Food Chains

The transfer of food energy from the source in plants through a series of organisms with repeated stages of eating and being eaten is known as the food chain. The green plants, in the food chain, occupy the first trophic (nutritional or energy) - the producer level, the herbivores that eat the plants the second trophic - the primary consumer level, the carnivores that eat the herbivores the third trophic - the secondary consumer level and perhaps even a fourth- the tertiary consumer level. Some organisms are omnivores that eat the plant as well as animals at their lower level in the food chain and they may occupy more than one trophic level in the food chain. Thus, in any food chain, energy flows from producers -----> primary consumers (herbivores) -----> secondary consumers (carnivores) A tertiary consumers (carnivores), and so on. At each step of food transfer, a large proportion, 80 to 90% of the potential energy is lost through dissipation of heat resulting in continuous diminution of available energy. This is the reason that rarely more than five trophic levels occur in a food chain. The efficiency of energy transfer also varies from one trophic level to another.

In nature, three types of food chains have been distinguished:

1 Grazing food chain

The consumers which utilise the living plant parts as their food or energy source constitute the grazing food chain. The food chain, thus begins from a green plant base. It is common in the terrestrial and aquatic ecosystems where most of the primary production is edible by herbivores. Some of the common examples of grazing food chain are given in Table 10.2

2 Parasitic food chain

It also begins from a green plant base and goes to herbivores, which may be the host of a huge number of lice living as ectoparasites.

3 Detritus food chain

The food chain goes from dead organic matters of decaying animal and plant bodies to the microorganisms and then to detritus feeding organisms (detrivores or saprovores) and their predators is known as “detritus food chain”. Soil organisms are thus less dependent on direct solar energy and depend chiefly on the influx of organic matter produced in another system. This is very clear from the following illustration:

In the brackish zone of Southern Florida, leaves of the red mangrove (Rhizophore mangle) fall into the warm, shallow waters. The fallen leaf fragments acted on by such saprotrophs as fungi, bacteria, and protozoa, and colonised by phytoplanktonic and benthic algae are eaten and

reeaten by a group of small animals. These animals include crabs, copepods, insect larvae, mysids, nematodes, grass shrimps, amphipods, etc. All these animals are called detritus consumers. These animals, in turn, are eaten by some minnows, small game fish, etc. The small carnivores, which in turn, serve as the food for large game fish, and so on. Mangrove leaves, through detritus food chain make substantial contribution to the food chain that is upto 90% of the stored energy in the dead organic material is consumed through detritus food chain. This chain is further important from the view point of mineral cycles within the ecosystem.

Food Web

Food chain, normally do not operate in isolated but are interlocked with each other forming some sort of pattern known as food web. An organism in the ecosystem may operate at more than one trophic level, i.e. it derives its food from more than one source and in turn, may serve as a source of food for several organisms of higher trophic level. This results into linking together, but intersecting each other, of several food chains. Another reason for the formation of food web seems to be successive loss of energy at higher trophic levels till no more energy is available to support yet another link in the food chain. A food web delineated for small organisms of a stream community in South Wales. This illustrates: (i) the interlinking of food chain, (ii) three trophic levels, (iii) intermediate position of the organisms e.g. Hydropsyche, and (iv) an "open" system in which part of the basic food is "imported" from outside the stream.

The food webs are very important in maintaining the stability of an ecosystem, in nature. For example, in grazing food chain of a grassland, in the absence of rabbit, grass may be eaten by mouse. The mouse in turn may be eaten directly, either by hawk or snake. The snake then may be eaten by hawk.

Absence of rabbit thus would not disturb the ecosystem as the alternative (mouse) may serve for the maintenance of its stability. Moreover, a balanced ecosystem is essential for the survival of all the living organisms of the system. For example, if the primary consumers (herbivores) are not in nature than the producers would perish due to overcrowding and competition. In the same way, the survival of the primary consumers is linked with the secondary consumers (carnivores) and so on. Thus, each species of an ecosystem is indeed kept under some sort of a natural check so that the system may remain stable.

A food web, unlike a food chain has therefore, several alternative pathways for flow of energy. Sudden decrease in population of one category of consumers at any trophic level does not affect much the functioning of an ecosystem, as at that trophic level, the second category of consumers multiply and build up their numbers. An ecosystem is, therefore, more stable, if it has a greater number of alternative pathways.