Competition Exclusion Principle

It is the principle used in ecology which states that if two species competing for the common resources cannot exist together if other ecological factors remain constant. If one species has a slight or more advantageous character than the other species, it will dominate in the long run. If this dominance continues, the dominant species will occupy much of the space and the less dominant species will undergoes extinction or may show either an ecological or behavioural shift towards another ecological niche. **That is complete competitors cannot coexist.** The completion exclusion principle is also called as **Gause's principle** or simply Gause's law.

The competition exclusion principle was formulated by **the Russian ecologist Georgii Frantsevich Gause** based on his experiments in **Paramecium**. He conducted experiments in two species of Paramecia namely **Paramecium aurelia** and **Paramecium caudatum**. In the initial stage, P.caudatum dominated but gradually P.aurelia recovered and replaced the P.caudatum completely. Gause provided constant conditions like freshwater and constant flow of food. So under constant environmental conditions, if competition occurs between two species, one can replace the other. He also conducted experiments in yeast species **Saccharomyces cerevisiae** and **Schizosaccharomyces kefir.** This experiment revealed that S.kefir out competed S.cerevisiae by producing high concentration of ethyl alcohol. Other examples of Gause's principle are **Darwin's finches** and **Mac Arthur's Warblers**.

In most of the ecosystems, plant as well as animal communities violate the competition exclusion law and is rarely observed in natural ecosystems. A well known example of species coexistence is the survival of plankton species in natural ecosystems using limited resources like sunlight, food etc. Even though the resources are limited, they live tighter without replacing one another. This behaviour of plankton life is known **as Paradox of Plankton.**

The competitive exclusion principle is based on a mathematical model developed independently by **Vito Volterra and Alfred Lotka**. Their construction of the competition model was based on an earlier mathematical model, called as the **Logistic model** of population growth.

This model is expressed in the equation $dN/dt = rN((K - N)/K)$, where **N** is the number of individuals in a population or the density and **K** is the number of individuals or population density of a species that the environment can support. K is the Carrying capacity of that environment for that species.

The **r** denotes the intrinsic rate of population growth. **dN/dt** represents the change in **N with time** and **d's** indicates change. *So the formula dN/dt represents the change in population size with change in time.* The environmental factors affecting the carrying capacity K includes food shortage, predation, disease, competition, etc. When the population size reaches the environment's carrying capacity, the population stops growing. Using the Logistic model for population growth, Lotka and Volterra suggested independently a model for interspecific competition.

D.Mohankumar