Department of biology

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((Environmental Pollution))

Stage (3)

LEC- ((2))

Effects of pollution

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Effects of pollution

Introduction

The scientists note that a very important aspect of the effect of pollution is its dose (or concentration) required to cause environmental damage. Therefore they define ***pollution response*** as "the change in the effect of a pollutant in response to a change in its concentration".

In this respect, we can identify 2 different types of response to different pollutants concentration;

1- **Linear effect**
2- **Threshold effect**

In *the linear effect*, environmental damage increases linearly with pollution concentrations. In other words, "the total damage or risk is directly proportional to the accumulated exposure".

This effect occurs with radioactive substances, most heavy metals and asbestos.

In *the* ***threshold effect***, pollution produces no effect until a certain threshold in pollution concentrations is achieved. In other words, "so long as a given threshold is not exceeded, the damage from pollution would be completely repaired. This effect is found with biodegradable pollutants.

Sequential effect of pollutants

1.Effects upon the individual organism

A molecular interaction occurs between the pollutant and cellular structures within the organism. Critically, many toxic effects are due to specific interactions between these pollutants and their sites of action. Sites of action may bind hormones (e.g., estrogen receptors), bind neurotransmitters (e.g., acetylcholine), or be the enzymes such as

acetylcholinsterase. Interactions of this kind will be termed biochemical effects. These localized biochemical effects often lead to physiological damage, e.g., of the brain or nervous system or the blood. Next, the localized damage can be distributed, leading to effects at the level of the whole organism. Effects at the whole organism level include sub-lethal ones on behavior or reproduction that have the potential to cause population declines, as will be explained later.

Generally, three major effects of pollutants on some organisms especially humans:

1- **Carcinogenicity (induction of cancer)**
2- **Mutagenicity (induction of mutation)**
3- **Teratogenicity (induction of birth defects)**

The World Health Organization states that 2.4 million people die each year from causes directly attributable to air pollution only, with 1.5 million of these deaths attributable to indoor air pollution.

Effects at the population level

A population is a group of individuals belonging to a single species. Effects at the population level may be characterized in two distinct ways:

(1) by changes in population numbers (population dynamics) and,

(2) by changes in the genetic composition (population genetics).

Taking population numbers first when studying population dynamics in the field. Migration in and out of an area during the course of an experiment can have a profound effect on the population numbers that are recorded. If the effect of a pollutant on a popula-tion is to be studied, it is

desirable that there be as little migration as possible during the experimental period.

Regarding genetic aspect, pollutants of all kinds, can cause harm to free-living organisms. They have the potential to exert a selective pressure on these organisms. Pesticides, which are designed to control populations of pests, are a very clear example of this. Broadly speaking, the most important resistance mechanisms that have been developed by insects against insecticides are of two kinds:

(1) enhanced enzymic detoxication and

(2) insensitivity of the site of action.

3. Effects upon the structure and function of communities and ecosystems

An *ecosystem* has been defined as a collection of populations that occur in the same place and at the same time that can interact with each other and their physical and chemical surroundings; a *community*, more simply, is a collection of populations that occur in the same place and at the same time.

The effects of pollutants upon communities are of two different kinds. First, there can be effects upon structure (i.e., on composition); here the primary concern is about the species that are present. While , the *function* of a community refers to the operation of processes within it for example, the operation of the carbon cycle or the nitrogen cycle. Studying these processes can provide measures of the health of a community or of an ecosystem as a whole. Effects of this kind can be measured by monitoring the levels of pollutants in natural processes.