

ECONOMIC IMPORTANCE OF BACTERIA

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Bacteria are cosmopolitan in distribution. They occupy most of the inhabiting space on earth. Bacteria are known as an agent of causing diseases in plants and human being, but several of them are essential in our daily life. Bacteria also inhabit our intestine and are helpful to break down food, thus keeping us healthy.

Some of the useful and harmful activities of bacteria are discussed here —

Useful activities :

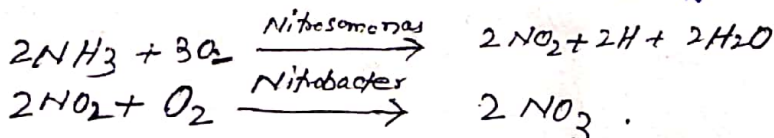
1. Role of bacteria in Agriculture:

- (i) Nitrogen fixing bacteria increase soil fertility by converting molecular nitrogen of the atmosphere into nitrogenous compound. These bacteria belong to two categories

Free living
or
asymbiotic bacteria
↓
occur in soil and fix
atmospheric nitrogen
directly
e.g., Azotobacter,
Clostridium

Symbiotic bacteria
↓
occur in roots of leguminous
plants mostly, some occur in
other plants also.
e.g. Rhizobium.
(R. leguminosarum)

- (ii) Putrefying bacteria also increase soil fertility by bringing about decay and putrefaction of dead complex organic compounds into simpler substances. For example protein, in dead remains of plants and animals, are decomposed by ammonifying bacteria such as Bacillus mycoides, B. ramosus, B. vulgaris etc. into ammonia. The latter is converted into nitrites (NO_2) by Nitrosomonas and nitrates (NO_3) by Nitrobacter.



2. Role of Bacteria in Industry;

(i) Bacteria play an important role in the manufacture of dairy products like curd, cheese, butter etc. Important among them include -

<u>Streptococcus</u>	<u>lactis</u>	-	Butter
<u>Lactobacillus</u>	<u>lactis</u>	—	Cheese,
<u>Lactobacillus</u>		—	curd.

(ii) other industrial products are -

Acetic acid or vinegar	-	<u>Acetobacter</u> <u>aceti</u>
Acetone - butanol	-	<u>Clostridium</u> <u>acetobutylicum</u>
Lactic acid	—	<u>Lactobacillus</u> <u>delbrueckii</u>
Lysine	—	<u>Micrococcus</u> <u>glutamicus</u>
Retting of fibres	-	<u>Clostridium</u> <u>butyricum</u>
Curing of tea	-	<u>Mycococcus</u> <u>condisans</u>
Curing of tobacco	-	<u>Bacillus</u> <u>megatherium</u>

3. Antibiotics from Bacteria :

Antibiotics are the metabolic products of bacteria which inhibits the growth of other microbes in very small quantity. Penicillin, a metabolic product of Penicillium notatum, was the first antibiotic; discovered by Alexander Fleming in 1929. Some antibiotics are specific while some other have broad spectrum of action i.e. effective against a variety of pathogens.

<u>Antibiotics</u>	<u>Bacteria</u>	<u>Range of action.</u>
Bacitracin	<u>Bacillus</u> <u>subtilis</u>	Gram+ bacteria
polymyxin B	<u>Bacillus</u> <u>polymyxa</u>	<u>M. tuberculosis</u>
streptomycin	<u>Bacillus</u> <u>griseus</u>	Mostly Gram+
Chloramphenicol (Chloromycetin)	<u>Streptomyces</u> <u>venezuelae</u>	Broad spectrum
Erythromycin	<u>Streptomyces</u> <u>erythraeus</u>	Rickettsias
Griseofulvin	<u>S. griseus</u>	Pathogenic fungi
Neomycin	<u>S. fradiae</u>	mostly Gram+
Terramycin (Oxytetracycline)	<u>S. rimosus</u>	Broad spectrum

4. As symbiont with human being:

Escherichia coli is a common colon bacterium found in human being and many vertebrates. The bacterium is helpful in digestion.

5. For Genetic Engineering:

The bacterium E. coli has been used as an important tool in which some important experiments have been done with the transfer of useful genes like - those responsible for the production of Vit. B12, human insulin gene (large scale production is being done), anti-viral agent interferon, human growth hormone (Somatotropin).

6. For cellulose digestion:

In ruminant animals, cellulose digesting bacteria like Ruminococcus albus, digest cellulose of the grasses.

7. For sewage disposal:

Some anaerobic and aerobic bacteria are helpful in the digestion of fecal matters collected in the sewage tanks. In this process methane and CO₂ are produced. Methane is used as biogas and CO₂ is used by certain algae present in the tank for photosynthesis. Oxygen released by algal photosynthesis is used in the oxidation of sewage. The sewage tank or pond is an example of algal-bacterial symbiosis.

Harmful activities:

1. Food poisoning:

Bacteria, present in the food preparations may excrete toxic substances and cause food poisoning, e.g.,

- Clostridium botulinum
- Micrococcus pyogenes
- Salmonella typhimurium
- Escherichia coli

2. Denitrification:

Some bacteria like Bacillus denitrificans, Thiobacillus denitrificans etc. release free nitrogen from nitrates present in the soil. Thus they reduce soil fertility as plants can't use free nitrogen.

3. Human diseases:

Some the common human diseases are tabulated here —

<u>Disease</u>	<u>Bacteria</u>	<u>Type</u>
1. Cholera	<u>Vibrio cholerae</u>	Gram ⁻ , comma shaped
2. Diarrhoe	<u>Bacillus coli</u>	Gram ⁻ , bacillus "
3. Dysentery	<u>Corynebacterium dysenteriae</u>	Gram ⁺ , bacillus "
4. Dysentery	<u>Shigella dysentery</u>	Gram ⁻ , bacillus "
5. Gastroenteritis	<u>Escherichia coli</u>	Gram ⁺ , bacillus "
6. Jaundice	<u>Leptospira icterohaemorrhagiae</u>	Gram ⁻ , spirillum
7. Leprosy	<u>Mycobacterium leprae</u>	Gram ⁺ , bacillus
8. Meningitis	<u>Neisseria meningitidis</u>	Gram ⁻ , cocci
9. Plague	<u>Pasteurella pestis</u>	Gram ⁻ , bacillus
10. Pneumonia	<u>Streptococcus pneumoniae</u>	Gram ⁺ , cocci
11. Syphilis	<u>Treponema pallidum</u>	Spirochaete
12. Tetanus	<u>Clostridium tetani</u>	Gram ⁻ , bacillus
13. Tuberculosis	<u>Mycobacterium tuberculosis</u>	Gram ⁺ , bacillus
14. Typhoid	<u>Salmonella typhi</u> <u>Escherichia typhosa</u>	Gram ⁻ , bacillus
15. Whooping cough	<u>Bordetella pertussis</u>	Gram ⁻ , bacillus

4. Plant Diseases :

Some Common Plant diseases

<u>Disease</u>	<u>Host</u>	<u>Causal bacteria</u>
1. Citrus canker	Citrus plants (Lemon, orange etc)	<u>Xanthomonas citri</u>
2. Blight of Paddy	Rice (<u>Oryza sativa</u>)	<u>Xanthomonas oryzae</u>
3. Fire blight of	Members of family Rosaceae e.g., <u>Pyrus malus</u>	<u>Erwinia amylovora</u>
4. Soft rot of vegetables	Carrot, turnip etc.	<u>Erwinia carotovora</u>
5. Tender or bacterial rot	<u>Triticum</u> (wheat)	<u>Corynebacterium tritici</u>
6. Red stripe of Sugarcane	<u>Saccharum officinarum</u>	<u>Pseudomonas rubrilineans</u>
7. Wilt of Potato, tomato etc	members of Solanaceae	<u>Pseudomonas solanacearum</u>
8. Wilt of cucurbits	cucurbits	<u>Erwinia tracheiphila</u>

Some plant pathogenic bacteria produce toxins or inject special proteins that lead to host cell death or they produce enzymes that break down key structural components of plant cells and their walls. Agrobacterium species even have the ability to genetically modify or transform their hosts and bring about the formation of cancer-like overgrowths called crown gall.

5. Cattle disease:

- Black leg - Clostridium chauve
- Anthrax - Bacillus anthracis

Other diseases include Bovine tuberculosis (by Mycobacterium), Haemorrhagic septicemia (Pasteurella multocida) etc.