

Dr. UMESH KUMAR

DEPARTMENT OF BOTANY

**U.R. COLLEGE ROSERA
(SAMASTIPUR)**

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(i) DECOMPOSITION.

Decomposition

Decomposition [Dec = away, cum = with, passare = to rest] →

"It is the process of physical and chemical breakdown of complex organic remains by organisms called decomposers, so as to produce inorganic raw materials (CO₂, H₂O, minerals) for recycling."

The major site for decomposition is the upper layer of soil in terrestrial habitats and bottom of water bodies. Freshly deposited organic matter is called detritus (rubbed food). Detritus is differentiated into above ground and below ground.

(1) Above ground detritus → It consists of dried plant parts or litter (leaves, twigs, barks, flowers), excreta and dead remains of animals.

(2) Below ground detritus → It is also called "soil detritus" because it is mainly composed of dead roots. Underground organisms and their excreta also form a part of below ground detritus.

Decomposition Process

(2)

Three types of processes occur simultaneously during decomposition of detritus.

① Fragmentation of Detritus → Small

invertebrate animals called detritivores

(detritus = to rubb off, vorare = to devour)

feed on detritus, e.g.; earthworm, termites, ants, millipedes, slugs, snails, woodlice, etc. They bring about its fragmentation.

A part of detritus eaten by detritivores comes out in highly pulverised state in their faeces called

worm castings. Due to fragmentation during eating and pulverisation in digested tracts, detritus is changed into fine particles which have a large surface area.

② Leaching → Part of soluble substances present in the fragmented and decomposing detritus (e.g.; sugar, inorganic nutrients) get leached to upper layers of soil by percolating water.

③ Catabolism → It is carried out by saprotrophic bacteria and fungi. They secrete digestive enzymes over the fragmented detritus. The enzymes change complex organic compounds into simple compounds. Inorganic substances are

also released in this process. ③

A part of digested or solubilised materials are absorbed by saprotrophs. Both detritivores and decomposers hold up a part of nutrients contained in detritus in their biomass.

The phenomenon of incorporation of nutrients in living decomposers and detritivores is called "nutrient immobilisation". It occurs for varying periods. After death of detritivores and decomposers the immobilised nutrients become available again for solubilisation.

Immobilisation protects the nutrients from being washed out and lost from ecosystem.

The rate of catabolic action or breakdown of different complex substances is different. This differential decomposition produces two substances, humus and inorganic nutrients in processes respectively called humification and mineralisation.

(i) Humification → It is the process of partial decomposition of detritus to form humus. Humus is a dark coloured amorphous partially decomposed organic matter. It is rich in cellulose, lignin, tannin, resins etc. It is

highly resistant nature. Humus is slightly acidic, colloidal and functions as reservoir of nutrients. The very slow decomposition that occurs in humus releases small quantities of nutrients that can be readily absorbed by plants.

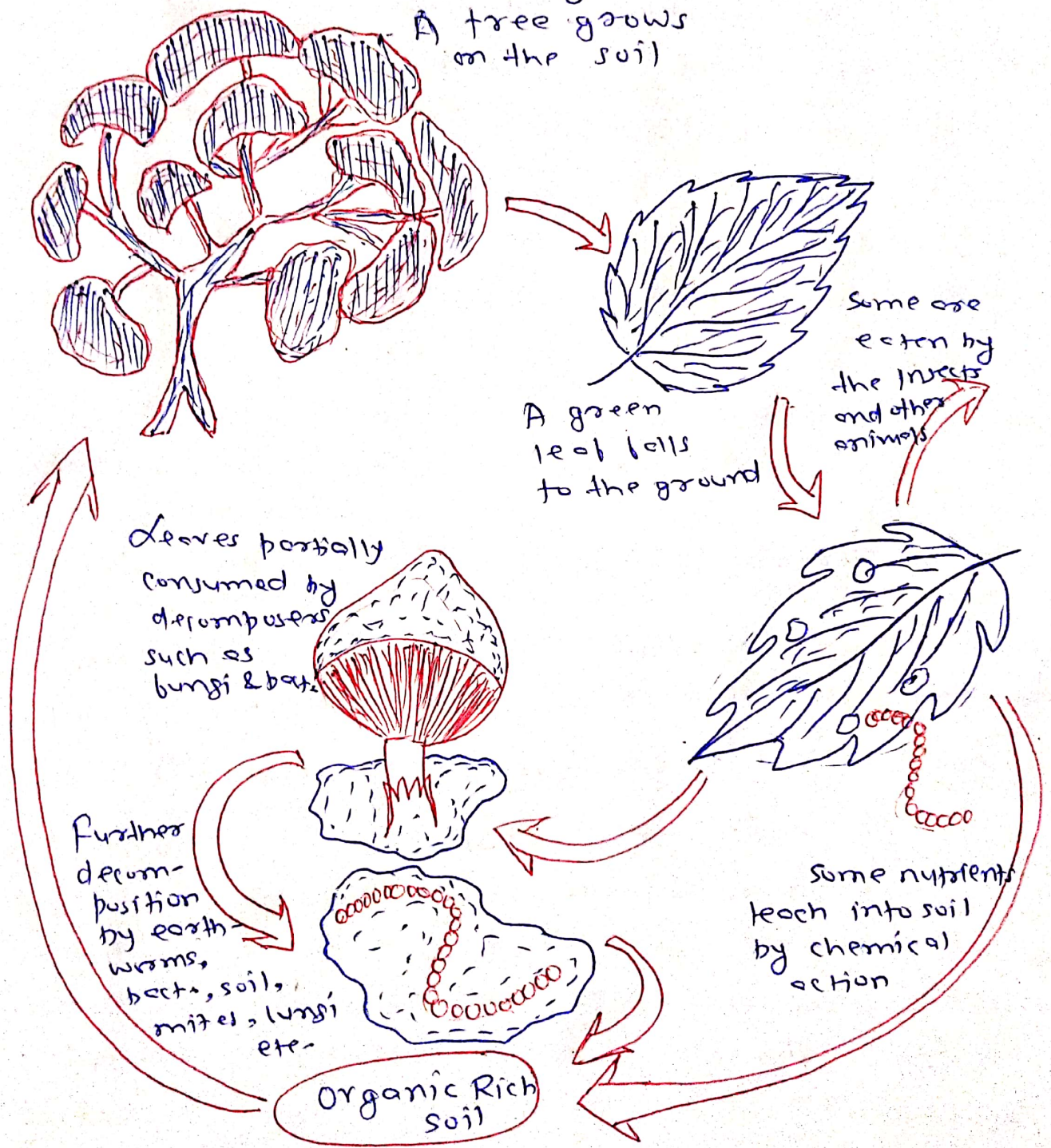


Figure 2 Diagrammatic Representation of decomposition cycle in terrestrial ecosystem.

(ii) Mineralisation → It is the release of inorganic substances (e.g., CO_2 , H_2O , minerals) from organic matter during the process of decomposition. They are formed along with simple and soluble organic substances when digestive enzymes are poured over organic matter by saprophytic microbes. Microbes absorb the solubilised organic compound for their own metabolism leaving the inorganic substances free, e.g., Ca^{++} , Mg^{++} , K^+ , NH_4^+ , Zn^{++} , Mn^{++} . They become available to plants for utilisation in synthesis of organic matter.

Factors affecting Decomposition

The rate of decomposition of detritus is controlled by a number of factors -

(i) Chemical Nature of Detritus → Decomposition of detritus is slow if it contains lignin, chitin, tannins and cellulose. It is rapid if detritus possesses more of nitrogenous compounds (like proteins, nucleic acids), reserve carbohydrates and water soluble substances like sugars.

(ii) Soil pH → Detritivores are fewer in acidic soils. Microbial activity is also low in such soils. Therefore, rate

of decomposition of organic matter (6) is slow in acidic soils. Partially decomposed organic matter piles up over such soils. Detritivores are abundant in neutral and slightly alkaline soils while decomposer microbes are rich in neutral and slightly acidic soils.

(iii) Temperature \Rightarrow At a temperature of more than 25°C , decomposers are very active in soils having good moisture and aeration. In humid tropic regions, it does not take more than 3-4 months for complete decomposition of detritus. However, under low temperature conditions ($< 10^{\circ}\text{C}$) of soils, the rate of decomposition is very slow even if moisture and aeration are optimum. Because of it complete decomposition of detritus may take several years or even decades. As a result partially decomposed organic matter may pile up over the surface of soil. It may even form 'peat'.

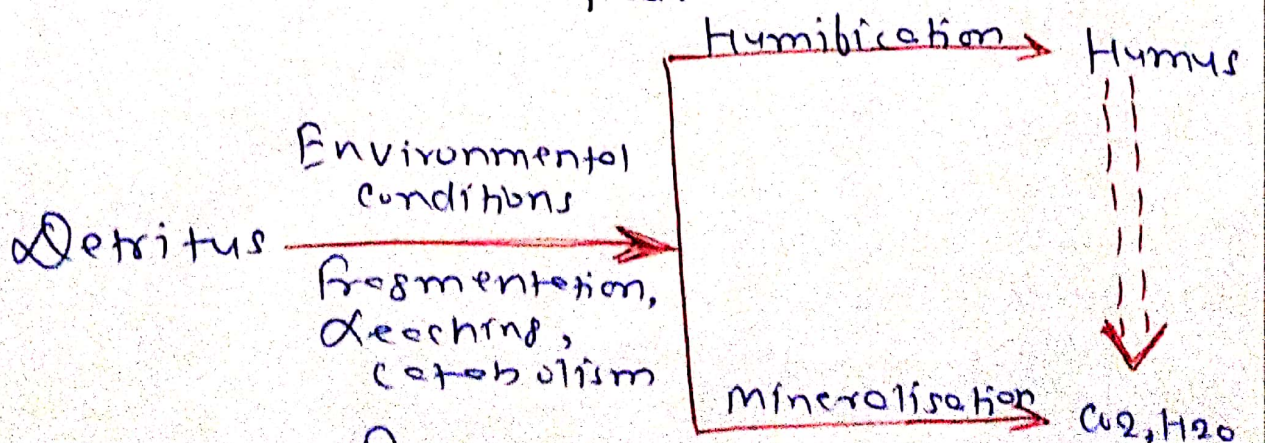


Figure \Rightarrow Process involved in decomposition of detritus.

(iv) Moisture An optimum moisture ⁽¹⁾ helps in quicker decomposition of detritus. Reduction in moisture reduces the rate of decomposition as in areas of prolonged dryness like tropical deserts where otherwise the temperature is quite high. Excessive moisture also impedes decomposition. It may promote pest burrowing.

(v) Aeration → It is required for the activity of decomposers and detritivores. A reduced aeration will slow down the process of decomposition.

Dr. Umesh Kumar
Department of Botany
U.P. College, Patna
(Samastipur)