ranikhet or Newcastle Disease is a highly contagious viral infection that affects many species of domestic chickens. Domestic fowl, turkeys, pigeons and parrots .The disease can result in digestive, respiratory and/or nervous clinical signs, which range from a mild, almost inapparent

respiratory disease to very severe depression, drop in egg production, increased respiration, profuse diarrhoea followed by collapse, or long-term nervous sign. Newcastle Disease is caused **by a paramyxovirus** that can vary in pathogenicity from mild to highly pathogenic. Spread is usually by direct physical contact with infected or diseased birds. There is no treatment for Newcastle Disease, although treatment with antibiotics to control secondary infections may assist.

4. Avian Leukosis is a neoplastic (tumour causing) viral infection of chickens that is found in flocks worldwide. Globally, the frequency of infection has been reduced substantially in the primary breeding stocks of several commercial poultry breeding companies. However, mortality up to 1.5% excess mortality per week has been reported in commercial broiler-breeder flocks naturally infected with an avian Leukosis virus. Affected birds show non-specific clinical signs including reduced feed intake, weakness, diarrhoea, dehydration, weight loss, depression and reduced egg production. Palpation often reveals an enlarged bursa of Fabricius and sometimes an enlarged liver. The disease can be immunosuppressant which increases susceptibility to other diseases. Lymphoid Leukosis appears to be controlled best by reduction and eventual eradication of the causative virus,

A brief account of Poultry farming.

Starting a poultry farming business is easy and involved with lots of regular work at the same time.

Production Type:

First of all determine the production type of poultry farm. We can raise broiler chickens for meat production purpose and choose layers if you want to produce eggs commercially. You can also start your poultry farm for selling poultry products and breeding stocks directly to your local customers..

Set Farm Location:

Selecting a good farm location for business is very important. select such a location which has all required facilities and favorable for your business. It can be slightly far from the town, where land and labor is pretty cheap. But don't setup the farm too far from the town. Because most of the towns have high density population, and you have to target that market. Also try to avoid setting up the farm in residential areas, because poultry farms produce offensive odor. While selecting the farm location, consider transportation system and medication facilities also.

Construct Poultry House:

After selecting farm location, construct a good house for birds. Ensure all required facilities are available in the new house. There are three types of poultry housing system you can use. Extensive, semi intensive and intensive. For commercial production, intensive system is most

convenient. We can raise your birds in floor or in cage system. On an average, broiler poultry needs about 2.5 square feet space and layer poultry needs about 4 square feet space. For example, if you want to raise 200 layers then you have to ensure about 800 square feet space is available. Don't forget to add proper lighting and ventilation system in the house.

Purchase Required Equipment :

List of required equipment are listed below for running a poultry farm successfully. Feeders, Waterers, Nests, Cages, Coops, Crates, Incubator, egg tray, Lighting instruments, Perches, Brooders or heaters, Ventilation system, Waste disposal system

Labor or Manpower

Based on the number of birds, you need more or less manpower/labor. As a beginner, if you start with a minimum number of birds (200-500) then you can manage your farm by yourself easily. If you plan for raising more birds then you will need additional manpower. Ensure cheap labor is available in your selected area.

Purchasing Chicks :

After setting everything up and having everything ready, purchase quality chicks from trusted breeder in your area and start caring them. As a beginner, it is wise to start with day old chicks instead of older chicks. If you are a complete beginner without any prior experience, keep the number of chicks to minimum (anyhow not more than 500).

Feeding is the most important part of poultry farming business. After constructing house and purchasing equipment and chicks, you have to spend a large amount of money for feeding your birds.

Health Management

We have to ensure proper medication system in the area. Poultry birds are prone to various types of diseases and you have to be ready for controlling them. We know 'prevention is better than cure', so you have to be conscious and take proper care of your birds to keep them safe.

Vaccinate them timely and always try to provide them fresh water and food. Also stock some required vaccine and medicine so that you can use them when needed.

Marketing : Good marketing strategies influence the profit from business. If you can sell your products in the market easily, then it will encourage you in getting more production. We always recommend determining marketing facilities in your area before starting any farming business. Because your business will not be much profitable if you can't market your products properly.

Unit-8 Dairy

A dairy is a business enterprise established for the harvesting or processing of animal milk mostly from cows or goats, but also from buffaloes, sheep, horses or camels for human consumption. With industrialization and urbanization the supply of milk become a commercial industry with specialized breeds of cattle being developed for dairy as distinct from beef or draught animals.

Most countries produce their own milk products, the structure of the dairy industry where is in different parts of the world in major milk producing countries most milk is distributed through whole sale markets.

Composition of milk and nutritive value of milk

Milk is produced by mammary gland. Its secretion is stimulated by prolactin in the mother at the time of birth of a calf (young one) adrenal hormone is also essential for lactation.

Milk is an emulsion of fat in a continuous phase. The dispersed phase consists of fat globule of varied diameter. Fat content varies from 0.1 to 10%.

The fat globules are surrounded by layers of protein phospholipids carotenes and cholesterol. This layer prevents the globules from coalescing together into large globules, protective layer may be broken by churning when the fat globules coalesce to form butter.

Milk /fat/ butter consists of glycerides of butyric caproic acid and capric acids. Which posses characteristic odour. The continuous aqueous phase consists of Carbohydrates(lactose) and a colloidal suspension of casein, stabilized by lactalbumin and lactoglobulin.

Lactose form the largest constituent of milk next only two water, fat soluble vitamins and water soluble minerals are present along the milk.

Amylase, catalase, peroxidase, lipase, phosphotase, galactase, lactase and aldehydase are important for the enzymes. These enzymes are destroyed due to pasteurization.

The white appearance of milk in reflected light and its opacity in transmitted light is due to emulsified fat and the colloidal calcium phosphate and caseinate.

Creamy colour is due to the presence of Keratin in the dispersed phase and of riboflavin in aqueous phase.

The flavour of milk is pleasant and sweet. Milk containing 3.5% fat and rich in lactose has a butter flavour.

constituent	Sindhi	Buffalo
Water	86.07	83.63
Fat	4.90	6.55
Protein	3.42	3.38
Lactose	4.91	5.23
Minerals	0.70	1.21

Nutritional value of milk

Milk is a complete food for infants up to 6 months of age. After which acts as a supplement to other food. Milk is a good source of phosphorus calcium and vitamins.

Cow milk is easily digestible, 50% of its caloric value is contributed by fat, 20% by lactose and 21% by protein. Milk is rich in vitamin A, D, B1 and B2.

Milk is rich in enzymes like amylase, catalase, peroxidase, lipase, phosphatase, galactase, lactase and aldehydase.

Proteins like lactalbumin, lactoglobulin which are also antibodies are Richey present. The additives like phospholipids, carotene, cholesterol are present.

Milk sugar like lactose a disaccharide constituents about 4 to 7% of milk, its hydrolysis gives glucose and galactose.

Milk consists of fat of about 4 to 7% called butter fat composed of triglycerides. Milk protein like cascin , globulins, immunoglobulins, proteases and peptones.

salts like, calcium chloride, citrate, sulphate and bicarbonate of sodium and potassium are present there are also traces of iron and copper.

Cattle breeds

A breed is group of one species of animals, which have the same descent and are similar in body shape, size and structure.

Examples: Amrithmahal, Kangayan, Malvi, Siri, Hallikar, Khillari etc..

Indigenous Draught breeds of cattle

Draft breed:

Hallikar:- They are breeds mainly meant for transport and field work.

- Originated from the former princely state of Vijayanagaram, presently part of Karnataka.
- The colour is grey or dark grey.
- Compact, muscular and medium size animal with prominent forehead, long horns and strong legs.
- The breed is best known for its draught capacity and especially for its trotting ability.
- Both bulls and cows have horns.
- The cows are average milk producers and an average can produce about 542kg of milk/lactation.
- Green fodder, chiefly comprises finger millet, grass sorghum or pearl millet.



uses

- The bulls are known for their strength and endurance and are primarily used for draft purposes.
- Along with normal draught purpose, the Breed is also used for cart racing.
- It is considered as one of the premier draft cattle breeds in India. That cows are always milkers.

Red Sindhi (Milch breed)

Examples: Gir, Red sindhi, Sahival and Deoni.

They are breeds mainly meant for milk production.

- This breed is otherwise called as Red Karachi and Sindhi and Mahi.
- Originated in Hyderabad and Karachi (Pakistan) regions of undivided India and also reared in certain organized farms in our country.
- Colour is red with shades varying from dark red to light, strips of white.
- Milk yield ranges from 1250 to 1800 kgs per lactation.
- Bullocks despite lethargic and slow can be used for road and field work.
- They having short, curved, lyre shaped horns.
- The bulls are usually of a darker colour than the cows.
- The heritability for milk yield is 0.30 to 0.35.



- Age of first calving is 39 to 50 months. Calving interval is 425 to 540 days.

Uses

- It has been used to improve beef and dual purpose cattle in many tropical countries.
- High milk production helps give a fast growing cough which is ready for market at 1year.
- Cross breeding method is commonly used for improving cattle breeds. It is used for producing more yield of milk

Ongole (dual purpose breeds)

Examples: Hariana, ongole,etc..

They are used for both work and production of milk.

- Otherwise known as Nellore.
- Home tract is Ongole taluk in Guntur district of Andhra Pradesh.
- Large muscular breed with a well developed hump.
- Suitable for heavy draught work.
- White or light grey in colour.
- Average milk yield is 1000 kgs per lactation.
- Animals of the Ongole breed were extensively exported to USA for beef production and also Brazil for beef and milk, Sri Lanka for drought etc..
- The Breed produces moderate milk with an average of 798 kg per lactation.
- In average fat percentage is about 3.79 percent.



uses

- The bulls commonly used in bull fight due to their strength and aggressiveness in Mexico.
- They are also used for traditional fight in Andhra Pradesh and tamilnadu.
- Ongole cattle were the first Indian breed of cattle to gain worldwide recognition.
- Ongole cows stay close to their calves to protect them from Predatory animals.

Exotic dairy breed:

They are breeds originated outside india and then imported to our country.

Examples: Holstein, Ayrshire and Redden etc..

Holstein Friesian

- Originated from the northern parts of Netherlands, especially in the province of Friesland.
- Largest dairy breed and ruggedly built in shape and possess large udder.
- Breeds have typical marking of black and white that make them easily distinguishable.
- The average milk production of cow is 6000 to 7000 kg per lactation.
- The adult males and females about 800 to 900 kg and 500 to 650 kg respectively.
- The healthy calf weighs 40 to 50 kg or more at birth.
- Generally breeders plan for HF to calve for the first time between 21 and 24 months of age. The gestation period is about 9 and half month. Breeders important specialised Dairy holstein from the United States to cross with the European black and whites.

Uses

It is an adult purpose breed, used for both dairy and beef.

The exotic breed of cattle are high milk production.



Red Dane (Danish red)

Originated in Denmark.

- Body colour of this Danish breed is red, reddish brown or even dark brown.
- It is also a heavy breed.
- The lactation yield of Red Dane cattle varies from 3000 to 4000 kg.
- They having great heat tolerance.
- It having fat content is about 4% and above.
- The calving interval 13 months.
- Both bulls and cows usually may have small horns.
- This breed is disease resistant and well adapted to varying climates.
- Mature males weighing up to 950kg and mature female is about 600kg.

Uses

The Danish red cattle are a dual purpose animal.



They are raised for both milk and meat production.

Buffalo breeds

Examples: Murray, Jaffrabadi, Bhadawari, Niki Ravi, surti, Nagpur.

Surti: Also known as Deccani, Gujarati, Talabda, Charator and Nadiadi.

- The breeding tract of this breed is Kaira and Baroda district of Gujarat.
- Coat colour varies from rusty brown to silver-grey.
- Tail is fairly long and back is straight.
- The horns are sickle shaped, moderately long and flat.
- The peculiarity of the breed is two white collars, one round the jaw and the other at the brisket region
- The milk yield ranges from 1000 to 1300 kgs per lactation.

The peculiarity of this breed is very high fat percentage in milk (8-12%)

Uses

They are mainly used for milk production purpose.

The bullocks are used for good light work.



Nagpuri

- This breed is also called as Elitchpuri or Barari.
- The breeding tract of this breed is Nagpur, Akola and Amarawati districts of Maharashtra.
- These are black coloured animal with white patches on face, legs and tail.
- The horns are long, flat and curved, bending backward on each side of the back. (Sword shaped horns).
- The bullocks can be used for heavy work.
- The milk yield ranges from 700 to 1200 kgs per lactation.
- The age at first calving is 45 to 50 months with an intercalving period of 450 to 550 days.
- It is an central Indian breed.
- They having 7.7% of fat soluble in milk.
- These breeds are slow movement and less active.

Uses

It is very good for milk production.

Male animals are used for draft purposes but it works slow than bull.



Diseases in Cattle

Mastitis is the inflammation of the mammary gland and udder tissue and is a major endemic disease of dairy cattle.

It is most often transmitted by contact with the milking machine and through contaminated hands or other materials.

causes

It is a multifactorial disease, since the infectious infection depends on germs, environmental conditions and the characteristics of the cow. The microorganisms invade the mammary gland causing inflammation of the gland. They are caused by two types of mastitis,

1) contagious mastitis:

This is caused by microorganisms *Streptococcus agalactiae* and *Staphylococcus aureus*. They are transmitted during milking through contaminated milking machinery. The cow or the improper handling by the workers it caused a reduced level of milk.

2) environmental mastitis:

This is caused by microorganisms environmental streptococci and coliforms. They are transmitted between periods of milking and dry periods when the gland does not produce milk.

Symptoms:

This is an inflammation of the affected udders the animals feel pain when touched.

The milk is altered and blood is sometimes seen as well as flakes, clots and colourless pus.

Fever, lower milk production and loss of appetite.

The microbial count and somatic cell count is high.

Diagnosis:

The milk samples are collected and conducted the following tests,

Somatic cell count

Bacterial culture of milk and other tests.

Treatment:

Treatment depends on the cause of the microorganisms and whether it is subclinical or clinical this can be done using intramammary antimicrobials.

Prevention:

Teat disinfection before and after milking

good hygiene during milk in period

good milking machine for also used

call out a veterinarian to take information

given a good nutrition, water and quality bedding to the cattles

good ventilation clean and dry tests

keeping cows standing after milking.

Anthrax:

Anthrax is an acute disease having rapidly fatal course. it is the oldest disease known in the cattle disease. It is characterized by septicemia and sudden death.

Causes

The causative agent of this disease is bacillus anthracis.

the organisms is a relatively large, rod-shaped and non motile.

the animals get infection by ingestion of food and directly from animal to animal.

Symptoms

Shivering fits with rise of temperature the temperature of animal body go up to 106 degree fahrenheit.

Rumination stops, eye become red, extremities get cold

breathing is difficult

abdominal pain and tympanites

dung is stained with blood and rectum protrudes

bloody discharge from mouth nostrils and rectum. the discharge is tarry in colour

the animal dies within 24 hours, if the disease is in acute form.

Treatment

The treatment is usually not possible in acute cases but subacute cases are treated with antibiotics and antianthrax serum.

Penillin and streptomycin in large doses are recommended

Annual vaccination of the animals recommended in the endemic areas.

Prevention:

Good hygiene is the most important single factor in the prevention of spread of Anthrax

destruction of contaminated material and disinfection of equipments and animal shed are also necessary vaccination in endemic areas is very important to control the diseases

as the population of disease causing organisms takes place in the presence of oxygen, the vegetative forms present in the tissues and body fluids will die if the carcass is not open but is burnt or buried deep with lime.

Septicemia:

It is also called hemorrhagic septicemia.

this is mainly occurs in cattle and buffaloes and also goats, camels, Horses and donkeys

it is a severe bacterial diseases.

Causes:

The causative agent of this disease is starting strains of *Pasteurella multocida*

the diseases is spread through contact with infected animals, contaminated clothing, equipments and through injection or inhalation of bacteria.

The animals under stress or with poor body condition are believed to be more susceptible to *P. multocida* infection.

Symptoms:

The infected diseases swollen neck and lower jaw

lethargy, reluctant to move

nasal discharge

painful or difficulty breathing

excessive salivation, fever and finally become death.

Treatment:

The antibiotics is only effective when administered early

several of the sulfonamides and antibiotics such as penicillin and the tetracyclines can be used successfully in the early stages.

animals with elevated temperatures are isolated and treated intravenously with a soluble sulfonamide.

Diagnosis:

Diagnosis on the basis of blood smear and clinical findings.

Prevention:

Maintaining herds in good physical condition and bearing the entry of animals

vaccination for haemorrhagic septicaemia is available

when favourable conditions for outbreaks are known to recur periodically.

In endemic areas the only practical ways to protect animals are by an organised program of vaccination.

Foot and mouth diseases:

It is a viral disease and it is highly communicable disease affecting cloven footed animals. It is characterized by fever, formation of blisters in the mouth, udder, teats and on the skin between toes and above the hoofs.

In India the disease is widespread and assumes a position of importance in livestock industry.

causes

The disease is caused by a virus called foot and mouth disease virus.

It is spread by direct contact or indirectly through infected water, manure, hay and pastures.

It is also conveyed by cattle attendants

The virus gains entry into the bloodstream of animals through injury to the lining membranes of tongue, intestine, clefts of hoofs and other similar parts.

Symptoms:

Rise of body temperature, dry muscle, dullness, depression, shivering, staring coat, loss of appetite and stoppage of rumination.

slight constipation

dribbling of saliva from the mouth.

formation of blisters on the tongue and cheeks.

shaking and kicking of legs and lameness.

Vesicles at the cleft of the hoof become ulcer like and may get fly blown.

The milk comes down in quantity and quality and the milk coagulates on boiling

The infected animals cannot be put to hard work especially in the sun and it gasps from breath a condition known as panting.

Treatment:

No therapeutic agents have been found till now to cure foot and mouth disease

a common and inexpensive dressing for lesions of feet is a mixture of Coal Tar and copper sulfate in the proportion of 5:1 some other measures to treat the disease are given below

clean the wounds and ulcers in the mouth, udder, teats and feet with 2% potassium permanganate lotion or alum water

decoction of babool bark for gargling the mouth and washing the ulcers may also be effective.

apply boric acid mixed with glycerine to ulcers in the mouth.

foot bath with a disinfectant solution such as cresol or phenol (1:100) may be used.

Sores on the udder and teats of milch cows should be kept clean and dressed with boric ointment.

Management of dairy form

The building in which dairy cattle are kept is called dairy house.

Selection of site should consist of dry place, elevated place drainage facility and good water supply.

The dairy house should contain cowshed, suckling calves room, feeding Room, milkroom, washroom, loafing room.

The cowsheds can be arranged in single row if the cows are less than 10 or in a double row if the cows are more than 10, in the middle there is a passage.

In the double row system the cows should be arranged face to face or tail to tail

MANAGEMENT OF COW

the cow has three stages in its life. They are,

1. new born calf

2. heifer

3. milking cow

CARE OF NEW BORN CALF

As soon as the calf is delivered, the mucus is removed from the nose and mouth and it is cleaned.

If the calf does not start breathing artificial respiration should be given by pressing the chest

.

Another method is to hold calf by the rear legs and lift from the floor with the head down, this may be repeated several times.

The navel cord of the calf is tied about 2.5 cm away from the body and cut about 1 cm below the ligature. Apply tincture iodine and repeat it 2-3 days. This prevents infection.

Feed colostrum within 15 minutes of calving.

Identification - metal ear tags or buttons with letters and numbers may be inserted in the year.

Dehorning - by use of hot iron to removal of horns within the age 3 to 10 days.

* Note - colostrum = it contains low fat, high protein, vitamins and minerals. This helps to protect the calf against various diseases as it contains antibodies.

MANAGEMENT OF HEIFER

Heifer is the stage of the cow which does not have yielded calf. It has got an age 15 to 18 months from the date of calving.

Usually heifers are kept indoors up to 9 to 12 months, then they are raised outdoors and protection from adverse climatic conditions, rains, sun etc, are essential.

The heifer cow is still growing and has not reached her adult body weight. So, extra growth ration as to be provided to milking heifer cow, is throughout first lactation.

Management of milk cow

1) Feeding management

Adequate quantity of roughages especially greens are usually fed 4 to 5 times a day.

The concentrates are fed usually at the times of milking, this helps in, let down, of milk.

Concentrate feed should be given at the rate of 1.5 kg per animal as maintenance ration.

1 kg of concentrate feed should be given for every additional 2.5 kg of milk yield.

1.0 to 1.5 kg concentrate feed should be given to the pregnant cows from 7th months of pregnancy.

A milking cow requires 15 to 25 kg of green fodder and 3 to 5 kg of paddy and straw per day in addition to the concentrate feed.

2)Breeding management

The heifer comes to heat at about 18 months of age .

A period in the oestrous cycle during which cow will mate is called the oestrus as heat period.

The oestrous cycle averages about 21 days in length.

The heat period will usually last from 14 to 18 Hours, but may vary and if ranges from 12 to 24 hours in length.

Dairy cows usually comes to heat about 30-40 days after calving.

The gestation period of cow is about 280 days.